A.VEERIYA VANDAYAR MEMORIAL

SRI PUSHPAM COLLEGE (AUTONOMOUS)

POONDI-613 503, THANJAVUR (DT)

SYLLABUS

M.Sc., Microbiology

(From 2020 - 2021 onwards)

M.Sc., MICROBIOLOGY 2020-2021

S.No	Semester	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks of Pass			Credits	Hours/ Week
					CIA	E.E	Total	CIA	E.E	Total		
1.	I	Core I	20P1MBC1	General Microbiology	25	75	100	10	30	50	4	6
2.		Core II	20P1MBC2	Biological Macromolecules	25	75	100	10	30	50	4	6
3.		Core III	20P1MBC3	Food and Agricultural Microbiology	25	75	100	10	30	50	4	6
4.		Major Elective -I	20P1MBEL1A	Bioinoculant Technology	25	75	100	16	24	50	4	6
5.		Major Elective -II	20P1MBEL1B	Seed Pathology	25	75	100	16	24	50	4	6
6.		Core PL	20P1MBCP1	Practical - I	40	60	100	10	30	50	5	6
7.	II	Core I	20P2MBC4	Microbial Physiology	25	75	100	10	30	50	4	5
8.		Core II	20P2MBC5	Environmental Microbiology	25	75	100	10	30	50	4	5
9.		Core III	20P2MBC6	Recombinant DNA Technology	25	75	100	10	30	50	4	5
10.		Core IV	20P2MBC7	Marine Microbiology	25	75	100	10	30	50	4	5
11.		Major Elective -I	20P2MBEL2A	Microbial Nanotechnology	25	75	100	16	24	50	4	5
12.		Major Elective -II	20P2MBEL2B	Soil Biology	25	75	100	16	24	50	4	5
13.		Core PL	20P2MBCP2	Practical - II	40	60	100	10	30	50	5	5
14.	III	Core I	20P3MBC8	Medical Microbiology	25	75	100	10	30	50	4	5
15.		Core II	20P3MBC9	Immunology	25	75	100	10	30	50	4	5
16.		Core III	20P3MBC10	Microbial Genetics and Molecular Biology	25	75	100	10	30	50	4	5
17.		Core IV	20P3MBC11	Fundamental of Biological sciences	25	75	100	10	30	50	4	5
18.		EDC	20P3MBEDC	Mushroom Technology	25	75	100	16	24	50	-	4
19.		Core PL	20P3MBCP3	Practical - III	40	60	100	16	24	50	5	5
20.		SSLL	20P3MBSS	Soft Skill using Language Lab							-	1
21.	IV	Core I	20P4MBC12	Research Methodology	25	75	100	10	30	50	4	6
22.		Core II	20P4MBC13	Microbial Biotechnology	25	75	100	10	30	50	4	6
23.		Major Elective-I	20P4MBEL3A	Biodiversity and Conservation Management	25	75	100	10	30	50	4	6
24.		Major Elective-II	20P4MBEL3B	Bioinformatics	25	75	100	10	30	50	4	6
25.		Core PL	20P4MBCP4	Practical - IV	40	60	100	10	30	50	5	6
26.		Project	20P4MBPro	Project Work	25	75	100				4	1
27		Comprehension	20P4MBCN	Comprehension	25	75	100				2	5
28		PD	20P4MBPD	Personality Development	-	-	-	-	-	-	-	1
		Core Opt I	20P1MBCOP1	Bio Energy	25	75	100	10	30	50	4	6
		Core Opt II	20P2MBCOP2	Veterinary Microbiology	25	75	100	10	30	50	4	5
		Core Opt III	20P3MBCOP3	Food Preservation and Processing	25	75	100	10	30	50	4	5
		Core Opt IV	20P4MBCOP4	Water and Textile Microbiology	25	75	100	10	30	50	4	6

EDC- Title (offered by Dept of Microbiology) - "**Mushroom Technology"**

M.Sc. MICROBIOLOGY (2020– 2021)

Nature of Course	Total No. Of Courses	Total Marks	Total Credits	Classification
Core	17	1700	72	✓
Elective	3	300	12	✓
E.D.C	1	100	---	✓
Project	1	100	4	x
Comprehension	1	100	2	✓
Soft skill using Language lab	--	--	---	X
Total	**23**	**2300**	**90**	

GRADING OF COURSE PERFORMANCE (10 POINT SCALE)

Aggregate Marks	Grade	Grade Point
96 and above	S+	10
91-95	S	9.5
86-90	D++	9.0
81-85	D+	9.0
76-80	D	8.0
71-75	A++	7.5
66-70	A+	7.0
61-65	A	6.5
56-60	B	6.0
50-55	C	6.5

Comprehensive Knowledge Test: Objective type question pattern with 100 compulsory questions carrying 100 marks to be answered in 3 Hours with 2 credits. The portion is entire core courses.

Industrial Internship: Students have to undergoIn-Plant training in Industry or Organization where any process related to Microbiology is going on. The period of training should be minimum 10 days. Students have to submit the report of the training underwent with the certificate from the concerned authority of the Industry / Organization.

Industrial Visit: Students have to attach a report on the Industrial visit made with the counter signature of Staff in charge for the Industrial visit while submitting the Project / Industrial Internship report

MOOC: Massive Open Online Course is introduced in the second and third semester as an extra credit course from this academic year 2020-2021.Students can avail any one or more of the courses available in MOOC to equip their skill and knowledge themselves.

Field Visit / Industrial Visit / Hands on Training Programme having minimum 15 hours of contact time as Extra credit course is introduced for I year PG students to gain experiential learning.

Evaluation of the visit report will be held at the end of II Semester

Components of Evaluation	
Internal Marks	40
External Marks	60
Total	100

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Question Pattern for UG and PG Programmes for students to be admitted during 2020 – 2021 and afterwards

Total Marks: 75

QUESTION PATTERN

SECTION – A
(Question 1 to 10)

10 x 2 = 20 Marks

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

SECTION – B
(Question 11 to 15)

5 x 5 = 25 Marks

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

SECTION – C
(Question 16 to 20)

3 x 10 = 30 Marks

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**20P1MBC1**	**Core I – General Microbiology**	**6**	**4**

Objectives:

- To enable the students to know the general principles of microbiology.
- To enable the students to know the general characters and classification of microbes.
- To enable the students to know the important features of cyanobacteria and fungi.
- To enable the students to know the life cycle o.
- To know about the extremophiles

Unit I

History and scope of microbiology– Principles and applications of bright field, dark field, phase contrast, fluorescence and electron microscope - General features of prokaryotic and eukaryotic microorganisms – bacteria, microalgae, fungi, actinomycetes,protozoa,mycoplamsa,rickettsiae,chlamydiae and prions.

Unit II

Bergey's Manual of Determinative Bacteriology, 1994 (9^{th} edition) - microbes growing in extreme environments – acidophilic, alkalophilic, thermophilic, barophilic and halophilic – general characters of the following family – Spirochaetaceae, Enterobacteriaceae, Streptococcaceae, Staphylococcaceae and Vibrionaceae.

Unit III

Virology – History, scope, general characters, classification (LHT system)andmultiplication – Bacteriophage – structure and its cycles of phage lambda, T4 phage, Ø X 174 phage, virusoids and satellite RNA.

Unit IV

Structure and life cycles of the following – Animal virus and DNA virus – Hepatitis –B, Herpes simplex virus – Adenovirus – Pox viruses – RNA virus, Retrovirus, Rhabdo virus, HIV, Influenza – Chikungunya,Dengu, – SARS, MARS - Corona virus and its impacts in current scenario,Oncogenic viruses, – Antiviral therapy - plant virus – TMV, CaMV – Transmission and control.

Unit V

Preservation of microbes –Cryopreservation – Lyophelizer - culture collection centre – fossil microorganisms. Identification of microbes – physiological characteristics, microbial identification system (MIS), fatty acid profile, 16srRNA sequence homology,RAPDand RFLP.

Course Out come

Students will be able to

identify the various types of microbes
overview of extremophilic microorganisms
know the structure and life cycle of viruses
get awareness on pure culture technique and methods of sterilization
acquire a knowledge on information of preservation of microbes

Books for References

- Dubey, R.C. and Maheswari, D.K., (2003). A text book by Microbiology. S. Chand and Company Ltd., New Delhi.
- Stanier*et al.,* (1994). General Microbiology, MacMillan Education Ltd., London.
- Prescott, L.M., Harley, J.P. and Klein, B.V., (2007). Microbiology, VI Ed., W.M.C. Brown Publishers IOWA, U.S.A.Baveja. C.P Text book of Microbiology. 5th Ed. Arya Publicaion.
- Jesus Murillo, Boris, A, Vinatzer, Robert W. Jackson and Dawn L. Amold, (2015). Bacteria-Plant interaction: Advanced research and future trends. Caister Academic press.
- Paul Hyman and Sephen T Abedon, (2018). Viruses of microorganisms. Caiser Academic Press.

- Powar and Daginawala, (1992). General Microbiology, Vol. I. Himalaya Publishing House, New Delhi.
- Powar and Daginawala, (1922). General Microbiology, Vol. II. Himalaya Publishing House, New Delhi.
- Dimmock, N.J, Primrose, S,B (1994). Inroducion to modern virology IVth Ed. Blackwell Scientific Publication Oxford.
- Topley and Wilson's (1990). Principles of bacteriology, virology and immunology VII Ed. Vol IV Virology Amold London.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**20P1MBC2**	**Core II – Biological Macromolecules**	**6**	**4**

Objectives:

- To enable the students to know the various types of macromolecules in biological organisms.
- To understand the role of different biological macromolecules in the physiology of microbes.
- To know the biosynthetic pathways of various macromolecules.

Unit I

Enzymes: History of Enzymes – Function – Nomenclature, structure - classification – Mechanism of enzyme action – Enzyme kinetics – Michaelis – Mentonconstant, Determination of Km and Vmax value –Factors influencing Enzyme reaction, Allosteric enzymes and Isoenzymes

Unit II

Nucleic acid – Types and functions of nucleic acid - Purines and Pyrimidines – Biosynthesis of Purines andPyrimidines – Interconversion of Nucleotides, Nucleosides and Free bases.

Unit III

Proteins: Classification of proteins (shape, composition and solubility) – Chemical bonds involved in Protein structure – Peptide bond – N and C terminal, Primary bond, Secondary bonds - Protein Configuration – Primary, Secondary, Tertiary and Quartenary – Biological Role of Proteins.

Unit IV

Lipids – General Structure – Physical,Chemicaland biological properties of Lipids – Types – saturated and unsaturated fatty acids – Simple Lipids (Fat, Oil), Compound Lipids (Phospholipid, Glycolipid) and derived Lipids - Steroids.

Unit V

Carbohydrates: Introduction, Definition, Scope, Biochemistry, Types and their properties – monosaccharides, oligosaccharides and polysaccharides –sucrose, lactose and cellobiose - storage polysaccharides - e.g. Starch, glycogen and insulin – structural polysaccharides – e.g. Cellulose, pectin and chitin.

Course Outcome

After completion of this course, students would be able to

know structure and function of carbohydrates

understand protein configuration

acquire a knowledge on the properties of lipids and nucleic acids

expertise the mechanism of enzyme action in the field of biological macromolecules

comprehend the knowledge on biosynthesis of purines and pyrimidines

Books for Reference

- An Introduction to Biomolecules and Enzymes – RenukaHarikrishnan, IndrajitPathipagam, 1996.
- Mott, A.G. and Foster, J.W., (1988). Microbial Physiology, John Wiley Sons.
- Jain, J.L., 1979. Fundamentals of Biochemistry, Published by S.Chand and Company Ltd., Ram Nagar, New Delhi.
- Dawn, B Maekens (1994). BiochemisryHarwalPublishing , New Delhi.
- Henny R. Mahler and Engene.HCerdesz (1996). Biological Chemistry , Harper Internaional Edi. New York.

Semester	Subject Code	Title of the Paper	Hours Teaching/ Week	No. of Credits
I	**20P1MBC3**	**Core III – Food and Agricultural Microbiology**	**6**	**4**

Objectives: To enable the students

- To know the various types of microorganisms found in the food.
- To know the principles and methods of preservation of foods.
- To know the ways of contamination of food and the prevention methods.
- To understand the principles of food spoilage and food borne diseases.
- To know the role of beneficial and harmful microbes in agriculture.
- To learn the microbial activity in soil.
- To understand the role of biofertilizers and biopesticides in agriculture.
- AgriUniversity – Visit – within the state -2 -3 days.

Unit I

Food microbiology – food as a substrate for microbes, sources of contamination. Food spoilage – General principles and causes – factors (intrinsic and extrinsic) affecting growth, chemical changes caused by microbes. The food safety and standards authority of India, INFOSAN. Spoilage of cereal and cereal products, vegetables, fruits, meat, fishes and eggs.

Unit II

Microflora of milk – sources of contamination, methods and minimization of contamination. Milk borne infections – milk preservation methods – pasteurization and sterilization. Fermented dairy products: butter milk, cream, yoghurt, kafir, cheese and its types.

Unit III

Food preservation, physical and chemical methods – use of high and low temperature – use of chemical preservatives, drying and irradiation – food borne infections and intoxications - sources, symptoms and prevention – Good manufacturing practices., Hazard analysis, food hygiene and quality control.

Unit IV

Agricultural Microbiology - Microbial interaction in soil – bacterial and fungal, fungi and plants. Organic amendments in soils. Biological and chemical control. Manipulation of physico–chemical and biological parameters in soil integrated pest management systems (IPM) – soil fertility and management.

Unit V

Diseases in crop plants - Bacterial: Leaf blight and Citruscanker. Fungal –Rust of wheat, Brown spot of paddy, Tikka diseases of groundnut, Viral: Tungro virus and TMV, Biopesticides. Physical and chemical control of plant diseases.

CourseOutcome

After completion of this course, students would be able to

acquire a knowledge on contamination, preservation and spoilage of various types foods

to prepare fermented milk products

information on microbial interaction in Agriculture microbiology

get awarness on various diseases in crop plants in the field of pathology

expertise examination the manufacturing practices in food items of food industry.

Books for References

- Frazeir, W.C. and Westheff, D.C., (1989). Food Microbiology, 8th Ed., Tata McGraw Hill Pub. Co., Ltd., New Delhi.
- Jay, J.M., (1987). Modern Food Microbiology, CBS Publishers and distributors, New Delhi.
- Subba Rao, N.S., (1995). Soil Microorganisms and plant growth. Third Edition Oxford and IBH Pub. Co. Pvt., Ltd., New Delhi.
- Rangaswami, G., and Mahadevan, A., (2004). Diseases of crop plants in India. Fourth Edition. Prentice Hall of India Private Limited, New Delhi.

Semester	Subject Code	Title of the Paper	Hours Teaching/ Week	No.of Credits
I	**20P1MBEL1A**	**Major Elective I – Bioinoculant Technology**	**6**	**4**

Objectives:

- To know the basic aspects of bioinoculant.
- To study the detail on various types of bioinoculant.
- To know about the production and mass multiplication of various bioinoculants.

Unit I

General account - microbes used as biofertilizer. *Rhizobium* – taxonomy, physiology, host – *Rhizobium* interaction, isolation, identification, mass multiplication and carrier based inoculants. Frankia: Isolation and mass multiplication.

Unit II

Azospirillum – taxonomy and physiology, isolation and mass multiplication, carrier based inoculants, rhizosphere competence and host plant specificity. *Azotobacter* – classification, characteristics, ecology, physiology and crop response to *Azotobacter*inoculums, maintenance and mass multiplication.

Unit III

Cyanobacteria (BGA), *Azolla* and *Anabaenaazollae* association, nitrogen fixation: symbiotic and non-symbiotic, factors affecting growth-Role of BGA and *Azolla* in rice cultivation.

Unit IV

Mycorrhizae – types of mycorrhizal association. VAM – taxonomy, occurrence, distribution - Influence of VAM on crops - PSM and phosphorus mobilizing microbes – growth, yield, isolation and inoculum production.

Unit V

Assessment of nitrogen fixing ability of different bioinoculants under controlled and field conditions - Culture production (fermentor),storage, carriers, packing and quality control- ISI standards and marketing- Methods of applications.

CourseOutcome

After completion of this course, students would be able to

Analyse the steps on mass multiplication and carrierbased inoculants of *Rhizobium*

Apply various types of inoculams on *Azospirillum* and *Azotobacter*

Formulate the blue green algae and *Azolla* production in rice cultivation

Acquire knowledge on assessment of nitrogen fixing ability of different bioinoculants

Apply the ISI standard and marketing of bioinoculants

Books for References

- Subba Rao, N.S., (2004). Soil Microbiology – Fourth Edition, Oxford and IBIT Publishing Co., Pvt., Ltd. New Delhi.
- Tilak, K.V.B.R., Algal Biofertilizers ICAR Publications, New Delhi.
- Phosphate Solublizing Microorganism – AC. Guru.
- Whitton and Carr – Biology of cyanobacteria
- LaxmiLal, Nitrogenous Biofertilizers.

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
I	**20P1MBEL1B**	**Major Elective II – Seed Pathology**	**6**	**4**

Objectives:

- To know the seed borne microbes and diseases.
- To know the methods of seed health testing.
- To learn the process of seed borne disease development.
- To know the quarantine for seed and organization for plant protection at various levels.

Unit I

History of Seed Pathology: Importance in agriculture – losses caused by seed borne diseases. Seed health testing for fungi, bacteria and viruses: Principles and methods.

Unit II

Seed borne fungi, bacteria and viruses. Diseases caused by fungi – blast of paddy, red rot of sugarcane; bacteria – Blight of paddy, black arm of cotton; viruses - leaf roll of potato, bean, Mosaic virus.

Unit III

Seed infection and establishment – avenues, factors and its establishment – location in seed – Epiphytotics due to seed borne inoculum.

Unit IV

Controls of seed-borne diseases – physical, chemical and biological treatment; post-entry control. Storage fungi and mode of seed deterioration. Mycotoxins, plant variety protection act, legal protection of crop varieties and seed legislation in developing countries.

Unit V

Seed Quarantine, history and importance, principles and regulations of plant quarantine in India. Seed certification – history, scheme, eligibility procedure – (Organization, Economic Co-operation and Development) – Changing concepts, Applying quarantine provisions for seed.

CourseOutcome

After completion of this course, students would be able to

Get information on importance of seed pathology in agriculture

Obtain an idea about the seed – borne diseases of important agricultural crops

Acquire knowledge on controls of seed - borne pathogens

Gain knowledge on quarantine and seed certification

Learn the role of mycotoxins in seed deterioration

Books for References

- Agrios, Geroge, N., 1998. Plant Pathology, Academic Press, San Diego, London.
- Bilgrami, K.S. and Dube, H.C., 1980. A text book of modern Plant Pathology, Vikas Publishing House, New Delhi.
- Mehrotra, R.S., 1980. Plant Pathology, Tata McGraw Hill Publishing Company Limited New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**20P1MBCP1**	**Core – PL – General Microbiology, Biological Macromolecules and Food & Agricultural Microbiology**	**6**	**5**

Objectives:

- To know about the basic principles involved in Microbiology.
- To learn the methods of pure culture techniques of various microbes.
- To know the various techniques involved in bacterial growth.
- To isolate the enumerate microbes from various habitats.
- To isolate and culture the coliphages from sewage.

General Microbiology

1. Preparation and use of glassware's cleaning solutions.
2. Sterilization: Principles and methods.
3. Media preparation: Liquid,solid,differential and selective media.
4. Pure culture techniques: Streak plate, pour plate and spread plate.
5. Micrometry – Measurement of microorganisms.
6. Isolation of aerobic bacteria, cyanobacteria, actinomycetes and fungi.
7. Enumeration of microorganisms – Fungi, bacteria and actinomycetes (Colony counter method).
8. Staining methods for fungi – Lactophenol cotton blue.
9. Staining methods for bacteria – simple stain, gram stain, endospore and capsular stain.
10. Growth Curve.
11. Microscopic count using Haemocytometer.
12. Determination of dry weight.
13. Isolation of coliphages from sewage water
14. Permanent slides to study the structure and character of fungi, protozoa and algae

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Biological Macromolecules

1. Qualitative test for carbohydrates – Glucose, fructose and starch.
2. Quantification of starch and protein
3. Isolation of DNA
4. Isolation of RNA

Food and Agricultural Microbiology

1. Microbiology of soft drinks, milk, meat and ice creams (Total plate count), fruits, vegetables and curd.
2. Methylene blue reduction test.
3. Isolation of phosphate solubilizers.
4. Isolation of nitrogen fixers-free living, associative and symbiotic.
5. Leghaemoglobin measurement.
6. Quantification and assessment of VAM fungi from rhizosphere soil.
7. Measurement of pH, moisture, salinity, nitrate and phosphate in soils.

CourseOutcome
After completion of this course, students would be able to

Understand the uses of cleaning of glassware solutions

Analyse the laboratory practices in practical classes

Classify the pure culture technique and understand to the students

Examine the measurement of microbes

Learn about the qualitative test of carbohydrates in biological macromolecules

Develop the understanding knowledge on food microbiology

Aqcuire knowledge on quantification and assessment of VAM fungi

Books for References

- Kanika Sharma, (2005). Manual of Microbiology Tools & Techniques Ane Books. New Delhi.
- Bharti Arora, D.R., Arora (2007). Practical Microbiology first ed. CBS Publishers and Distributors, New Delhi.
- Cappuccino, J.G. and Sherman, N., (2006). First ed. Microbiology. A Laboratory Manual, Sixth ed. Pearson Education, New Delhi.
- Jayaraman, J. 1981. Laboratory manual in biochemistry, New Age Internaional Publishers, New Delhi.
- Boyer,R. 2001. Modern experimental biology, 3rd Ed. Benjamin Cummings Publishing company.
- Switzer, R.L, Garriy, L.F. (1999). Experimental Biochemistry, 3rd Ed. Freeman and Company.
- Plummer, D.(1987). An introduction to practical biochemistry. 3rd Ed. McGraw hill, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20P2MBC4**	**Core I – Microbial Physiology**	**5**	**4**

Objectives:
To enable the students
- ❖ To know about nutritional aspects of microbes.
- ❖ To know the basic aspects of chemical reactions and their processes.
- ❖ To know the various metabolic reactions of microbes.

Unit I

Free energy and reactions – law of thermodynamics, oxidation – reduction carriers, role of ATP in metabolism. pH – measurement and itsimportance - pH regulation. Buffer system –Mechanism and examples – Bicarbonate buffer system, phosphate buffersystem.

Unit II

Microbial nutrition – nutritional requirements – carbon, hydrogen, oxygen, phosphorus and sulphur. Growth factors: Uptake of nutrients –imbibition, diffusion, osmosis, active transport, group transport and ion uptake.

Unit III

Anabolism: Photosynthesis in prokaryotes – light reactions in cyanobacteria, green bacteria and purple bacteria, C3 and C4 cycle - cholesterol, fatty acid and amino acid biosynthesis.

Unit IV

Catabolism: Breakdown of glucose to pyruvic acid, Glycolytic pathway – PPP and EMP pathways – TCA cycle – electron transport and oxidative phosphorylation. Gluconeogenesis – Anapleruotic reactions - lipid catabolism - β oxidation.

Unit V

Methylotrophs – pathway of methanoxidation, methanogens – process of methanogenesis. Sulphur reducing bacteria and pathway of sulphate utilization.

Course Outcome
After completion of this course, students would be able to

Get information on laws of thermodynamics

Apply the various types of nutritional requirements for growth of microbes

Learn important steps on various pathways in microbial physiology

Gain knowledge on methylotrophs and process of methanogens

Understand the role of β oxidation in breakdown of fattyacids

Books for References

- Mott, A.G. and Foster, J.W., (1988). Microbial Physiology, John wily sons.
- Caldwell, D.R., (1995). Microbial Physiology and metabolism, Wm C. Brown Publishers.
- Lim, D.(2001) Introduction to Microbiology, Rata McGraw, New Delhi.
- Powar and Daginawala, (1982). General Microbiology, Vol I. Tat McGraw, New Delhi.
- Meenakumari, L., (2006). Microbial Physiology, MJP Publishers Co., Chennai.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20P2MBC5**	**Core II – Environmental Microbiology**	**5**	**4**

Objectives:

To enable the students

- ❖ To know the microorganisms from environment.
- ❖ To know the different types of habitat and their microbial communities.
- ❖ To learn the role of microbes in biodegradation of industrial, municipal and other waste products.
- ❖ To understand the biological utilization of waste and food sources.
- ❖ To understand the uses of microorganisms and control of pollution.

Unit I

Aeromicrobiology: Droplet nuclei, aerosols, air borne transmission of microbes and diseases assessment of microbes- Assessment of air quality and sanitation- Marine habitats- estuarine, deep sea; hydrothermal vents, salt pans, coral reefs, mangroves and their microbial communities.

Unit II

Biodegradation – Cellulose, lignin, hemicelluloses, chitin, pectin, petroleum products, pesticides and Bioplastics – mode of degradation, enzymes involved and their significance.- Vermicomposting– landfills – leather degradation.

Unit III

Role of Microbes in waste process technology – Bioremediation, Bioleaching, Degradation of xenobiotics. Utilization of waste as food (SCP, Yeast and Mushroom), fuel (Ethanol and Methane), fertilizer (Bacteria, algae and fungi) and as feed (Algae and Yeast).

Unit IV

Liquid waste management- Composition, BOD, COD and DO- Sewage treatment –physical, chemical and microbiological treatment -pollution and its hazards –sources – mine drainage, radioactive leakage –air pollution

Unit V

Aquatic microbiology –aquatic habitats fresh water, lakes, ponds and streams –Role of microorganisms in the aquatic ecosystems-ecological pyramids, food chain and food web –water borne diseases –solid waste management –Aerobic and anaerobic digestions.

CourseOutcome

After completion of this course, students would be able to

Develop understanding the significance of assessment of air quality and sanitation

Get more idea about the biodegradation of xenobiotic compounds

Get awareness on role of microbes in waste process technology

Obtain idea about the solid and liquid waste management in Environment

Diogonosisof the role of varions microbes in aquatic ecosystem

Books for References

- Sharma, P.D.,(2005) Ecology and Environment.
- Dr.SushmithaBaskar and R.Baskar(1970)– Environmental science for engineering under graduates.
- Cyoel, P.K., (2005)Water Pollution (Causes, effects and control).
- Rao, C.S., (1991)Environmental Pollution Control engineering.
- Vasudevan, N.,(2006) Essentials of Environmental Science.
- Joseph, E., Daniel, (1996)Environmental aspects of Microbiology.
- Sharma, P.D.,(2005) Environmental Microbiology.
- Vijaya Ramesh, K.,(2005) Environmental Microbiology.
- Sharma, P.D.,(2005)Ecology and Environment.
- Paulsamy, S., (2001)Introduction to Environmental Biology.
- SunakarPanda,(2005) Environmental and Ecology.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20P2MBC6**	**Core III – r DNA technology**	**5**	**4**

Objectives:
To enable the students
- ❖ To know the modern concepts of microbial biotechnology.
- ❖ To learn genetic engineering, application, cloning strategies, gene libraries DNA cloning, database collection and bioinformatics.
- ❖ To understand the microbes and their applications in enzyme technology.

UnitI

Enzymes involved in genetic engineering - properties of enzymes, methods of enzyme production and application. Vectors – Plasmids, cosmids, phagemids, phasmids, expression vectors, shuttle vectors and artificial chromosomes (BAC and YAC). Cloning strategies – Isolation of desired gene –Steps in gene cloning methods.

Unit II

Blotting techniques – Southern, Northern, Western and Dot blotting- Colony and Plaque plating- PCR: Types and its applications -Chromosomal Walking and jumping -cDNA Libraries and genomic libraries- DNA finger printing-Transgenic fish, animals andplants- gene therapy-Gene silencing.

Unit III

Genomics – definition- Whole genome analysis- Automated sequences – Physical methods of sequencing – Maxam and Gilbert and Sanger's method. DNA micro arrays and microchips. Proteomics – definitions, multidimensional protein identification technology.

Unit IV

Protein engineering – enhancement of enzymes activity - modifiedspecific methods- addition of disulphide bonds – aminoacidsubstitutions – substitutions reducing free sulfhydryl residences – site directed, evolutionary mutagenesis and DNA shuffling – uses and advantage of protein engineering .

Unit V

Biosafety:Introduction,Containment, physical and biological methods- Recognition of facility competent authority – Large scale experiments and manufacture Biological Produced by r DNA technology. Release to environments & field. Genetic engineering approval committee (GEAC) Good Laboratory Practices (GLPs)

CourseOutcome
After completion of this course, students would be able to

Acquire knowledge on various types involved in genetic engineering process

Students gathering more information about the gene theraphy and gene silencing

Understand the uses of protein engineering in rDNA technology

Get information on biosafety measures and containment process

Learn the importance of human genome project

Books for References

- Old, R.W. and Primose, S.B., (1987). Principles of Gene Manipulation, Blackwell Scientific Publications, Oxford, U.K.
- Satyanarayana, U., (2005). Biotechnology, Books and Allied Private Limited, 1st Edition, Kolkata.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
II	**20P2MBC7**	**Marine Microbiology**	**5**	**4**

Objectives:

- To know the various microbes of marine
- To learn the noval bioactive compounds
- To know the various metabolic activity of marine microbes .

Unit I

Marine Microbial disserts Marine environment – see benthic and littoral zone, saltpan, mangroves and estuarine microbes loop – marine microbial community – planktons,bacteria, fungi, protozoa.

Unit II

Marine Microbial - Disease Marine food borne pathogens – Aeromonas ,Vibrio, Salmonella, Pseudomonas and Corynebacter.

Unit III

Marine microbial biotechnology, production and application of marine microbial products – pigments –Astaxanthin B, carotene, enzyme, antibiotics – polysaccharide- sea food preservation methods.

Unit IV

Seafood microbiology: General features associated with fish spoilage - fish and human pathogens :Indicator of pollution – faecalcoliforme, prevention and control.

Unit V

Methods of studying the marine microorganism, methods of collection enumeration (total and vial count)- Microbial nutrition – influence of environment factors on microbial growth, activity and distribution - preservation of marine microbes.

CourseOutcome

After completion of this course, students would be able to

Understand the knowledge on marine microbial community

Learn important steps in the preparation marine microbial products

Acquire knowledge on spoilage of sea food

Develop understanding the knowledge on significance and influence of environmental factors on marine microbial growth

Examine the steps involved in preservation of marine microbes

Books for References

- Prescott,L.M Harley J.P Klein (1999) Microbiology WCB,Mc Grow Hill Publication Rain M.Maier Ian
- L.Pepper, Charles P.Gerba (2006) EnvironomentalMicrology,
- Academic Pree.
- Jamesh W. Nybakker(2001).Marine Biology Benjamin Cummings Shimshon Belkin and Rita
- 4.R.Colwell(2005) Ocean and health : Pathogens in the marine environment. Springer.
- Scheper,T. (2005) Advances in Biochemical Engineering / Biotecnology – MerineBiotecnology
- I.SpringerBhaakuni,D.S. and Rawat D.S. (2005).Bioactive marine natural products.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20P2MBEL2A**	**Major Elective 2 – Microbial Nanotechnology**	**5**	**4**

Objectives:

- To understand the importance of nanotechnology.
- To know the role of various types of nanoparticles.
- To understand the applications of nanotechnology in medicine.
- To enable the student to acquire the knowledge on nanoparticles in environment.

Unit I

Basic concepts in Nanotechnology: Classification of nanostructures, nanoparticles, nano-clusters, nanotubes, nanowires and nanodots, liposomes, cubosomes and hexosomes, lipid based nanoparticles-liquid nanodispersions- solid lipid nanoparticles (SLP), nanoscale dimensions affected properties.

Unit II

Synthesis of Nanoparticles: Chemical- pyrolysis- inert gas condensation, solvothermal reaction, sol-gel fabrication, structured media- physical – Combustion method – soft chemical method ; Ball milling-and biological methods of nanoparticle synthesis- silver, zinc oxide, gold and titanium; intracellular synthesis and extracellular synthesis; role of microorganisms in nanoparticle biosynthesis, mechanism of synthesis of nanoparticles, properties; assembly. Inorganic, organic and hybrid nanomaterials.

Unit III

Characterization Techniques Structural studies of Nanoparticles- XRD and FT- IR. Microscopic techniques- electron Microscopy- SEM, TEM, biological sample preparation for TEM- scanning probe microscopy- STEM- AFM- confocal Microscopy- Scanning Near Field Microscopy- Spectroscopic and Electrochemical techniques- UV-Vis Spectroscopy- Energy Dispersive X-ray spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy, Differential Scanning Calorimetry (DSC).

Unit IV

Applications of Nanoparticles:Biomedical Applications Antimicrobial activity of nanoparticles- antibacterial, antifungal, antiviral, antiparasitic, antihelmenthic, mosquito larvicidal, bacterial sporicidal, insecticidal activity, herbicidal activity. mechanism; mode of action of nanoparticles on microbial growth. Nano science in agriculture-fertilizers and pesticides. Nanoscience for water treatment and fermentation process. Cleaning the air with Nanotechnology.Nanoparticles as Photocatalyst (TiO_2andZ_nO)

Unit V

Nanotoxicology- Nanotoxicity in humans and environment- *In vitro* toxicity assessment methods- proliferative assay, oxidative stress assay, inflammatory assay. *In vivo* toxicity assessment. Nanotoxicity evaluation in aquatic and terrestrial ecosystem.

CourseOutcome
After completion of this course, students would be able to

Get information on basic concept and its potential role in nanotechnology

Appraise the knowledge about the synthesis of nanoparticles and nanomaterials

Get knowledge on stuctrural studies of nanoparticles in nanoscience

apply the nanotoxicity evaluation in aquatic and terrestrial ecosystem

Understand the role of nanoparticles in Agriculture

Books for References

- Bandyopadhyay, A.K., (2008). Nanomaterials, New age International publisher. New Delhi.
- Rosenthal, S.J. Wright, D.W., (2005). Nanobiotechnology protocols (Methods in Molecular Biology) Human Press Publisher, Totowa, New Jersey.
- Poonam, T. and Sheefali, M.T., (2011). *In vitro* methods for nanotoxicity assessment: advantages and applications. *Arch. Appl. Sci. Res.,* **3(2):**389-403.
- Jain Taylor, K.K., (2006). Nanobiotechnology Molecular diagnostics: current techniques and applications (Horizon Bioscience) 1st edition, Basel, Switzerland
- Johnston, H.J., Hutchison, G., Christensen, F.M., Peters, S., Hankin, S. and Stone, V., (2010). A review of the in vivo and in vitro toxicity of silver and gold particulates: Particle attributes and biological mechanisms responsible for the observed toxicity. *Cri. Rev. Toxicol.,***40(4):** 328–346.
- Batley, G.E., Kirby, J.K., and McLaughlin, M.J., (2013). Fate and risks of nanomaterialsin aquatic and terrestrial environments. *Accounts of Chem. Res.,***46(3):** 854–862.
- Ravichandran, K., Swaminathan, K. andSakthivel, B., (2013) Introduction to thin films, Research India Publications, New Delhi.

Web References :

- http://crnano.org/whatis.htm
- www.microbiologyprocedure.com/genetics/microbial-genetics/microbial-genetics.htm
- www.nanobotblogspot.com
- www.azonano.com

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. Credits
II	**20P2MBEL2B**	**Major Elective - II Soil Biology**	**5**	**4**

Objectives:

- To understand the biocontrol, IPM, soil fertility and also to learn the mineral transformation of different minerals in soil.

Unit I

Soil forming factors: Parental material, climate, Biota (Microbial biodiversity)and organic residue, Topography (Slope and elevation) and time soil – Mechanical composition of soil – Physical properties of soil – texture, structure, air, colour, temperature and other properties.

Unit II

Soil colloids and chemical properties – clay, organic colloids (Humus), inorganic colloids – importance of soil colloids -soil erosion and effects of erosion .

Unit III

Role of biogeochemical cycles and its importance – nitrogen, carbon, sulphur, phosphorus and iron.

Unit IV

Soil surveys – early and modern concepts – Factors that control the distribution of soil – Development of soil survey and the soil map of Tamil Nadu. Mineral transformation of N, P, K, S, Fe and other micro nutrients, C:N ratio.

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Unit V

Soil – definition – subsoil – Soil factors for plant growth – origin of soil sedimentary – transported. Soil – minerals and rocks – Landforms and the classification of parent materials – Materials deposited from water, wind and ice.

Course outcome

After completion of this course, students would be able to

Develop the understanding the significance of soil forming factors

Get information of functions of soil microflora and fauna in soil biology

Aquire knowledge on role of biogeochemical cycle and its importance in soil ecosystem

Seek information of soil survey and its early and modern concepts

Distinguish the role of organic and inorganic soil colloids

Books for References

- Raymond, W., Miler and Roy, L. and Donahue, (1992). Soils – An introduction to soils and plant growth, Prentice Hall of India P. Ltd., New Delhi.
- Marlin Alexander (1961). Introduction to Soil Microbiology, Wiley International Ed.
- Soil survey Division Staff (1955). United States Dept. of Agri., Soil Survey Manual Scientific Publishers, Jodhpur.
- V.Kumarsan (-) Plant ecology and phytogeography, saras publication
- Sharma .P.D. (2003) Ecology and environment Rastogi publications

Semester	Subject Code	Title of the Paper	Hoursof Teaching /Week	No. of Credits
II	**20P2MBCP2**	**Core – PL – Microbial Physiology, Environmental Microbiology, Recombinant DNA Technology and Marine Microbiology**	**5**	**5**

Objectives:

- To know about the production of enzymes by microbes.
- To estimate the various biochemical parameters in microbes.
- To isolate, plasmids, chromosomal DNA.
- To know the separation and quantification of nucleic acids.
- To isolate resistant mutants.
- To know about water and soil analysis

Microbial Physiology

IMVIC test
Casein hydrolysis.
Urease test.
Hydrogen sulphide production test.
Catalase test.
Triple sugar iron test
Oxidase test
Lipid hydrolysis
Effect of pH on growth
Effect of temperature on growth
Carbohydrate fermentation test
Coagulase test
Amylase production test
Estimation of glycogen.
Estimation of protein (Lowry's method).
Estimation of sugar (Anthrone method).

Environmental microbiology

Microorganisms in Air.
MPN technique

Water Analysis

Alkalinity of Water
Total Carbondioxide
Chloride
Dissolved Oxygen
Biological Oxygen demand
Chemical Oxygen demand
Total hardness
Soil Analysis

Moisture
pH
Estimation of Organic Carbon

Recombinant DNA Technology

Plasimd DNA isolation from *E.coli*.
Agarosegel electrophoresis technique
Visualization of protein by SDS PAGE

Marine Microbiology

Isolation and enumeration of microorganisms from marine soils
Isolation of microorganisms from salt pan
Isolation of planktons marine environment.
Isolation of microorganisms from polluted environment.

CourseOutcome
After completion of this course, students would be able to

Classify the various biochemicals tests used for identification of microbes

Learn to estimate various microbes role of compound in microbial growth

Examine and detected the MPN technique

Obtain the knowledge on isolates and identification of air born microbes

Demonstrate the separation of protein by using SDS

References

- John, P, Harley (2007), Microbiology Laboraory manual 1st Ed. McGraw – Hill Publication.
- Collins, C.H. Lyne P.M. 1985. Microbiological methods. Butterworths, London.
- James G. Cappuccina and Natalie Sherman (1996). Microbiology-A laboratory Manual 4h Ed. The Benjamin publishing company, New York.
- Atlas R.M. and Bartha. R.1993. Microbial ecology. Fundamental and applications 3rd Ed. Benjamin cummings. Publishers Co. New York.
- Rengaswamy G and Bagyaraj, D.J.(2001). Agricultural Microbiology 2nd Ed. Practice Hall of India pvt. Ltd. New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3MBC8**	**Core I – Medical Microbiology**	**5**	**4**

Objectives:
To enable the students
- ❖ To know the microbes of medical interest.
- ❖ To learn the bacterial diseases and its treatment.
- ❖ To learn the viral diseases and its treatment.
- ❖ To learn the fungal diseases and its treatment.
- ❖ Medical research Institute –lab visit compulsory neighbouring place within the state -2-3 days.

Unit I

Bacteriology: Gram positive organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis and prophylaxis of *Staphylococcus aureus, Streptococccuspyogenes, Pneumococcus sp., Bacillus anthracis, Corynebacteriumdiphteriae, Clostridium welchii, Cl. tetani, Clostridium botulinum. Mycobacteria, Spirochaetes – Treponemapallidium*, and Elementary knowledge on Chlamydiae, Rickettsiae and Mycoplasma

Unit II

Bacteriology: Gram negative organisms:- Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of *E.coli, Klebsiellasp, Enterobactersp, Salmonella sp, Shigellasp, Pseudomonas sp, Vibrio cholerae, Aeromonashydrophila, Bordetellapertusis, Yersinia pestis, Bacteroides and Neiserria spp.*

Unit III

Virology: Basic concepts of virology - General properties of Human viruses, Approaches to viral diagnosis- Serological and Molecular techniques. Pathogenicity and Laboratory diagnosis and prophylaxis of viral infections - Hepatitis, Polio, Rabies, Influenza, Measles, Mumps, Rubella, Dengue, HIV, Ebola, Zika Corona virus.

Unit IV

Mycology : General properties and approaches to laboratory diagnosis. Mycosis –Superficial, Subcutaneous and Systemic infections – Dermatophytosis, Cryptococcosis, Madura mycosis, Histoplasmosis, *Candida albicans*. Parasitology: Pathogenicity and laboratory diagnosis of *Entamoebahistolytica, Taeniasolium, Plasmodium vivax, WucherariabancroftiEnterobius vermicularis andTrichomonas vaginalis*.

Unit V

History of Medical Microbiology: History, Classification of medically important microbes. Normal microbial flora. Infection- Source, mode of transmission, Diagnosis – Process of sample collection, transport and examinations of the specimens.

CourseOutcome
After completion of this course, students would be able to

Acquire knowledge on prophylaxis of positive ad gram negative microorganisms

Approaches on properties and diagnosis of human viruses

Enable the pathogenicity treatmentfor content of pathogens in mycology and parasitology

Get information on classification of medically important microbes

Evaluvete the various types of viral infection especially covid 19

Books for References

- Ananthanarayanan and JayaramPanicker.(2005) Textbook of Microbiology.
- Lisa Anne Shimeld, Anne T. Rodgers .(1999) Essentials of Diagnostic Microbiology.
- Lenetle, E, Balows, H.A. (1985)Manual of Clinical Microbiology.
- Subash. C. Parija.(2013) Textbook of Medical Parasitology.
- Geo. F. Brooks. (2010)Medical Microbiology.
- JagadeshChander.(1992) Medical Mycology.
- Topley and Wilson (1990). Principles of Bacteriology, virology and immunology VIII ed.VolIIIedward Arnold .London.
- Huge W.B. Russell A.D. 1989. Pharmaceutical Microbiology. IVth ed. Blackwell Scientific Publication oxford.
- David Greenwood, Richard C. B, Slack and John F. Peutherer. (1992). Medical Microbiology. 14th ed. ELBS with Churchil Livingstone.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3MBC9**	**Core II – Immunology**	**5**	**4**

Objectives:

To enable the students

- ❖ To learn immunity and its types.
- ❖ To know the antigen antibody interactions
- ❖ To learn immunization with classical vaccines. Modern vaccination
- ❖ To learn tumor immunology.

Unit I

Organs and cells of immune system – Immunoglobulin – Structure, types and properties – monoclonal antibodies production. Innate immunity – acquired immunity.Hypersensitivity reaction – antibody mediated type I anaphylaxis – type II antibody dependent cell mediated cytotoxicity immune response.

Unit II

B and T Cell Activation - B cell receptors complex, B cell maturation, Generation of antibody diversity, T cell subpopulation, Organisation of T cell receptors. Humoral and cell mediated immunity.

Unit III

Agglutination, precipitation, Complement fixation – pathway of complement activation – Transplantation-Auto immuneresponse.Tolerancelymphokines and cytokines. Types of vaccines – vaccines in current scenario and development. Tumour immunology.

Unit IV

Immunotechnology and its applications - radiology in immunotechniqes, Enzyme-Linked immunosorbent assay (ELISA), Western blotting, immunofluorescence, Flowcytometry and immunoelectron microscopy. Immunodeficiency diseases - immune system in AIDS, Plasmatheraphy, Immunbooster.

Unit V

Immunology: History,Introduction– Antigen – Types and properties.Antigen – Antibody reaction – agglutination, precipitation, Complement fixation.

CourseOutcome

After completion of this course, students would be able to

Gain knowledge on types of immunity and immune system

Get information on antigen Antibody reaction

Seek information on vaccines in current use and development

Gain knowledge on application radiology in immunotechniques

Plan to know the structure types and properties of immunoglobulins

Books for References

- Roitt, IM., (1998). Essential of Immunology ELBS Blackwell Scientific Publication.
- Kuby, J, (1994). Immunology, II Edition WH, IVeeman and Company, New York.
- Klaus D. Elgent, (1996). Immunology understanding of immune system, Wiley Liss NY.
- Stitcs, D.P. Terr, A.I., Parslow, T.G., (1993).Medical Immunology 9th Edition, Appleton and larnge, Stamford.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	20P3MBC10	Core III – Microbial Genetics and Molecular Biology	5	4

Objectives:

To enable the students

- To know the types and forms of nucleic acids in the microbial world.
- To understand the internal mechanism of the genes and its techniques.
- To understand the isolation and purification of plasmids of microorganisms.
- To learn the gene transformation and transduction mechanism.

Unit I

DNA replication – bidirectional, rolling circle replication and semiconservative DNA repair mechanism – excision repair, SOS repair and mismatch repair.Process of transcription – initiation, elongation – termination, RNA processing – capping and polyadenylation., Process of translation – initiation, elongation and termination – signal sequences and protein transport.

Unit II

Concept of Gene – Operon concept - lac and trp operons. Regulation of gene expression in Prokaryotes and eukaryotes. Translational control – ribosome binding, codon usage, antisense RNA; Post translational regulations

Unit III

Gene transfer mechanisms – Transformation – competence of cells, mechanisms of transformation – Transduction – general and specialized – conjugation – Hfr strains – mechanism of conjugation..

Unit IV

Transposable elements: IS elements and transposons, - mechanism of transposition and recombination. Introduction, characteristics, mechanism and regulation of transposition in Tn3 and Tn5. Transposable elements in fungi. Mutagenesis - biochemical basis of mutants, spontaneous and induced mutation. Isolation techniques of mutants. Reversion and suppression of mutation. Site directed mutagenesis.

Unit V

Types and forms of nucleic acid – their organization and functions Plasmids – types – F plasmid, Resistance plasmid, Col plasmid, fertility plasmid, Degradative plasmid, Virulence plasmid, and replication - Genetic code.

CourseOutcome

After completion of this course, students would be able to

Acquire knowledge on DNA replication and process of transcription

Get information on regulation of gene expression in prokaryotes and eukaryotes

Gain knowledge on gene transfer mechanisms

Distinguish the molecular biology

Understand the role of genetic code in genetic engineering

Books for References

- James, D., Watson, Tania A. Baker, Stephen, P. Bell and Alexander Gann,2013 Molecular Biology of the Gene, Fifth Edition.
- Malaunsinsk, G.M. and Freifelder, D., (1998). Essentials of Molecular Biology, 3rd Ed, Joh and Bartleh – Publishers.
- Lewin, B., (2000). Genes VII Oxford University Press.
- Stryer, L., (2002). Biochemistry 5th Ed, W.H. Freeman and Company.
- Wilson, K and Walker, J (2010). Principles and techniques of biochemistry and molecular biology, Cambridge university Press.
- Meneely P, Hoang R D, Okeke , IN and Heston K (2017), Genetics, genes and evolution, Oxford University Press.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
III	**20P3MBC11**	**Fundamental of Biological Sciences**	**5**	**4**

Objectives:

- To enable the students to understand the basic knowledge in Biological Sciences
- To understand different life cycle patterns of plants and animals
- To know the structure and reproductive behaviour of organisms

Unit I

Algae and Fungi Thallophytes: Algae-General characteristics- Economic importance- Types of life cycle- Outline of various classifications. Fungi: General characteristicsClassifications and Economic importance

Unit II

Plant reproduction General characteristics- Economic importance and outline of reproduction methods in Bryophytes, Pteridophytes and Gymnosperms

Unit III

Plants Basics of plant cell – Monocot and dicot - Classification of plant diversity – Classes of plant kingdom- Morphology: Inflorescence types -Racemose, cymose, and Mixed –Special types, Cyathium, Hypanthodium, Verticillaster and Thyrsus. Technical description of flower and floral diagram- Microsporangium and structure of Polygonum type embryo sac- Taxonomy: Systems of classification, (Artificial, Phylogenetic and Natural). Outline of Bentham and Hooker's classification.

Unit IV

Invertebrates General characteristics and outline classification upto classes in Protozoa, Porifera, coelenterata, Platyhelminthes and Ashelminthes; Economoic importance of invertebrates. Classification of Chordata – Characteristic features - protochordata class – Pisces and Amphibia up to orders - General characters - a brief study on Star fish.

Unit V

Vertebrates and pests control Salient features of Reptilia, Aves and Mammalia- Economic importance of Vertebrates. Bioluminescence. Insect pests of rice, sugarcane, coconut, cotton, vegetables, fruits and stored products (with an example of each). Principles of insect control: physical, mechanical, chemical, biological and integrated methods of pest control.

CourseOutcome
After completion of this course, students would be able to

Gain knowledge on classification and economic importance of algae and fungi

Get information on outline of reproduction methods in bryophytes pteridophytes and gymnosperms

Outline the Bentham and Hooker's classification and its merits and demerits

Acquire information on general characteristics of vertebrates and invertebrates

Formulate the procedure for integrated methods of control

Books for References

- Arumugam N. Invertebrate Zoology, Saras publication, Nagercoil.2002.
- Ekambaranatha Iyar M and Ananthakrishnan TN. Manual of Zoology. Vol. I. part I and II, S. Visvanathan publication, Chennai.1994.
- Ayyar EK and Ananthakrishnan. A Manual of Zoology, Vol. II (Chordata).1992.
- Ekambaranatha Iyar M and Ananthakrishnan TN. Manual of Zoology Vol.II. S. Visvanathan publication, Chennai.1994.
- RanganathanTN.Chordata Zoology, Rainbow printers, Palayamkottai.1996.
- EkambaranathaAyyar. Outlines of Zoology. Vols. I and II S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.1993.
- Kotpal RL. Invertebrata, Rastogi Publication, Meerut.2000.
- Jordan EL and Verma PS. Invertebrate Zoology, 12th Edition, S. Chand and Co.1995.
- Mani MS. General Entomology, Oxford and IBH publishing Co., New Delhi. 1982.
- Nayar KK, Ananthankrishnan TN and David M. General and applied Entomology, Tata McGraw Hill Pub. Co., Ltd., New York. 1995.
- David BV. Pest Management and pesticides Indian Scenario, Namrutha Publications.1992.
- Krishnan NT. Economic Entomology, J.J. Publications, Madurai. 1993.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3MBEDC**	**Extra Disciplinary Course – Mushroom Technology**	**4**	**-**

Objectives

- To know the various types of edible mushroom and their nutritional value.
- To understand the methods of cultivation of mushrooms.
- To know the types of food prepared from mushroom and their importance in human health.
- Marketing of mushrooms in India and abroad.
- Mushroom cultivation unit visit- mandatory –Neighbouring District –oneday.

Unit I

Introduction – history and scope of edible mushroom cultivation – Types of edible mushrooms available in India – *Calocybeindica, Volvariellavolvacea, Pleurotuscitrinopileatusand Agaricusbisporus.*

Unit II

Pure culture – preparation of medium (PDA and Oatmeal agar medium) - sterilization – preparation of test tube slants to store mother culture – culturing of *Pleurotus*mycelium on petriplates, preparation of mother spawn in saline bottle and polypropylene bag and their multiplication.

Unit III

Cultivation Technology: Infra structure – Mushroom bed preparation – paddy straw, sugarcane thrash, maize straw, banana leaves - Factors affecting the mushroom bed preparation – Low cost technology - Composting technology in Mushroom production.

Unit IV

Storage and nutrition: Short-term storage (Refrigeration – upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutritive value – proteins, amino acids, mineral elements, Carbohydrates, Crude fibre content and Vitamins – medicinal value of Canoderma.

Unit V

Food Preparation – Types of food prepared from mushroom; Soup, Cutlet, Omlette, Samosa, Pickles, Curry, mushroom 65 and Briyani – Research Centres – National level and Regional level – Cost benefit ratio – Marketing in India and abroad and Export value.

CourseOutcome

After completion of this course, students would be able to

Get information on the various types of edible mushroom available in india

Gain knowledge on preparation of mother spawn by using saline bottle

Acquire knowledge on storage of mushroom using long term preservation

Develop skill for the mushroom cultivation unit in their native place

Demonstrate the proficiency of marketing of mushrooms

Books for References

- Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayaranjan, R., (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
- Swaminathan, M., (1960). Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No.88, Mysore Road, Bangalore 560 018.
- Tewari, Pankaj Kapoor, S.C., (1988). Mushroom Cultivation, Mittal Publications, Delhi.
- Nita Bahi (1984-1988). Handbook of Mushrooms, II Ed, Vol. I & II.
- Paul Stamets, J.S and Chilton J.s (2004). Mushroom cultivation. A practical guide to graining mushroom at home Agarikon Press.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3MBCP3**	**Core – PL – Medical Microbiology, Immunology and Microbial Genetics & Molecular Biology**	**5**	**5**

Objectives:

- To identify the normal flora of human body.
- To estimate various properties in urine, blood etc.,
- To perform various tests for disease confirmation.
- To learn about mutant and isolation
- To learn the bacterial transformation

Medical Microbiology and Immunology **Hrs60**

1. Collecion and transport of clinical specimen for microbiological examination.
2. Isolation of bacteria from skin
3. Isolation of bacteria from urine
4. Estimation of urine – bile salt and albumin
5. Determination of total count of blood cells – WBC, RBC, Differential count.
6. Haemoglobin estimation
7. Estimation of glucose in serum (orthotoludine method)
8. Widal test (Typhoid fever)
9. Determination of ABO blood group
10. Determination of Rh blood group
11. ELISA technique
12. Immunodiffusion - double
13. Antibiotic Sensitivity test

Microbial Genetics and Molecular Biology

14. Bacterial conjugation
15. Bacterial transformation
16. Isolation of mutants by gradient plate techniques
17. Separation of protein by SDS-PAGE
18. Isolation of lactose (Lac) mutants of *E.coli*
19. Separation of Isozymes by native gel electrophoresis.
20. Diagnosis of virus

CourseOutcome

After completion of this course, students would be able to

Gain more knowledge about the isolation of microbes from various clinicalsamples on microbiological examination

Acquire knowledge about the determination of total count of blood cells in human

Outline the double immune diffusion methods to detect antigen- antibody reaction

Get information on antibiotic sensitivity test by kirbybauyer method

Learn the techniques on the isolation of lac-mutants

References :

- Lesile Hudson, Frank, C. Hay. (1989). Practical immunology, 3rd Ed. Blackwell scientific publication.
- Talwar, G.P Gupta SK (2012). A hand book of practical and clinical Immunology. CBS publication.
- Frank C. Hay, Olwyn, M.R. Westwood (2008). Practical Immunology, 4th Ed. Blackwell Scientific Ltd.
- Hilay Warren (2003). Practical Immunology, Blackwell Scientific Ltd.
- Current Protocols in molecular biology (2007). John Wicey and sons Inernaional Publishers. Vol.1 and 2.
- John , P. Harley (2007). Microbiology Laboratory manual. McGraw. Hill Publication,1st Ed.
- Harry W, Seeley Jr and Paul J vandemark W.H. Freeman (2003).A Laboratory manual of Microbiology.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20P4MBC12**	**Core I – Bioinstrumentation and Biostatics**	**6**	**4**

Objectives:

- To learn the techniques used in research.
- To make the students understand the main principles in biostatistics.
- To make the students apply statistical principles to biological studies.
- To enable the students to understand computer hardware, software and various programming languages.
- To make the students know the scientific application of packages.
- To make the students understand the problems selection and project design.

Unit I

Filtration – methods, filter media, filter aid, ultra filtration, Industrial filters – dead end filter, cross flow filter, Rotary vacuum filter, frame filter etc. Radio active isotopes, half life of isotopes and tracer technique – autoradiography – scintillation and GM counters.

Unit II

Principle and application ofchromatography, adsorption affinity and ion exchange, Gel permeation - GCMS and HPLC. Colorimeter, Flame photometer, atomic absorption spectrophotometer, NMRE and TIR.

Unit III

Centrifugation- Principles, types,simple and differential, Ultra centrifugation,Isopyenic and rate zonal centrifugation –preparative and analytical –principles and application of pH meter - UV–Vis- Spectophotometer.

Unit IV

Biostatistics- History and scope –population and sampling (Methods**).** Variables – Graphical and diagrammatic representation. Measures of central tendency – Measures of dispersion – range, mean deviation - Standard deviation; coefficient of variants, application of standard error

Test of significant: ‘t’ test, ‘chi square test’, one way ANOVA – simple correlation and linear regression, application of computers in biostatistics.

Unit V

Research design – choosing the problem, review of literature – primary, secondary and tertiary sources, bibliograhy, - Reporting the results of research in conferences – oral and poster presentation – report writing – components and preparation of thesis - Plagiarism

Course Outcome

After completion of this course,students would be able to

- Get more idea about the radioactive isotopes and its role in half life period
- Learn important steps in chromatographic techniques
- Understand the application of computers in biostastics
- Acquire knowledge about the preparation of manuscript
- Plan the preparation of oral and poster presentation

Books for References

- Jayaraman, J., (1972). Techniques in Biology. HigginbothamsPvt., Ltd., Madras.
- Jayaraman, J., (1985). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
- Balagurusamy, E., (1985). Programming in BASIC, 2nd Ed., Tata McGraw Hill Pub. Co., New Delhi.
- Khan, I.A. and Khanum, A., (1994). Fundamentals of Biostatistics, Vikas Pub., Hyderabad
- **Text Books**
- Gurumani, N., (2006). Research Methodology for Biological Sciences 1st Ed, MJP Publishers, Chennai.
- Gurumani, N., (2005). An Introduction to Biostatistics, Second Revised Edition, MJP Publishers, Chennai.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20P4MBC13**	**Core II –Microbial Biotechnology**	**6**	**4**

Objectives:

- To know the principles of microbial fermentation and screening of industrially important strains.
- To know the fermentor – its types and their uses in the production of various enzymes and products.
- To learn about the fermentation products and the role of microbes involved.
- To understand the IPR and industrial management practices.
- Industrial visit is compulsory Regional /National / International level for a period of 5 days.

Unit I

Principles of Microbial fermentation – Principles and types of Screening. Types of Immobilization and its application.Industrial Management and management practices .

Unit II

Upstream processing- Fermentors – Types – Design and Operations – continuous parameters, sampling systems – Chemostat, Turbidostat. Containment – Mechanism of foam fermentations and foam breaking. Computerized control system - Biosensor.

Unit III

Downstream processing – Precipitation, filtration, centrifugation, cell disruption, liquid - liquid extraction, whole broth processing.

Unit IV

Biotechnological productsfromrDNA technology - Primary and secondary - penicillin, ethanol, vitamin B_{12}, citric acid, amylase, rabies vaccine, insulin, Interferon and SCP,Biofuels, Detergents Enzymes – amaylase, protease and lipase.

Unit V

Patent laws and legal protection; Indian and International patent laws to patening of microbes and their products. Intellectual Property Rights (IPR).culture collection and maintenance of important industrial strains.

CourseOutcome

After completion of this course, students would be able to

Gain knowledge about the microbial fermentation processes

Gathering more information on upstream and downstream processing

Obtain idea about the biotechnological products from r DNA technology

Seek information in patent laws and legal protection

Analysis the role of fermentation in Industries

Books for References

- Agarwal, (2006). Industrial Microbiology: Fundamental and Application, M/S, IBD Publishers and Distributors, New Delhi.
- Patel, A.H., (2003). Industrial Microbiology, Mac Millan.
- Stanley, P.F.A., Whittaker and Hall, S.J., (1995). Principles of Fermentation Technology.
- Alexander, N., Glazer and HisorshiNikaido, (1994). Microbial Biotechnology, Fundamentals and Applied Microbiology, W.H. Freeman and Co., New York.
- Rajak, 2005. Microbial Biotechnology for Sustainable Development and Productivity, M/S. IBD Publishers and Distributors, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20P4MBEL3A**	**Major Elective – Biodiversity and Conservation Management**	**6**	**4**

Aims and Objectives:

- The aim of the study of biodiversity conservation is to protect the existing flora and fauna for enhancing the beauty of our planet mother earth and to pass it on for our future generation with all the conserved resources for maintaining environment friendly sustainable development.
- Field visit –Marine Biodiversity, Algal industries

Unit I

Biodiversity – Definition – Levels of Biodiversity, Types of Biodiversity – Public education and awareness, sustainable uses of component of Biological diversity, Biodiversity – conservation department in India.

Unit II

Biodiversity assessment and inventory programmes – Morphological and molecular characterization of biodiversity – Methods for species Identification and Classification – UNEP – MAB Financial Resources.

Unit III

Conservation of Biodiversity – *Ex-situ* and *Insitu* conservation – protected areas – biosphere conserves – National park and wild life sanctuaries – Values of Biodiversity – Natural resources – Future strategy for conservation.

Unit IV

IUCN categories – Endangered, Threatened, vulnerable and extinct species – Biodiversity registers - Red Book – Blue book – Green book - species richness in north east India, current status of Biodiversity Indicators.

Unit V

Global Biodiversity Information System, Global back bones – Global species information system, Global Information Facility (GIF) – species 2000 – Tree of life – overview of the UNEP – Biodiversity Data Management Project (BDM) –CBD and Bioethics.

CourseOutcome

After completion of this course, students would be able to

Understand the sustainable uses of component of biological diversity

Gain knowledge on biodiversity assessment and inventory programme

Get information on conservation of biodiversity

Acquire knowledge on current status of biodiversity indicators

Books for References

- Agarwal, SK. And Dubey, P.S. (1996) Biodiversity and Environment, APH Publishing Corporation, NewDelhi.
- Kotwal and Banerjee,( ) Biodiversity Conservation in managed and forests protected areasAgrobio, Jodphur.
- Kumar, U. and AsijaAgrobios, M.(2008) Principles and Conservation, Jodhpur.
- RajendraKanshik, (2008)Jaipur. Introduction to Conservation Genetics Oxford Book Company
- G.Senthilkumar and A.Panneerselvam,(-) Biodiversity Conservation and Management, Sri Murugan Publications, Thanjavur.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20P4MBEL3B**	**Major Elective – Bioinformatics**	**6**	**4**

Aims and Objectives:

- This subject was initiated with an aim to have basic knowledge in computer operating. Nowadays it is necessary to go to the websites and internet for future research work.

Unit I

Basics of computers: Input, Output and Storage Devices (keyboard, Mouse, Scanner, touch screen, Barcode, Microphone, Monitor, Speaker, Printer, RAM, ROM.Hard disk, CD, DVD, Floppy Disk etc.) - Operating System: Windows, UNIX, LINUX; Internet Perception – Internet Service Providers, WWW, Search Engines, Search Techniques; Finding Scientific articles – Pubmed, Highwire, Press and Plos.

Unit II

Biological databases and its types – Sequence, Mapping, Information retrieval from biological databases and Genomic data bases. Data bank, Information analysis centers, Referral centers and Translation centers.

Unit III

Sequence alignments pairwise and multiple alignment – local, Global, dot plot, dynamic. Matrix – BLOSUM, PAM, multiple alignment – Clustal W.

Unit IV

Analysis of nucleotides – restriction mapping, primer synthesis, ORF prediction. Phylogenetic analysis – Neighbour-Joining, Maximum parsimony, minimum livelihood, rooted and unrooted phylogenetic tree.

Unit V

Analysis at protein level – signature, profiles and motifs, Secondary structure prediction, SWISS Model, Visualization of protein structure: RASMOL, SWISS PDB. Inferring Data relationships – BLAST services – blastp, blastx, PSI, PHI and FASTA.

Books for References

- Cynthia Gibas and Per Jambeck, (2001). Developing Bioinformatics Computer Skills: Shroff Publishers and Distributors Pvt. Ltd (O'Reilly), Mumbai.
- Rashidi, H.H. and Buehier, L.K., (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
- Des Higgins and Willie Taylor (2002). Bioinformatics: Sequence, structure and databanks, Oxford University Press.
- Baxevains, A.D. and Ouellette, B.E.F., (2001). Bioinformatics: A practical guide to the analysis of genes and protiens, Wiley Interscience – New York.
- Arora, P.N. and Malhon, P.K., (1996). Biostatistics Himalaya Publishing House, Mumbai.

- Sokal and Rohif (1973). Introduction to Biostatistics, Toppan Co. Japan.
- Stanton, A. and Glantz (2012), Primer of Biostatistics - The McGraw Hill Inc., New York.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20P4MBCP4**	**Core – PL – Bioinstrumentation and Biostastics**	**6**	**5**

Microbial Biotechnology

1. Immobilization ofyeastcells by using sodium alginate.
2. Production of citric acid
3. Cultivation of edible mushrooms – Preparation of spawn and mushroom bed.
4. Production of bioethanol and its estimation
5. Wine production
6. Characterization of wild yeast and test its ethanol producing ability.
7. Production and quantification of enzymes – Amylase, cellulase, protease and lipase.

Research Methodology

1. Preparation of Index cards
2. Citations of References in the test and reference section
3. Proof Correction
4. Preparation of Standard graph – Glucose and Protein

CourseOutcome

After completion of this course,students would be able to

More idea about the immobilization of yeast cells

Outline the production of citric acid by submerged fermentation process

Get informative about the cultivation of edible mushroom with special reference to pleurotus species

Acquire knowledge about the quantification of amylase enzyme production

References

1.Harrigan W. F. 1998. Laboratory methods in food microbiology, Academic press. USA.

2. Spencer J. F. T., Alicia L. Ragout de Spencer. Food microbiology protocols Humana press, USA

3. Frances Pouch Downes, Keith Ito. 2001. Compendium of methods for the microbiological examination of foods. American public health association. Washington.

4. Ahmed Elmeleigy Yousef, Carolyn Carlstrom. 2003. Food microbiology: a laboratory manual, John Wiley and sons Inc, Canada.

5. Chris Bell, Paul Neaves, Anthony P. Williams. 2005. Food microbiology and laboratory practice.

6. https://foodscience.psu.edu/workshops/food-microbiology

7. https://www.mooc-list.com/tags/food-safety

8. http://www.cftri.com/

9. https://fri.wisc.edu/

10. http://www.naro.affrc.go.jp/english/nfri/

11. https://www.fda.gov/

CORE OPTIONAL PAPERS

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**20P1MBCOP1**	**Core Optional – Bio Energy**	**6**	**4**

Objectives:

- The emphasis of course is learning the energy and sources , types of biogas plants , feedstock materials for biogas plant, utilization of biomass for energy production and as biofuels.

Unit I

Biodiesel - Energy –Renewable and non – renewable energy – Energy plantations – Latex producing plants - *Jatropha* – nuclear energy – Energy management and use.

Unit II

Biogas plant – Types – Construction details – Loading of biogas plants – Biogas requirement for various use – Biogas applications – dual fuel engine. Conversion of biogas into electricity.

Unit III

Effective use of Agricultural , Horticultural, Forest and fishery wastes and byproducts as an alternative feed stock for biogas plants – Bio digested slurry – Manural value – Enrichment – Pelletization.

Unit IV

Bio mass residues for agriculture , Horticulture , forest and fishery energetic – fast growing biomass species as energy source – solid, liquid, gaseous energy production from biomass and its use.

Unit V

Biomass briquetting – coir pith groundnut shell etc., - Alcohol from sweet sorghum, tapioca , sweet potato – producer gas – Aqua gas , pyrolytic gas from biomass such as maize cob, groundnut husk, cotton stalk, briquettes.

CourseOutcome

After completion of this course, students would be able to

Obtain knowledge on biodiesel production from renewable sources

Acquire knowledge on biogas plant and its instruction details

Get information in effective use forproduction of byproducts from various sources

Identify ways to control the biomass briquetting

Especially coir pith ,groundnut shell etc

Books for References

- Chawla, O.P.1986, Advances in Biogas Technology. ICAR Publication , New Delhi.
- Khandelwall, K.C. and S.S. Mahdi 1989. Biogas technology. Tata Mcgraw. Hill Publishing company Ltd., New Delhi.
- Kuppuswamy , G. and A.Jeyabal . 1996 . Biogas from Alternative feed stocks.
- MNES project publication.
- Mathur, A.N & N.S. Rathore . 1992. Bio gas Production Management and utilization. Himanashu publications Udaipur. Rajasthan.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20P2MBCOP2**	**Core Optional - Veterinary Microbiology**	**5**	**4**

Objectives: To enable the students

- To learn about the different diseases caused in animals by bacteria, fungi, viruses, their treatment and control and also emphasizes the study of different parasites on animal and control.

Unit I

Microbes Associated with Animal Diseases – Symptoms, diagnosis, treatment and control of Actinobacillosis – Anthrax – Tuberculosis – Bovine mastitis – Haemorrhagicspecticaemia.

Unit II

Mycotic Diseases and Control. Pathogenic fungi – Characteristics Epidemoilogy of fungal diseases symptoms, diagnosis, treatment and control of mycotic diseases of animals.

Unit III

Parasites and control. Definition – Parasites , host, vector, parasitism , Effect of parasitism on the host – Protozoan parasites – Trypanosomes, Leishmania, Plasmodium, Coccidia – Diagnosis, treatment and control. Miscellaneous Protozoan parasites – Amoebae, Ciliates Sarcocysts.

Unit IV

Types of Important viral diseases on Animals. Picorna virus group – Foot mouth disease virus – Enteroviruses of animals – Reovirus group – African horse sickness virus – Blue tongue virus – Roto viruses – Infectious bursal diseases virus. Togo virus group – Swinefever viruses, Mucosal disease virus – Paramyxovirus group, pseudovirus group, Bovine Rhinotracheitis virus.

Unit V

Methods of diagnosis of animal diseases – types of vaccines.

Course Outcome
After completion of this course, students would be able to

Get more idea about the anthrax diseases caused in animals by bacteria,fungi and virus

Gain knowledge on mycotic diseases and control methods

Acquire knowledge on effect of parasitism on the host

Obtain idea about the diagnosis of animal diseases with special reference to covoid-19

Learn more information in different diagonostic methods of detecting animal diseases

Books for References

- Batzing , B.L.2002, Microbiology , An Introduction. Thamsan Brooks cole Publication, London.
- Inglis T.J.J. 1996. Microbiology and infection. Long Man Singapore pub.Ltd.
- Ingraham, J.L and C.A Ingarham 2002. Introduction to microbiology, 2nd Edn. Thamsan Brooks Cole publication, London.
- Johnson,A.G. 1996, Microbiology and Immunology 3rd Edn, Williams and Wilkins Pub. U.K
- Prescott, M.L., J.P.Harley and D.A Klein. 2002. Microbiology 5th Edn. McGraw Hills, USA.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3MBCOP3**	**Core Optional - Food Preservation and Processing**	**5**	**4**

Objectives

- To learn about food preservation
- To know about food processing
- To learn about food contamination
- To learn about food sterilization

Unit I

Food Preservation: Principles and methods - Perishable, semi-perishable and nonperishable foods - Methods of preservation - Temporary preservation - Asepsis, low temperature, antiseptics, pasteurization, electromagnetic radiation - Permanent preservation - Sterilization processing by heat, effect of acidification and antiseptics.

Unit II

Preservation by salting, Preservation by sugar syrup - Preservation by concentration - Preparation of Jam Jelly - Role of pectin in Jam - Preservation by chemicals: Benzoic acid, parabenzene, sulphur-di-oxide, sulphites, nitrites diethylpyrocarbonates (DEPC), hydrogen peroxide, chlorine and CO2

Unit III

Processing - Methods - Wet heating method by cookers. Microwave heating method - Processing of fruits and fruit products - Canning of fruits - Preparation of fruit juices - Squashes - Cordials - Preservation by antibiotics and irradiation.

Unit IV

Vegetable and vegetable products - Canning of vegetables and pickles. Baked products: Classification of wheat - hard wheat, soft wheat, durum wheat, flour preparation, baking formulation, processing. Milk and milk products: butter, ghee, lassi, unfermented milk products, condensed milk, cheese, ice-cream and milk powder.

Unit V

Food additives: Definitions, preservatives, antioxidants - colouring agents, emulsifier, stabilizers and thickening, bleaching and maturing agents, clarifying agents, anti-foaming agents, function of additives. Food adulteration - Adulterants and simple detection techniques - Food grades - Standards, laws and regulations.

Course Outcome
After completion of this course, students would be able to

Learn important steps in principle and methods of food preservation

Develop understanding the significance of microwave heating methods of preservations

Understand the processing of vegetable and vegetable products

Acquire knowledge about the food additives and its role in food industry

Get information to learn the canning of vegetables and pickles

Books for References

- Adams, M. R. and Moss, M. O. (1996). Food Microbiology. New Age International Pvt. Ltd. Publishers, New Delhi.
- Frazier, W. C. and Westhoff, D. C. (1988). Food Microbiology. 3rd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Giridharilal, Siddappa, G. S. and Tandon, G. L. (1990). Preservation of Fruits and Vegetables, CFTRI, Mysore.
- Lal, B., Siddappa, G. B. and Tandon, G. N. (1967). Preservation of Fruits and Vegetables. ICAR Publication, New Delhi.
- ManorajanKalia and SangitaSood. (1992). Food Preservation and Processing. Department of Food Science and Nutrition, College of Home Science. Himachal Pradesh Agricultural University,
- Palampur. Ranganna, S. (1986). Handbook of Analysis and Quantity Control for Fruit, Vegetable Products. CFTRI, Mysore.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20P4MBCOP4**	**Core Optional - Water and Textile Microbiology**	**6**	**4**

Objectives:

- The study Emphasises the different types of water habitats, estuaries, microbial ecosystems, microbial analysis of water, sources of water pollution and purification, biological sludge digestion, spoilage of aquatic products and its utilization, microbial degradation of fibers viz., jute, hemp, coir, flax, cotton, wood and leather and also prevention of damages of fibers.

Unit I

Microbiology of Water – Types of water – Fresh water – Ponds, Lakes, Streams – Marine habitats – Estuaries – Mangroves – Deepsea – Hydrothermal vents – Salt pans – Coral reefs – Microbial ecosystems – Potability of water – Microbial assessment of water quality – Water purification – Brief account of water borne diseases.

Unit II

Microbial analysis of water – Sanitary tests for coliforms – The MPN of coliforms (the membarane filter technique, advantages, disadvantages, defined substrate test, tMViCftest) – Purification of water : Sedimentation filteration, disinfection.

Unit III

Sources of water pollution – water recycling – BOD – COD – Methods of sewage treatment – (Biological – Sludge digestion, activated sludge, aeration filters , oxidation ponds) imhoff tanks – Spoilage of aquatic products – corrosion and leaching.

Unit IV

Liquid waste treatment – Treatment methods primary, Secondary (anaerobic – methanogenesis : aerobic trickling filter and activated sludge process – Oxidation ponds) tertiary treatment – Utilization of liquid wastes.

Unit V

Microbiology of fibers – Retting of plant fibers – jute,hemp, coir,flaxect. – Microbialdigeradation of cotton , jute coir, wood and leather – prevention of damage of fibers.

Course Outcome

After completion of this course, students would be able to

Acquire knowledge on microbial analysis water

Get information an sources of water pollution

Seek information on liquid waste water treatment

Obtain idea about the microbial degradation of textile and effluent dyes

Inoculate the knowledge in the microbiology of fibres

Books for References

- Nybakken W., (1982). Marine biology – An Ecological Approach, Ames harper and Row publications. New York.
- Reheinheimer G., (1980). Aquatic Microbiology.
- Mitchell R.,(1974). Introduction to environmental Microbiology.
- Dubey,R.C and Maheswari, D.K.,(1999). A Text Book of Microbiology. S.Chand and company Ltd., New Delhi.
- Rajak, (2005). Microbial Biotechnology for Sustainable Development and Productivity, M/S. IBD Publishers and Distributors, New Delhi.

COMMUNICATION SKILL AND PERSONALITY DEVELOPMENT

SEMESTER	SUBJECT CODE	TITLE	HOURS OF TEACHING/ WEEK	NO OF CREDITS
IV	20P4-CPD	Communication Skill and Personality Development	1	

COURSE OBJECTIVES:

- To cultivate positive personality traits for successful life.
- To groom Winning Attitude among the learners.
- To assist the learners to identify their own potential and realize their aspirations.
- To enable a holistic development.
- To facilitate optimum means of improving personal performance.

UNIT 1

1. Personality- Definition.
2. Determinants of Personality.
3. Perceptual Process.
4. Personality Traits.
5. Developing Effective Habits.
6. Self Esteem (Freud and Erikson).
7. Self Appraisal and Self Development.
8. Dos and Don'ts to develop positive self esteem.
9. Interpersonal Relationship.
10. Difference between Aggressive, Submissive and Assertive behaviour.
11. Mind Mapping, Competency Mapping, 360 degree assessment.
12. Presentation Skills – Opening, ending, Handling nerves, Handling audience, Power Storytelling, Visual aids, Question and answer session

UNIT 2

1. Projecting Positive Body Language.
2. Conflict Management.
3. Change Management.
4. Stress Management.
5. Time Management.
6. Goal Setting.
7. Assertiveness and Negotiating Skill.
8. Problem Solving Skill.
9. Decision Making Skills.
10. Leadership Qualities of a Successful Leader.
11. Attitudes – Positive Attitudes.
12. Public Speaking – Engaging, Connecting, and Influencing the audiences.
13. Employability Skill – Group Discussion, Interview Questions, Psychometric analysis.

COURSE OUTCOMES:

After completion of the course, Students will be able to:

- Gain self confidence and broaden perception of life.
- Maximize their potential and steer that into their career choice.
- Enhance one's self image&self esteem.
- Find a means to achieve excellence and derive fulfilment.

References:

Hurlock.E.B (2006) : Personality Development, 28th Reprint. New Delhi: Tata McCraw Hill.

Stephen.P.Robbins and Timothy. A.Judge (2014) : Organisation Behaviour.16thEdition.Prentice Hall.

Andrews, Sudhir. How to Succeed at Interviews. 21st (rep) New Delhi.Tata McGrew Hill 1988.

Lucas, Stephen. Art of Publication. New Delhi. Tata McGrew Hill. 2001.

Kumar, Pravesh. All about Self Motivation. New Delhi. Goodwill Publication House. 2005.

EXTRA DISCIPLINARY COURSES

Sl. No.	Subject Code	Title of the Paper	Department
1.	20P3HYEDC	**INDIAN ADMINISTRATION**	History
2.	20P3ECEDC	**ISSUES IN INDIAN ECONOMY**	Economics
3.	20P3TAEDC	***தமிழ்மொழி வரலாறு***	Tamil
4.	20P3ENEDC	**SHAKESPEARE STUDIES**	English
5.	20P3CMEDC	**ENTREPRENEURIAL DEVELOPMENT**	Commerce
6.	20P3MAEDC	**APPLICABLE MATHEMATICAL TECHNIQUES**	Mathematics
7.	20P3PHEDC	**FUNDAMENTALS OF NANOTECHNOLOGY**	Physics
8.	20P3CHEDC	**CHEMISTRY IN EVERY DAY LIFE**	Chemistry
9.	20P3BOEDC	**MEDICAL BOTANY AND PHARMACOGNOSY**	Botany
10.	20P3MBEDC	**MUSHROOM TECHNOLOGY**	Microbiology
11.	20P3ZOEDC	**CLINICAL LAB TECHNOLOGY**	Zoology
12.	20P3BTEDC	**RECENT TRENDS IN BIOTECHNOLOGY**	Biotechnology
13.	20P3CSEDC 20P3ITEDC	**E-LEARNING TECHNOLOGIES**	Computer Science
14.	20P3LSEDC	**DOCUMENTATION CENTERS IN INDIA**	Library and Information Science

Semester	Course Code	Title of the Course	Hours of Teaching /Week	No. of Credits
III	**20P3HYEDC**	**Extra Disciplinary Courses – Indian Administration**	**5**	**--**

Objectives:

1. To know the evolution of Indian Administration.
2. To prepare the students for the competitive examination.
3. To give up-to-date knowledge on Indian administration.
4. To trace economic planning of India, through which the students may get practical knowledge on budget, etc.
5. To expose the state administration and the latest issues like Lok Ayukt and LokPal through which the students may get awareness about the latest issues.

Unit I ***Hrs 15***

The evolution of Indian administration: Structure and Functions–Mauryan and Mughal legacy; British Indian system: Company's experiments–Warren Hastings, Lord Cornwallis, Lord Hastings and Lord Dalhousie; Administrative consolidation since 1861 – Famine policy - Financial, Police and judicial administration.

Unit II ***Hrs 15***

Indian Administration since 1950: Parliamentary Democracy–Federation–Structure of Central Administration–Central Secretariat–Cabinet Secretariat, Ministries–Department of Boards.

Unit III ***Hrs 15***

Machinery for planning: Plan formulation at the National level – National Development Council – Planning Commission – Public undertaking – Controls of Public expenditure.

Unit IV ***Hrs 15***

State Administration–Executives–Secretariat–Chief Secretary–Directorates–District and Local Administration–District Rural Development Agency–Special development programmes.

Unit V ***Hrs 15***

Center-State relations – Public services – Police and Judicial administration – Lok Ayukt – Lok Pal – issues on Indian administration – Integrity in administration – Administrative reforms.

General References:

1. Altekar, A.S., State and Government in Ancient India, 1958.
2. Bhambri, C.H., Public Administration in India.
3. Vidya Bhushan, Indian Administration, Delhi, 2000.
4. Vishnoo Bhagawan & Vidhya Bhushan., Indian Administration, New Delhi, 1996.

Course Outcome: The students have clearly understood about the evolution of Indian Administration, State and Central administration, police and judicial administration, Centre State relations, etc.

Semester	Subject code	Title of paper	Hours of Teaching / Week	No. of Credit
III	**20P3ECEDC**	**Extra Disciplinary Courses – Issues in Indian Economy**	**4**	**-**

Objective:

- This Elective paper is offered to the Non-Economics Students to make them familiar with the recent trends in Indian Economy. The syllabus is framed accordingly with the Civil Service Examination.

Course Outcomes

- To understand the status of Indian economy before the reforms
- To assess the rationale of introducing reforms in India
- To familiarize with the package of LPG
- to get insight on the recent trends in EXIM policy

Unit I **Hrs 15**

Economic development and growth – determinants of growth and development – Market Economy – Indian Economy – a shift form mixed economy to Market economy – Reform measures introduced in India – First and second generation reforms – (Brief out line)

Unit-II **Hrs 15**

Economic reforms in India – background, rational – implementation – Trade policy – Industrial policy – exchange rate and capital market reforms

Unit-III **Hrs 15**

Dis-investment of public enterprises – rational – changing profile of PSUs comparison of public and private sector

Unit-IV **Hrs 15**

Privatization – Meaning and scope – Globalization – impact on India – foreign capital – Types FDI and FII, Policies and pattern.

Unit-V **Hrs 15**

Foreign Trade – Exim Policies – Recent exim policy – BOP- Trends in BOP – Economic reforms and BOP.

References:

Uma kapila – Indian Economy (Issues in Development and Planning and Sectoral aspects) Fifth Edition, 2006-07, Academic Foundation, New Delhi

Datt Ruddar &

Sundharam K.P.M. - Indian Economy (2007)

Misrapuri - Indian Economy

Semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
III	**20P3TAEDC**	**கூடுதல் சிறப்புப் பாடம்: தமிழ்மொழி வரலாறு**	**4**	**-**

கூறு: 1 இந்திய மொழிக் குடும்பங்கள் நேரம்: 12

இந்தோ ஆரிய மொழிகள் - ஆஸ்டிக் மொழிகள் - சீன திபெத்திய மொழிகள் - திராவிட மொழிக் குடும்பம் - டாக்டர் கால்டுவெல், திராவிட மொழிகளின் சிறப்பியல்புகள் - தென் திராவிட மொழிகள் - தென் திராவிட மொழிகளில் தமிழ் - நடுத்திராவிட மொழிகள் - வட திராவிட மொழிகள்.

கூறு: 2 தமிழ் நேரம்: 12

தமிழ் என்பதன் வடிவம் பற்றியும் பொருள் பற்றியும் பல்வேறு செய்திகள் - பெயரெச்சங்கள் - வினையெச்சம் - சங்க இலக்கியத்தில் வினையெச்சங்கள் - தொல்காப்பிய உரைகாரர்களும் வினையெச்சங்களும்.

கூறு: 3 நேரம்: 12

தமிழ் எழுத்தின் தோற்றமும் வளர்ச்சியும் - ஆய்வெழுத்து இராசியெழுத்து, நாள், எழுத்து - ஓவியம், பானை ஓடுகள், இலங்கை முத்திரை முதலானவற்றில் காணப்படும் உருவ எழுத்துகள் - வட்டெழுத்து, பண்டைத் தமிழ் எழுத்து. தமிழ்மொழி வரலாறு: தமிழின் தொல் வரலாறு, தமிழ்மொழி வரலாறு - பழந்தமிழ்க் காலம், இடைத்தமிழ்.

கூறு: 4 நேரம்: 12

தொல்காப்பியமும் ஒலியியலும் - தொல்காப்பியமும் சொல்லியலும் - தமிழ் ஒலிகளின் பிறப்பு விளக்கம் - புணர்ச்சி வகை. தமிழ் உருபனியலும் தொடரியலும் - தலைமை இலக்கணக் கூறுகள் - தொடரமைப்பு இலக்கணம். பெயர்த்தொடர் அமைப்புகள்: மொழியின் பெருமை - எழுத்தும் பேச்சும் - கிளை மொழிகள் தோற்றம் - இலக்கியக் கிளைமொழி- வட்டாரக்கிளை மொழிகள்.

கூறு: 5 நேரம்:12

தமிழ் வளர்ச்சி - தமிழ் ஆட்சிமொழி வரலாறு - தமிழ் கல்விமொழி வரலாறு - கலைச் சொல்லாக்கம் - அறிவியல் தமிழ் வளர்ச்சி-உலகத் தமிழ் மாநாடுகள்- உலக அரங்கில் தமிழ் - தமிழ் அமைப்புகள்- உலகத் தமிழாராய்ச்சி நிறுவனம் - தமிழ்ப்பல்கலைக் கழகம்-செம்மொழி ஆய்வுமையம் - அயல் மாநிலங்களில் தமிழ்.

பார்வை நூல்கள்:

1. *தமிழ் வரலாறு - தேவநேயன். ஞா.*
2. *தமிழ் மொழி வரலாறு - பரிதிமாற்கலைஞர்*
3. *பழந்தமிழ் - இலக்குவனார் . சி*
4. *தமிழ் வரலாறு - குணா*
5. *தமிழ் மொழி வரலாறு - தமிழ் வளர்ச்சி இயக்ககம்*
6. *ஆட்சித் தமிழ் - புதுவை மொழியியல் பண்பாட்டுக் கழக வெளியீடு*
7. *இந்திய ஆட்சிப்பணி வழிகாட்டி - முனைவர் ெர. குமரன்.*
8. *உலகத்தமிழ் மாநாடுகள் - சாலை இளந்திரையன்*
9. *தாய்மொழியில் படிக்க வைப்போம் - NCBH வெளியீடு.*
10. *தமிழ் ஆட்சி மொழி வரலாறு - தமிழ்ப்பல்கலைக்கழகம்.*
11. *தமிழ் ஆட்சிமொழி வரலாறு - தெ.பொ.மீ.*
12. *தமிழ் மொழி வரலாறு - சக்திவேல்*

Semester	Course Code	Title of the Course	Hours of Teaching / Week	No. of Credits
III	**20P3ENEDC**	**Extra Disciplinary Course - Shakespeare Studies**	**4**	

Objective

- To initiate the non English majoring students to study Shakespeare's plays, and his sonnets.

Outcome

- Gaining appreciative and analytical understanding of Shakespeare's dramas and sonnets.
- Achieving potentiality to situate and relate Shakespeare's wisdom in various current disciplines and media cultures.
- Obtaining a profound perspectives on handling racism, class divisions, gender roles, crime, love, war, death betrayal, hope, loyalty etc., derived from the works

Unit – I

Shakespeare's Sonnets 1, 18, 29, 33, 35, 65 and 130

Unit – II

The Merchant of Venice

Unit – III

Henry IV, Part I

Unit – IV

Othello

Unit – V

Antony and Cleopatra

References:

- Bates, Jonathan. *The Genius of Shakespeare.* London: Picador, 1997.
- Leishman, J.B. *The Theme and Variation in Shakespeare's sonnets.* London: Routledge, 2005.

Semester	Subject Code	Title of the paper	Hours of Teaching/ Week	No. of Credits
III	**20P3CMEDC**	**Entrepreneurial Development**	**4**	**-**

Objective:

- To make the students to become a successful entrepreneur and to know the process involved in entrepreneurship.

Course Outcome:

- Learn the incentives and subsidies provided to budding entrepreneurs and Become familiar with institutions offering various forms of assistances.

Unit - I

Entrepreneurship - Nature and Characteristics of an Entrepreneur - Difference between Entrepreneur and Manager - Qualities, Types, and Functions of an Entrepreneur - Role of Entrepreneur in Economic Development.

Unit - II

Business Ideas - Sources of Idea - Idea Processing and Selection - Start up Process - Project Identification and Selection - Project Formulation - Project Appraisal.

Unit - III

Factory Design and Layout - Importance - Factors affecting Factory Design - Factory Layout - Objectives - Types - Consideration in Designing Layout - Design Requirements.

Unit - IV

Institutions Assisting to Entrepreneurs - NSIC - SIDCO - SSIB - DIC – TIIC – KVIC – TCO – ITCOT - Commercial Banks and New Entrepreneurial Development Agency.

Unit - V

Entrepreneurship Development Programmes - Need - Objectives - Institutional efforts in Developing Entrepreneurship – Evaluation of EDPs – Problems in the conduct of EDPs – Suggestions to make EDPs effective – Planning EDPs - Role of SISI, SIPCOT and SIDBI – Recent Development in Small Enterprises in India – Government rules and regulations – Rural Entrepreneurship – Need for Rural Entrepreneurship Problems – SHGs and Rural Development – MUDRA Banking /MSME Loans.

Text book:

1. C.B.Gupta., N.P.Srinivasan, (2018), Entrepreneurial Development, Sultan Chand & Sons, New Delhi.

Reference Books

1. Khanka S.S., (2019) Entrepreneurial Development, S.Chand & Co, New Delhi.
2. Saravanavel, P. (2016), Entrepreneurial Development, Principles, Policies and Programmes, Ess Pee Kay Publishing House, Tanjore.
3. Renu Arora, Sood S.K., (2018)Fundamentals of Entrepreneurship and Small Business, Kalyani Publications, Ludhiana.
4. Jayashree Suresh, (2019)Entrepreneurial Development, Margham Publications, Chennai.

Semester	Subject Code	Title of the Paper	House of Teaching / Week	No.of Credits
III	**20P3MAEDC**	**Extra Disciplinary Course- Applicable Mathematical Techniques**	**4**	**-**

Objectives:

- To discuss various methods of Interpolation

Out comes: After studying this course the student will be able to

- Student will demonstrate the ability to solve financial math problem.

Unit I **12 Hrs**

Interpolation with unequal intervals: Newton's divided difference formula - Lagrange's interpolation formula and inverse interpolation. (Only simple Problems)

Unit II **12 Hrs**

Assignment problems

Unit III **12 Hrs**

Replacement problems (Only simple Problems)

Unit IV **12 Hrs**

Decision Analysis

Unit- V **12 Hrs**

Game Theory

Text Book:

1. *For unit I,* ***Numerical Methods*** *– P. Kandasamy, K. Thilagavathy, K. Gunavathy, S.Chand*
2. *For units II to V,* ***Operation Research 12th Edition 2004:****KanthiSwarap, P.K. Gupta and Manmohan, Sultan Chanda and sons, New Delhi.*

   Unit I : Chapter - 8 (Sec: 8.5, 8.7)

   Unit II : Chapter - 11 (Sec: 11.1 to 11.4)

   Unit III : Chapter - 18 (Sec: 18.1 to18.3)

   Unit IV : Chapter - 16 (Sec: 16.1 to 16.5)

   Unit V : Chapter - 17 (Sec: 17.1 to 17.6)

General Reference:

1. *S.S. Sastry Introductory Methods of Numerical Analysis Prentice Hall of India 2000.*
2. *H.A. Taha Operation Research Prentice Hall of India 1995.*

Semester	Subject Code	Title of the paper	Hours of Teaching / Week	No. of Credits
III	**20P3PHEDC**	**Extra Disciplinary Course- Fundamentals of Nanotechnology**	**4**	**-**

Unit – I Introduction to Nanotechnology

Nanotechnology – Definitions - History of nanotechnology – Nanomaterials: classification – zero, one and two dimensional nanomaterials – Classification based on the composition of materials (metal, semiconductor, ceramic, polymeric and carbon-based nanomaterials) - Properties of nanomaterials – Surface area to volume ratio (S.A/V) – Quantum dots - Challenges in nanotechnology.

Unit – II Preparation Methods

Top-down and Bottom-up approaches – Top down methods: Ball milling - Electron beam lithography – Advantages – Limitations. Bottom-up methods: Vacuum evaporation - Sputter deposition process - Laser ablation

– Advantages – Limitations.

Unit – III Fullerenes

Fullerenes – Types of fullerenes – Bucky ball/Buckminster fullerene - Carbon nano tubes (CNTs) - Single walled CNTs – Multi walled CNTs – Differences – mechanical and electrical properties of CNTs - preparation of CNTs – Plasma discharge method – Applications.

Unit – IV Characterization Techniques

Construction, working principle, merits and demerits of X-ray diffractometer - Scanning Electron Microscope (SEM) – Atomic Force Microscope (AFM) - UV-Vis–NIR double beam spectro photometer – Energy dispersive X-ray analysis (EDAX) .

Unit – V Applications

Nanoelectronics – Nanophotonics – Nanomaterials in energy conversion and storage – Nanomaterials as antibacterial agents – Nanomaterials as photocatalysts – Nanomaterial in industrial applications – Bio-medical applications : Targeted drug delivery – Nanomaterial based radiation therapy – Photodynamic therapy (PDT) – Bio imaging.

Books for Study

1. K. Ravichandran, K. Swaminathan, P.K. Praseetha, P. Kavitha, Introduction to Nanotechnology, JAZYM publications.
2. M.Ratner.et al., Nanotechnology; A Gentle intro Practices – hall ISBN 0-13-101400-5, 2003.
3. Nanotechnology; Basic Science and Emergining Technologies, CRC Press

Books for Reference

1. Charles P.Poole Jr and Frank J.Owens. "Introduction to Nanotechnology" Wiley, 2003.
2. A. S. Edelstien and R.C. Cornmarata, Nanomaterials; synthesis, Properties and Applications, 2ed, Iop (U.K), 1996.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
III	**20P3CHEDC**	**Extra Disciplinary Course - Chemistry in Every Day Life**	**4**	

OBJECTIVES

Students learn about the scientific and chemical principles underlying in everyday life.

- Students learn about the cleaning agents and water chemistry,
- Students understand about the food chemistry,
- Students shall learn about the cosmetic and their effect in health aspects
- Students shall know about the green chemistry and their significance for clean environments
- Students learn about the nano technology and their importance.

Unit-I

Cleaning agents - manufacture and uses of soaps, detergents, baking powder, shampoo, washing powder and bleaching powder **Water –** uses of water Characteristics' of water, soft water and hard water - removal of hardness – ion exchange method. Reverse osmosis method, Water pollution, causes and prevention.

Unit-II

Food – importance – spoilages – causes, preservation – additives – colouring and flavouring agents, beverages. Soft drinks aerated water – manufacturing – mineral water. Fruits, vegetables, dairy product – storage, preservation. Minerals in food and anti oxidants. Preparation of fruit Jam and pickle.

Unit-III

Cosmetics – Face powder – constituents, uses – side – effects. Nail polish, hair dye – composition and side effects. Tooth powder – lotions. Preparation of phenyl, liquid blue and incense sticks.

Unit-IV

Basic concepts of Green chemistry and its significance in day to day life. Polymers – Classification – Types of polymerization – plastics – classification – types of plastics – PVC, Teflon, PET, Bakelite – Rubber – Natural and synthetic – Bunas rubber, Butyl Rubber. Vulcanization of rubber, neoprene rubber, Plastic pollution and prevention.

Unit-V

Basic concepts of Nano Technology and its importance in day to day life.

Dyes – importance of food colours – PFA (Prevention of Food Adulteration Act) Natural dyes – Synthetic Classification importances – Uses of the following Synthetic dyes - Direct dyes, acid dye, Basic dye, mordant dye, Reactive dye, Disperse dye, Fastness – Light and Washing. Application of dyes in food, paper, plastic and lather.

COURSE OUTCOME:

- Students should able to learn about the cleaning agents and water chemistry,
- Students should able to understand about the food chemistry,
- Students should able to learn about the cosmetic
- Students shoud able to know about the green chemistry
- Students should able to learn about the nano technology

References:

1. Norrish Shreave. R. and Joseph A. Brink Jr Chemical Process Industries, McGraw Hill, Industrial Book Company London 1978.
2. Brain A.C.S. Reinhold, Production and properties of Industrial chemicals 11th Ed, John Wiley & Sons, New York.
3. Burgh, A. Fermentation Industries, Inter science, 4th Ed, 1983, A *Inter science*, New York.
4. Ramani,V. Alex, Food Chemistry(2009),MJP publishers.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3BOEDC**	**Extra Disciplinary Course – Medicinal Botany and Pharmacognosy**	**4**	**-**

Objectives

- To enable the students to identify local medicinal plants.
- To enable the students to prepare herbal medicines for curing human ailments.
- To impart knowledge to students on Botany and Phyto chemistry of medicinal plants.

Unit I

Medicinal Botany: Definition, Introduction, History, – Classification – Common medicinal plants cultivation, storage, collection and habitats of medicinal plants (*Catharanthus, Coleus*, *Aloe*) – Importance of medicinal plants.

Unit II

Indian systems of medicine – AYUSH - Siddha, Ayurveda, Homeopathy and Unani – Indigenous medicinal plants – Useful parts –Chemical constituents – medicinal uses – medicinal plant drugs.

Unit III

Herbal medicines for human ailments – Heart, kidney, liver, eye, skin, hair, stomach problems, diabetics, blood pressure, headache, cough, cold, fever, digestive problems, joint pains and wounds.

Unit IV

Pharmacognosy – History, Introduction, commercial drugs, crude drugs – classification of drugs – Chemistry of drug and drug evaluation of natural products.

Unit V

Drug adulteration and detection – Substitution – Detection of Adulterations - Elementary knowledge on alkaloids and flavonoids – Preparation of herbal oil, herbal tooth powder, herbal soup, herbal immune boosters.

Books for Reference

- Kumar, N.C., (1993). An introduction to Medical Botany and Pharmacognosy.
- Shah, S.C. and Quadry (1990). A text book of Pharmacognosy.
- Nadkarni, (1981). Indian MateriaMedica.
- Jain, S.K., (1980). Indian Medicinal Plants.
- Balu, S., Murugan, R. and Pandiyan, P., (2005). Herbal Technology.

Outcome

After completion of this course, students would be able to

- Understand the various Indian system of medicine
- Learn about the vital role of herbal medicines for human ailments
- Outline and classify the crud drugs
- Trained about drugs adulteration and direction

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3MBEDC**	**Extra Disciplinary Course – Mushroom Technology**	**4**	**-**

Objectives

- To know the various types of edible mushroom and their nutritional value.
- To understand the methods of cultivation of mushrooms.
- To know the types of food prepared from mushroom and their importance in human health.
- Marketing of mushrooms in India and abroad.
- Mushroom cultivation unit visit- mandatory –Neighbouring District –one day.

Unit I

Introduction – history – scope of edible mushroom cultivation – Types of edible mushrooms available in India – *Calocybeindica, Volvariellavolvacea, Pleurotuscitrinopileatus*, and *Agaricusbisporus.*

Unit II

Pure culture – preparation of medium (PDA and Oatmeal agar medium) sterilization – preparation of test tube slants to store mother culture – culturing of *Pleurotus*mycelium on petriplates, preparation of mother spawn in saline bottle and polypropylene bag and their multiplication.

Unit III

Cultivation Technology: Infra structure – Mushroom bed preparation – paddy straw, sugarcane thrash, maize straw, banana leaves. Factors affecting the mushroom bed preparation – Low cost technology. Composting technology in Mushroom production.

Unit IV

Storage and nutrition: Short-term storage (Refrigeration – upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutritive value – proteins – amino acids, mineral elements – Carbohydrates, Crude fibre content – Vitamins.

Unit V

Food Preparation – Types of food prepared from mushroom; Soup, Cutlet, Omlette, Samosa, Pickles, Curry – Research Centres – National level and Regional level – Cost benefit ratio – Marketing in India and abroad, Export value.

Books for Reference:-

- Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayaranjan, R., (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
- Swaminathan, M., (1960). Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No.88, Mysore Road, Bangalore 560 018.
- Tewari, Pankaj Kapoor, S.C., (1988). Mushroom Cultivation, Mittal Publications, Delhi.
- Nita Bahi (1984-1988). Handbook of Mushrooms, II Ed, Vol. I & II.
- Paul Stamets, J.S and Chilton J.s (2004). Mushroom cultivation. A practical guide to graining mushroom at home Agarikon Press.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3ZOEDC**	**Extra Disciplinary Course – Clinical Lab Technology**	**4**	**-**

Objectives:

1. To study the various sterilization techniques.
2. To know the disposal of waste.
3. To identify the blood group and urine sugar.
4. To identify the bacteria and fungus.
5. To know the various diagnostic equipment.

Unit I **12 Hrs**

Scope for study of Clinical Technology. Sterilization – Methods of Sterilization – Dry heat method – Wet heat method – Chemical method of sterilization – Disposal of hospital wastes and infected material - Disinfection laboratory glassware and equipments.

Unit II **12 Hrs**

Composition of blood–ABO blood typing–Rh blood typing–Blood cells counting – Total erythrocyte count, total WBC count and differential count – Sugar level in Blood – Hypoglycemia, Hyperglycemia conditions. Composition of urine – Physical characters of urine–Method of urine analysis for sugars.

Unit III **12 Hrs**

Analysis of Semen, Sputum and stool, Identification of blood parasites, Bacterial culture in NA medium, Fungal culture in PDA medium, Histological study of cells – Histological procedure for the preparation of tissue slides.

Unit IV **12 Hrs**

Diagnostic equipment and apparatus – ECG, EEG, Colorimeter, pH meter, PCR, laminar airflow inoculation chamber, Binocular microscope and Incubator.

Unit V **12 Hrs**

Immuno techniques – ELISA, HLA typing, VDRL Test.

Viral , bacterial and fungal diseases, First aid- definition and types and applications

Reference:

1. Medical Laboratory Technology (1994) (4th edition), By Ramik Sood, Jaypee Brother Medical Publishers (P) Ltd., New Delhi 110 002.
2. Medical Laboratory Technology, K.M. Samuel.
3. Clinical Pharmacology (1987), by Dr. Lawrance and P.N. Bennett (Sixth Edition), ELBS, English Language Book Society, Churchil Livingstone, England.
4. District Laboratory Practice in Tropical countries, part I, By Mouica Cheesbrough, Cambridge Las Priced Edition, Cambridge University Press, Cambridge, U.K.
5. Basic Clinical Paraitology (1993), W.Harold Brown and A.Franklin Neva (5th edition), Prntice Hall Internation Edition.
6. Biological Chemistry – Leringer.

7. Human Physiology by Pearse.
8. The Biology of Animal Paraistes (1984), Cheng, T.Toppan C9 Ltd., Japan.
9. Medical Laboratory Technology: A procedure manual for routine diagnostic tests Volume – I-II By Kanai, L.Mukherjee, Tata McGraw – Hill Publishers, New Delhi.
10. Basic Clinical Paraitology 5th Edn, Harrold, W.Harold Brown and A. Franklin Neva-prentice Hall Internation Editions, U.S.A.

Web Links:

https://www.sunydutchess.edu/academics/catalog/current/courses/medical_laboratory_tech/index.pdf(Dutchess Community College, New York).
https://www.sunydutchess.edu/academics/catalog/current/programs/medicalandalliedhealth/mlt.pdf(Dutchess Community College, New York).
https://makautwb.ac.in/syllabus/BSc%20(Medical%20Lab%20Technology)28.02.2018.pdf

Course Outcome

- Pare the way for basic idea of various aseptic technique.
- Understanding the significance of waste disposal.
- Knowledge on Blood grouping and Blood sugar & urine sugar level.
- Gaining knowledge on culture of Bacteria, fungi and expertise on histological slide preparation.
- Operation technique of Diagnostic apparatus.
- Understanding for various immune techniques.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3BTEDC**	**Extra Disciplinary Course – Trends in Biotechnology**	**4**	**-**

Objectives:

1. To study the concept and scope of Biotechnology.
2. To Understand r-DNA Technology.
3. To aware the programmes of cell culture, preparations of hormones and vaccines, transgenic animals and human genome project.
4. To study the Bioprocess technology and their applications.
5. To study the Environment Biotechnology and aware the biodiversity and their conservation.

Unit I **Hrs12**

Biotechnology – Introduction and Scope of Biotechnology – Gene Cloning, Cell –free protein production – Production of Health care Products, Medical and Forensic application (RFLP, RAPD, DNA finger printing). Applications of PCR and LCR in disease diagnosis.

Unit II **Hrs12**

Nuclear transplantation, Transgenic Animals Development and uses – mice, goat, fish and sheep. Tendered meat production. Transgenic Plant: Insect resistance, fungus resistance, virus resistance, drought, cold resistance, saline resistance, Transgenic plant with vitamin A, Gene Production of therapeutic antibodies and edible vaccine.

Unit III **Hrs12**

Bioprocess technology – Scope – Fermentor –Bioprocess products: Organic acids – Citric acid, Lactic acid, acetic acid. Antibiotics – Wide and Narrow specxtrum antibiotics. Aminoacids – Glutamic acid, Lysine, Isoleucine, Aspartic acid and Proline. Production of SCP. Enzyme Production – Amylase, Pectinase and Cellulase. Dairy products and Biofuel production.

Unit IV **Hrs12**

Biofertilizers – N_2 fixing microbes (Azolla, Azatobacter, Azospirillum) for use in Agriculture – A. tumifasciens for crop improvement – Biopesticides. Biopolymer and its Application – Biosensor and its application – Bioleaching- Biomining – Biotechnology in oil recovery – Bioremediation of Xenobiotics – superbug – its application. Biodegradation.

Unit V **Hrs12**

Regulations of Biosafety: possible dangers of GEO, Biohazards of rDNA technology. National and International biosafety guidelines, Primary and secondary containments and implementation. Web based information of biosafety on GMO.

Reference:

1. Dubey, R.C. – A Text Book of Biotechnology, S. Chand & Co., Ltd, New Delhi, 1996.
2. Gupta, P.K. – Elements of Biotechnology, Rastogi and Co., Meerut, 1994.
3. Kumar, H.F. A text book on Biotechnology, Affiliated East & West Press Pvt., Ltd, N-Delhi.
4. D.Balasubramanian *et. al.,* - Concepts in Biotechnology.
5. Singh, R.S. – Introductory Biotechnology, Central book deport, Allahabad.
6. Primrose, R. – Molecular Biotechnolgoy, ASM Press.
7. Lick, E.R. and Pastenak – J.J. Molecular Biotechnology.
8. Ignachimuthu – Plant biotechnology, Oxford IBH Publishers, New Delhi.
9. Ranga – Fishery Biotechnology.
10. Primrose, R. – Molecular Biotechnology, ASM Press.
11. Purohit – A Text Book of Biotechnology, Agrobions, Jodhpur.

Semester	Subject code	Title of the course	Hours of Teaching/ Week	No. of Credits
III	**20P3CSEDC/ 20P3ITEDC**	**Extra Disciplinary Course- E-Learning Technologies**	**4**	**-**

Objective

- To learn the various E-learning approaches and components.
- To understand the types of design models of E-Learning.
- To explore the models for E-learning courseware development.
- To learn about E-learning authoring tools.
- To know about evaluation and management of E-learning solutions.

UNIT I INTRODUCTION

Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Basics of Design Thinking.

UNIT II DESIGNING E-LEARNING COURSE CONTENT

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

UNIT III CREATING INTERACTIVE CONTENT

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests – Adding Additional Resources– Courseware Development Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool

UNIT IV LEARNING PLATFORMS

Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

UNIT V COURSE DELIVERY AND EVALUATION

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.

REFERENCES:

1. Clark, R. C. and Mayer, R. E, "eLearning and the Science of Instruction", Third Edition, John Wiley, 2016.
2. Means, B., Toyama, Y., and Murphy, R, "Evaluation of Evidence – Based Practices in Online Learning: A Meta – Analysis and Review of Online Learning Studies", Centre for Learning Technologies, 2010.
3. Crews, T. B., Sheth, S. N., and Horne, T. M, "Understanding the Learning Personalities of Successful Online Students", Educause Review, 2014.
4. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Riley Media, 2011.
5. Madhuri Dubey, "Effective E – learning Design, Development and Delivery", University Press, 2011.

Course Outcomes:

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

- Distinguish the phases of activities in the models of E-learning.
- Identify appropriate instructional methods and delivery strategies.
- Choose appropriate E-learning authoring tools, Create interactive E-Learning courseware, Evaluate the E-learning courseware, Manage the E-learning courseware.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3LSEDC**	**Extra Disciplinary course Documentation Centers in India**	**4**	**-**

Objectives:

- To promote and support adoption of standards in library operations.
- To coordinate with other regional, national & international network for exchange of information and documents

Unit I

Components of information systems-Libraries, Documentation centers, Information centers.

Unit II

Data banks, Information analysis centers, Referral centers, Clearing Houses, Reprographic and translation centers-Their function and services.

Unit III

National Information systems: DESIDOC, NASSDOC, SENDOC, NISCAIR and INFLIBNET.

Unit IV

Information Aggregators, Databases Proquest, EBscohost, J-gate, POPLINE, Shodhganga, NDL,.

Unit V

Information products and series – Newsletters, House Bulletins in – house Journals, state of art reports, digest and Technical Digest.

Outcome:

The students shall be able to:

- Know the standards in library operations.
- Understand the regional, national & international network for exchange of information and documents

Reference:

1. Date, C.J. An Introduction to Database System, ed.7, Delhi: Pearson Education (Singapore), 2002
2. Desai, Bipin C. An Introduction to Database System, New Delhi, Galgetia, 2001
3. Karts Henry F, DBS Computer, New Delhi, McGraw Hill, 2000.
4. Raghu Ramakrishnan, DBMSS, New Delhi, McGraw Hill, 2000.
5. Gangadharaiah G, Management of Information Products and Services in University Libraries, Common Wealth, New Delhi, 2012.