

दिनांक : 22.06.2025

सेवा में,

कुलसचिव

राजा महेन्द्र प्रताप सिंह विश्वविद्यालय, अलीगढ़

विषय : जंतु विज्ञान की अध्ययन परिषद (BOS) द्वारा स्नातक (प्रतिष्ठा) [UG Honours)] / स्नातक (प्रतिष्ठा सह अनुसंधान) [UG (Honours) with Research) एवं स्नातकोत्तर (बायोटेक्नोलॉजी, माइक्रोबायोलॉजी) का अध्ययन पाठ्यक्रम प्रेषित करने के सम्बन्ध में

संदर्भ : पत्रांक - आर. एम. पी. यू. / RR / 2025 दिनांक 17.6.2025

महोदय,

आपके पत्रांक आर.एम.पी. यू. / RR / 2025 दिनांक 17.6.2025 के संदर्भ में आज दिनांक 22.6.2025 को एक बैठक सम्पन्न हुई जिसमें सभी सदस्य / विषय विशेषज्ञ वर्चुअल रूप में (गूगल मीट पर) उपस्थित रहे। इस बैठक में स्नातक (प्रतिष्ठा) [UG Honours)] / स्नातक (प्रतिष्ठा सह अनुसंधान) [UG (Honours) with Research) एवं स्नातकोत्तर पाठ्यक्रम के 8-8 प्रश्न पत्रों एवं दो (2) प्रायोगिक परीक्षा तथा 1-1 रिसर्च प्रोजेक्ट में विभाजित किया गया है जिसका पूर्ण विवरण मास्टर प्लान में पाठ्यक्रम के साथ दिया गया है। इस बैठक में निम्नलिखित सदस्य उपस्थित रहे :-

1. डॉ. विनय कुमार (प्रोफेसर एवं संयोजक, बोर्ड ऑफ स्टडीज, धर्म समाज कॉलेज, अलीगढ़)
2. डॉ. शीबा (प्रोफेसर, धर्म समाज कॉलेज, अलीगढ़)
3. डॉ. मीरा सिंह (प्रोफेसर, धर्म समाज कॉलेज, अलीगढ़)
4. डॉ. मनीष माहेश्वरी (प्रोफेसर, धर्म समाज कॉलेज, अलीगढ़)
5. डॉ. हरेन्द्र कुमार गौड़ (सहायक प्रोफेसर, श्री वाष्ण्य महाविद्यालय, अलीगढ़)
6. डॉ. हरेन्द्र नाथ शर्मा (सहायक प्रोफेसर, श्री वाष्ण्य महाविद्यालय, अलीगढ़)
7. डॉ. बाबू राम सिंह (सहायक प्रोफेसर, धर्म समाज कॉलेज, अलीगढ़)
8. डॉ. मोहम्मद आमिर (प्रोफेसर, अलीगढ़ मुस्लिम विश्वविद्यालय, अलीगढ़)
9. डॉ. सुरेंद्र सिंह राघव (सेवानिवृत्त प्रोफेसर, जीवन विज्ञान संस्थान, खंदारी, डॉ० बी. आर. अम्बेडकर विश्वविद्यालय, आगरा)

उपरोक्त सभी विषय विशेषज्ञों / सदस्यों द्वारा तैयार किया गया स्नातक प्रतिष्ठा / स्नातक प्रतिष्ठा सह अनुसंधान एवं स्नातकोत्तर (बायोटेक्नोलॉजी, माइक्रोबायोलॉजी) के पाठ्यक्रम को अनुमोदित किया जाता है। यह पाठ्यक्रम आवश्यक कार्यवाही हेतु आपके समक्ष प्रेषित है।


22/6/2025

प्रो० विनय कुमार

संयोजक

जंतु विज्ञान अध्ययन परिषद (BOS)

राजा महेन्द्र प्रताप सिंह विश्वविद्यालय, अलीगढ़

**SEMESTER WISE TITLES OF THE PAPERS
IN U.G. (HONOURS), U.G. (HONOURS WITH RESEARCH) IN
MICROBIOLOGY**

YEAR	SEM	COURSE CODE	PAPER TITLE	THEORY/ PRACTICAL	CREDIT	TOTAL
4TH YEAR	VII	RB080701T	MYCOLOGY	THEORY	4	20/16
		RB080702T	VIROLOGY	THEORY	4	
		RB080703T RB080704T	Choose both for U.G.(Honours) and one for U.G. (Honours with Research)- I. MICROBIAL BIOCHEMISTRY II. CLINICAL MICROBIOLOGY	THEORY THEORY	4 4	
		RB080705P	PRACTICAL	PRACTICAL	4	
		RB080801T	BACTERIOLOGY	THEORY	4	
	VIII	RB080802T	BIOANALYTICAL TECHNOLOGY.	THEORY	4	20/24
		RB080803T RB080804T	Choose both for U.G. (Honours) and one for U.G. (Honours with Research)- I. BIOSTATISTICS & COMPUTER APPLICATION II. GENOMICS & PROTEOMICS	THEORY	4 4	
		RB080805P	PRACTICAL	PRACTICAL	4	
		RB080806R	Research Project (Submission and Evaluation)		8	

SEMESTER WISE TITLES OF THE PAPERS IN POSTGRADUATE COURSE IN MICROBIOLOGY

5 TH YEAR					
IX	RB080901T	MICROBIAL GENETICS	THEORY	4	16
	RB080902T	MICROBIAL METABOLISM	THEORY	4	
	RB080903T RB080904T	Choose any one– I. FOOD & DAIRY MICROBIOLOGY OR III. AGRICULTURE & SOIL MICROBIOLOGY	THEORY	4	
	RB080905P	PRACTICAL	PRACTICAL	4	
	RB081001T	MOLECULAR BIOLOGY & RECOMBINANT DNA TECHNOLOGY	THEORY	4	24
	RB081002T	PRODUCT & PROCESS DEVELOPMENT	THEORY	4	
	RB081003T RB081004T	Choose any one– I. BIOENTREPRENEURSHIP OR II. PHARMACEUTICAL MICROBIOLOGY	THEORY	4	
	RB081005P	PRACTICAL	PRACTICAL	4	
	RB081006R	Research Project (Submission and Evaluation)		8	

RB080701T- MYCOLOGY

UNIT -I

Status of fungi in living world, general features of fungi and fungus like organisms, recent trends in the classification of fungi, physiology and growth of fungi, nutritional and environmental factors affecting growth, saprotrophs, parasites of Mutualistic symbionts, physiology of reproduction in fungi, Phylogeny of fungi. Fungal and Biotechnological Production of alcoholic beverages, antibiotics, organic acids, ergot alkaloids, the cultivation of fungi for food- Mushrooms, mycofoods, Role of fungi in agriculture and forestry, Mycorrhizae and their application.

UNIT-II

Fungal Diversity I- major taxonomic groups, structure, reproduction, life cycle and significance of the following representatives:

1. Gymnomycota- Cellular slime moulds (*Dictyostelium*), Plasmodial slime moulds (*myxomycetes*)
2. Mastigomycotina- Coelomomyces, Lagenidium, Achlya, Phytophthora, Peronospora, Plasmodiophora
3. Amastigomycotina- Zygomycotina, Mucor, Syncephalastrum, Blakeslea, Cunninghamella, Entomophthora.

UNIT- III

Fungal diversity II-

1. Ascomycotina- Taphrina, Chaetomium, Morchella, Neurospora.
2. Basidiomycotina- Puccinia, Melampsora, Polyporus, Lycoperdon.
3. Deuteromycotina- Fusarium, Cercospora, Curvularia, Beauveria, Microsporum.

UNIT- IV

1. Life cycle and sexual process in fungi,
2. Genetic variation in fungi- Nonsexual variations- haploidy, heterokaryosis, parasexuality, sexual variations, homothallism and heterothallism, Mutation, physiological specialization.
3. Mycopensticides Mycotoxins.

Suggested readings:

1. Introductory Mycology, CJ Alexopoulos, CW Mims, M Blackwel, John Wiley & Sons.
2. The Fungi: An Advanced Treatise, GC Ainsworth, KF Sparrow, AS Sussman.
3. An Introduction to Fungi, HC Dube, Vikas Pub., New Delhi.
4. The Fungi, PD Sharma, Rastogi Publications, Meerut.
5. Fungi: Experimental Methods in Biology, R Maheshwari, CRC Press, Boca Raton, Florida.
6. Introduction to Fungi, J Webster & WS Roland, Cambridge University Press.
7. A Text Book of Modern Plant Pathology, KS Bilgrami, HC Dube.
8. Plant Pathology, RS Mehrotra.
9. Fungi and Plant Disease, VK Gupta, TS Paul
10. Diseases of Crop Plants in India, Rangaswamy & Mahadevan.
11. Plant Pathology, GN Agrio Elsevier Academic Press.
12. Molecular Plant Pathology, Dickinson CM, Bios Scientific Publisher
13. Plant Pathology: Concepts and Laboratory Exercises, NT Robert, MT Windham, AS Windham, CRC Press.
14. Principles of Plant Pathology, RS Sing, Oxford and IBH Publishing Co. Pvt Ltd.

Mycology –Lab

- Isolation and identification of fungi from different environmental samples,
- Study the nutritional requirement of fungi,
- Cultivation of fungi in submerged and solid state fermentation,
- Production of enzymes, organic acids and other metabolites by fungi,
- Collection and study of basidiomycetous fungi,
- Study and culturing of yeasts, study yeast dimorphism,
- Isolation and identification of algae from different habitats,
- Culturing of algae under lab conditions,
- Study hydrogen and bioethanol production by algae,
- Algae as a source of SCP,
- Study pollution control by algae.

RB080702T-VIROLOGY

UNIT I:

Classification, Morphology and Chemistry of Viruses: Virus evolution and classification, properties of viruses, virus structure, Techniques for visualization and enumeration of viral particles, measuring biological activity of viruses, assays for virus estimation and manipulation, characterization of viral products expressed in infected cells.

UNIT II

Virus replication Strategies: Principal events involved in replication: Adsorption, penetration, uncoating nucleic acid and protein synthesis, intracellular trafficking, assembly, maturation and release, viral-host interaction, Host response to viral infection. Replication patterns of specific viruses: Replicative strategies employed by animal DNA viruses. Replicative strategies employed by animal RNA viruses. Identification of virus prototypes associated with different virus replication schemes; Details on important viruses namely Herpesvirus, Poliovirus, Influenza virus, Adeno Virus, Poxviruses, Hepatitis Viruses, coronaviruses, Retroviruses.

UNIT III

Subviral pathogens: HDV, Prions, Viroids, Pathogenesis of viral infection: Stages of infection, Patterns of some viral diseases, epidemiology, transmission, infection, symptoms, risk, transformation and oncogenesis, emerging viruses. Anti-viral strategies-prevention and control of viral diseases: Host specific and nonspecific defense mechanisms involved in resistance to and recovery from virus infections. Role of interferon in viral infections. Contributions of various host defense mechanisms in viral infections; Viral Chemotherapy: Nucleoside analogs, reverse transcriptase inhibitors, protease inhibitors. History of vaccines especially smallpox and polio. New methods: subunit vaccines, anti-idiotypic and DNA vaccines.

UNIT IV

History and development of plant virology, cryptoviruses and classification of plant viruses and viroids. Brief history of virology highlighting the significant contributions of scientists to the development of plant virology; significance of plant virology and modern classification of plant

viruses and viroids according to ICTV; cryptograms of various plant viruses and virus groups. Symptoms of plant viral diseases, transmission of plant viruses, viral and viroid diseases and their control. General discussion on symptoms caused by viruses and viroids in economically important trees and agricultural crops, and their control including development of virus disease resistant transgenetics, Microbial viruses: Diversity, classification, characteristics and applications of bacteriophages, and general account on algal, fungal and protozoan viruses.

Suggested readings:

1. Medical Virology 10 Th Edition by Morag C and Tim bury M C . Churchill Livingstone, London.
2. Introduction to Modern Virology 4th Edition by Dimmock N J, Primrose S. B.. Blackwell Scientific Publications. Oxford.
3. Virology by Conrat H.F., Kimball P.C. and Levy J.A. Prentice Hall, Englewood Cliff, New Jersey.
4. Text Book on Principles of Bacteriology, Virology and Immunology Topley and Wilsons.
5. Molecular Biology, Pathogenesis and Control by S.J. Flint and others. ASM Press, Washington, D.C.
6. Applied Virology. 1984. Edited by Edonard Kurstak. Academic Press Inc.
7. Introduction to Modern Virology by Dimmock. MB.

PRACTICAL PAPER –VIROLOGY

1. One step growth curve for determination of virus titre.
2. Phage typing of E.coli bacteriophages.
3. Induction of lambda lysogen by UV radiations.
4. Studies on Specialized transduction.
5. Isolation of lambda DNA and their characterization.
6. Amplification of lambda DNA by PCR
7. Cultivation and assay of viruses using embryonated eggs and Tissue culture Technique.

RB080703T-MICROBIAL BIOCHEMISTRY

UNIT I

1. Biomolecules – Chemical composition and bonding, three-dimensional structure, configuration and confirmation.
2. Chemical reactivity – five general types of chemical transformation: oxidation reduction reactions, nucleophilic substitution, electron transfer within molecules producing internal rearrangement, group transfer reaction, condensation reaction
3. Water – weak interactions in aqueous system, ionization of water, weak acid and weak base, concept of pH & pKa, Buffers (bicarbonate buffering system).
4. Principles of Bioenergetics – Entropy, enthalpy and free energy.
5. Oxidative and Photophosphorylation, ATP production.

UNIT II

1. Carbohydrates: Classification, Structure, chemical feature and function.
2. Lipids – Classification, Structure, chemical feature and function
3. Amino acids, peptides and proteins - Classification, Reaction & physical properties. Three dimensional structure of protein and protein folding.
4. Nucleotides and nucleic acids

UNIT III

1. Cell Signaling: paracrine, endocrine, autocrine. Signaling molecules – hormones, neurotransmitter, proteins and environmental factors. Cell surface receptors - G protein coupled receptor, receptor protein tyrosine kinase, cytokine receptor and non-receptor protein tyrosine kinase, receptor linked to other enzymatic activities.

2. Signaling pathways: Cyclic AMP pathway (second messenger and protein phosphorylation), cyclic GMP pathway, phospholipids and Ca²⁺ pathway, Ras-Raf and MAP kinase pathway, JAK/STAT pathway,

UNIT IV

1. Enzymes – Classification and factors affecting enzyme activity
2. Allosteric Enzymes and their regulation
3. Enzyme kinetics – Equilibrium and steady state theory (Michaelis-Menten equation) and determination of kinetic parameters.
4. Enzyme inhibition – reversible and irreversible inhibition, competitive, non-competitive and uncompetitive inhibition

Suggested readings:

1. Biochemistry, Voet Donald and Voet J.G., John Wiley and sons INC
2. Biochemistry, Zubay .G. - Wm.C.brown Publishers
3. The Physiology and Biochemistry of prokaryotes White .D. -Oxford Univ.press
4. Principles of Biochemistry, Lehninger A.L.Cox and Nelson , CBS Publishers and Distribution Pvt. Ltd
5. Biochemistry, Stryer .L., W.H.Freeman and Co
6. Principle and Techniques –Practical Biochemistry Wilson. K. and Walker.J. -Cambridge University press
7. Biochemistry, Murray, Harpers Mc Graw Hill
8. Biochemistry, Satyanarayana and Chakrapani, Books and Allied Publishers
9. Fundamentals of Biochemistry, Voet Donald,J.W.Voet and Ch.W.Pratt, Jhon Willey & Sons Inc.
10. 10. Enzyme Kinetics by Paul Engel. John Wiley and Sons.

BIOCHEMISTRY -LAB

Biochemistry:

- Preparation of standard and buffer solutions;
- Use of simple techniques in laboratory (spectrophotometry-verification of Beer's law, Relation between O.D. and percentage transmission; Centrifugation)
- Estimation of sugars,
- Estimation of Proteins by Lowry's method;
- Estimation of DNA and RNA by diphenylamine and orcinol methods;
- Determination of enzyme activity and study of enzyme kinetics;
- Separation of biomolecules by electrophoresis.

RB080801T- BACTERIOLOGY

UNIT –I

History, scope and development of bacteriology, Sterilization, isolation, enrichment, pure culture and staining techniques, systematic study of bacteria; morphological, physiological, biochemical and serological studies, genetic characterization. Habitat, structure, reproduction & classification of bacteria.

UNIT- II

1. The photosynthetic bacteria; cyanobacteria, green bacteria, halobacteria and their economic importance 2. Methanogenic bacteria and their significance 3. Chemoautotrophs and Methylotrophs: Nitrifying bacteria, sulphur oxidizers, iron bacteria and their economic importance.

UNIT- III

1. Enterobacteriaceae and related organisms, their morphological & physiological characters, genetic interrelationship, taxonomic sub-division & their importance in human health. 2. Myxobacteria, cytophage group, filamentous & gliding chemoheterotrophs & filamentous sulphur oxidizing bacteria.

UNIT IV

2. Gram positive spore forming bacteria: Unicellular endospore former-bacillus Clostridia.
3. Miscellaneous bacteria: Lactic acid bacteria, Micrococci, Corynebacteria, Mycobacteria.
4. Actinomycetes, Mycoplasma, Rickettsiae, Chlamydiae and their significance.

Suggested readings:

1. General Microbiology: R Y Stanier, Adelberg E A and J L Ingraham, Mac Millan Press Inc
2. Introduction to microbiology: Ingraham J L and Ingraham C A Thomson Brooks/ Cole
3. Principles of microbiology R M Atlas Wm C brown Publishers
4. Brock's biology of Microorganisms Madigan M T and Martinko J M Pearson Education Inc
5. Microbiology: An introduction: Tortora G J, Funke B R and Case C L Pearson Education Inc

BACTERIOLOGY -LAB

- Methods of isolation, purification and maintenance of microorganisms from different environments (air, water, soil, milk and food).
- Staining of bacteria and actinomycetes,
- Use of selective media,
- Enrichment culture technique – isolation of asymbiotic nitrogen fixing bacteria;
- Isolation of symbiotic nitrogen fixing bacteria from nodules,
- Isolation of antibiotic producing microorganisms.
- Morphological, physiological and biochemical characterization of isolated bacterial cultures.

RB080802T-CLINICAL MICROBIOLOGY

UNIT-I

INTRODUCTION, HISTORY & SCOPE OF MICROBIOLOGY

Introduction and history & developments of microbiology, scope of microbiology, general characteristics of prokaryotes and eukaryotes, classification of prokaryotes, introduction to mycology, virology and parasitology

STRUCTURE OF BACTERIAL CELL structure and functions of gram positive and gram negative bacteria, cell wall, cell membrane, cytoplasmic inclusions and mesosomes, flagella, capsule, ribosome, chromosome, plasmid and endospore, morphological classification of bacteria

UNIT-II

MICROSCOPY 12

Definition, Importance of microscopy, principle, operation and applications of light microscope, phase contrast microscopy, fluorescence microscopy, electron microscopy

STERILIZATION AND DISINFECTION Introduction and its types, principle, procedure and its application, definition and types of disinfectant, quality control for sterilization and disinfection, biosafety in microbiology lab, biowaste management

UNIT-III

CHEMOTHERAPY AND CHEMOTHERAPEUTIC AGENTS

Introduction, types of chemotherapeutic agents, mode of action and clinical importance of different chemotherapeutic agents, antibiotic sensitivity tests and its medical importance, introduction, types, mode of action and importance of multiple drugs resistance, mechanism of drug resistance .

NORMAL MICROBIAL FLORA AND PATHOGENIC MICROORGANISMS

Normal microbial flora of the human body, collection and transport of specimens, processing of clinical specimens for microbiological examination .

MICROBIAL NUTRITION AND GROWTH

Growth kinetics, different types of culture medium, continuous culture and synchronous growth cultures, aerobic & anaerobic cultures, Introduction and its types, various affecting factors on microbial growth.

UNIT-IV

NOSOCOMIAL INFECTIONS

Introduction and its types, pathogenicity and laboratory diagnosis of nosocomial infection, prevention and control of nosocomial infections.

ENVIRONMENTAL MICROBIOLOGY

Bacteriology of air, water, food, milk, soil

Suggested readings:

1. Tortora, G.J., Microbiology: Benjamin/Cummings Funke, B.R., Introduction Publishing And Case, C.L Company, Inc.
2. Pelczar, M.T. Microbiology Tata Mcgraw Hill Publication, New Delhi.
3. Schegel, H.G General Microbiology Cambridge University Press
4. Stanier, R.Y. General Microbiology Macmillian Press London

CLINICAL MICROBIOLOGY LAB

Simple staining of bacteria

- To prepare bacterial smear and perform simple staining using methylene blue Gram staining
- To perform Gram staining of different bacterial cultures Special stain
- To perform endospore staining, acid-fast staining and Albert's staining of bacterial cultures
- Counting of bacterial cell
- To perform viable count of bacteria using pour plating technique Effect of nutritional factors on growth
- To study the effect of different carbon & nitrogen sources on the growth of microorganisms
- Effect of environmental factors on growth
- To study the effect of pH on the growth of microorganisms
- To study the effects of UV radiation on growth of microorganisms

Bacteriological examination of water & milk

- To perform the bacteriological examination of water and milk
- To perform the bacteriological examination of milk by methylene reductase test Microbes in hospital environment
- To isolate and identify the bacteria and fungi from hospital environment

Qualitative analysis of biomolecules

- Qualitative test for carbohydrates: Molisch Test, Benedict test
- Qualitative test for amino acid and protein: Biuret test, Ninhydrin test
- Qualitative test for lipid: Acrolein test Quantitative analysis of blood parameters
- Quantitative estimation of blood cholesterol
- Quantitative estimation of blood glucose
- Quantitative estimation of blood urea Quantitative analysis of blood parameters

- Quantitative estimation of creatinine
- Quantitative estimation of protein albumin
- Quantitative estimation of uric acid Quantitative analysis of liver enzymatic markers
- Quantitative estimation of SGPT
- Quantitative estimation of ALP Quantitative analysis of heart enzymatic marker
- Quantitative estimation of SGOT a cardiac marker Quantitative analysis of prostate gland enzymatic marker
- Quantitative estimation of ACP

RB081006P-PRACTICALS BASED ON THEORY PAPERS.

RB081007R-RESEARCH PROJECT/INDUSTRIAL TRAINING

RB080801T-BIOANALYTICAL TECHNIQUES

UNIT- I

1. Photometry – Basic principles, Instrumentation and applications of UV-Visible spectrophotometry
2. Infrared (IR) spectroscopy and its applications
3. Fluorescence spectroscopy – principle, instrumentation and applications.
4. Mass spectroscopy – Mass analyzers, principle, instrumentation and applications.

UNIT -II

1. Raman spectroscopy and its applications
2. Electron spin resonance (ESR) spectroscopy and applications
3. Nuclear magnetic resonance (NMR) Spectroscopy – principle, instrumentation and applications
4. Circular Dichroism (CD) spectroscopy – principle, instrumentation and applications
5. X-ray Crystallography – principle, instrumentation and applications.

UNIT- III

1. Centrifugation – basic principle, types and applications
2. Chromatography: Principle, types and applications of Paper, Thin layer, High performance liquid chromatography; Column Chromatography – Gel filtration, Ion exchange chromatography, affinity chromatography, adsorption chromatography.
3. Electrophoresis: Principle, types and applications; Agarose gel, PAGE, SDS-PAGE, Iso-electric focusing, Two-Dimensional gel electrophoresis, Immuno-electrophoresis, Capillary electrophoresis, Pulse Field gel electrophoresis.
4. Autoradiography – Principle and applications, radioisotopes used in biology and their application.

UNIT- IV

1. Microscopy – Basic principle and components of microscope, phase contrast and fluorescent and Confocal microscopes
2. Electron microscopy – principle and applications
3. Sequencing techniques for proteins and nucleic acids
4. Nano-biotechnology: definition history and Application of nanoparticles in diagnosis therapy.

Suggested readings:

1. Instrumental Methods of Analysis. H.H. Willard, L.L. Merritt Jr. and others. CBS Publishers and Distributors.
2. Instrumental Methods of Chemical Analysis. Chatwal G and Anand, S. Himalaya Publishing House, Mumbai.
4. Spectroscopy. Volume 1. Edited by B.B. Straughan and S. Walker. Chapman and Hall Ltd.
5. Chromatography: Concepts and Contrasts- 1988 by James Miller. John Wiley and Sons. Inc., New York.
6. Analytical Biochemistry by Holme.
7. Introduction to High Performance Liquid Chromatography by R. J. Hamilton and P. A. Sewell.

RB0810802T BIOANALYTAL TECHNIQUES -LAB

- Determination of absorption maxima of some important chemicals from their absorptionspectra,
- Estimation of biomolecule using spectrophotometer,
- Separation of carbohydrates and amino acids by paper chromatography,
- Separation of lipids by thin layer and column chromatography,
- Separation of proteins by ion exchange and gel filtration chromatography,
- Electrophoretic techniques to separate proteins and nucleic acids,
- Preparation of stock solutions and buffers;
- Standard curves of BSA;
- Estimation of protein, RNA and DNA;
- SDS-PAGE of proteins;
- Polymerase chain reaction;
- RAPD analysis;
- DNA restriction analysis.

RB080803-BIOSTATISTICS AND COMPUTER APPLICATIONS

UNIT- I:

Presentation of data; Frequency distributions; Graphical representation of data by histogram, polygon, frequency curves and pie diagram. Measures of central tendency: Mean, median and mode; Measures of dispersion: Mean deviation, standard deviation, variance, Standard error, coefficient of variation; Correlation and regression: properties, nature, coefficient of correlation, rank correlation, linear regression and regression equations and multiple linear regression, significance of correlation and regression.

UNIT- II:

Probability: Basic concepts related to probability theory, classical probability. Probability Distributions: Introduction and simple properties of Binomial, Poisson and Normal Distributions and their applications in biology. Sampling: Concept of sampling and sampling techniques.

UNIT -III:

Testing of hypotheses: Some basic concepts, Errors in hypothesis testing; critical region; Students t-test for the significance of population mean and the difference between two population means; Paired t-test; Chi square test for population variance, goodness of fit and for the independence of two attributes in a contingency table; F-test for the equality of two population variance; Analysis of variance- One-way and two-way analysis of variance.

UNIT -IV:

Introduction to Computers: Definition, Components of computer, Classification of Computers, Generation of Computers; Number system; Introduction to Software; Translators (Compiler & Interpreter); Basics for operating systems (MS-DOS, Windows, Unix and Linux); Introduction to MS Office (MS-Word, MS-Excel, MS-Power Point); Introduction to Networking, Internet (E-Mail, File Transfer Protocol, Usenet, Telnet)

UNIT V:

Introduction to Bioinformatics: Definition and scope; Search engines: tools for web search; Introduction to biological databases (NCBI, EBI, DDBJ, GenBank, PDB, NDB and MMDB), Introduction to BLAST and FASTA; Brief idea about important softwares for microbiological studies.

Suggested Readings

1. Bailey, NT J (2000). Statistical Methods in Biology. English Univ. Press.
2. Campbell R.C (Latest Edition). Statistics for Biologist. Cambridge University Press, UK.
3. Sinha PK (Latest Edition). Fundamentals of computers. BPB Publication, New Delhi.
4. Jonathan, P. 2008. Bioinformatics & Functional Genomics.
5. B.D.Singh(2015). Biotechnology, Kalyani Publication Sharma and Munjal (2015).
6. A test book of Bioinformatics, Rastogi publication.

RB0800204T-MICROBIAL GENOMICS AND PROTEOMICS

UNIT-I

Introduction to microbial genomics: sequencing genomes, first generation DNA sequencing, shot gun sequencing, second generation DNA sequencing, third and fourth generation DNA sequencing

Biological sequences as information – DNA, RNA and protein as informative molecules, general characteristics of microbial genomes, genome assembly, genome annotation, identification of an open reading frame in a genome.

Microbial genomes size and content – small genomes and large genomes – genomes of organelles – symbionts and organelles – eukaryotic microbial genomes an introduction: genomes of microbial parasites – the yeast genome.

UNIT-II

Functional genomics: microarrays and transcriptomes, gene chips and gene expression and its applications, RNA sequence analysis, methods in proteomics, comparative genomics and proteomics, the interactome.

Culture independent studies of microorganisms, metagenomics: principles and applications, steps in construction of a metagenomes, examples of metagenomic studies, metagenomics as a tool to reveal the vast microbial diversity.

UNIT -III

Functional proteomics :Molecular analysis of gene expression (RTPCR)., CRISPR (CRISPR/Cas9)- Mechanism and applications.: Gene functions through protein interactions: Identification of Protein–Ligand Interactions. Combining yeast two-hybrid and phage display data, Detecting Interactions with Protein Fragment Complementation Assays. Mass Spectrometry for Protein–Protein Interaction Mapping: Overview, Identification of substrates for E. coli GroEL, Studying the transcriptome and proteome of Escherichia coli and Saccharomyces cerevisiae.

UNIT -IV

Protein microarrays: overview, principle, limitations; Protein microarray Manufacturing technology, solid supports, different formats, experimental approach and detection, peptidomics; Microarray for protein-carbohydrate interaction (phage display technology); protein domain microarray; protein biochips; Antibody microarray; protein microarray for drug discovery

Suggested readings:

1. Madigan M.T., Bender K.S., Buckley D.H., Sattley W.M. and Stahl D.A. (2017) Brock Biology of

Microorganisms, 15th Edn. (Global Edn.) Pearson Education.

2. Sanders E.R. and Miller J.H. (2010) I Microbiologist: A discovery-based course in Microbial Ecology and Molecular Evolution, ASM press.

3. Fraser C.M., Read T. and Nelson K.E. (2004) Microbial Genomes, Springer.

4. Highlander S.K., Rodriguez-Valera F. and White B.A. (2015) Encyclopedia of Metagenomics: Environmental Metagenomics, Springer Science.

5. Dale J.W. and von Schantz M. (2007) From Genes to Genomes: Concepts and Applications of DNA Technology, 2nd Edn. Wiley publishers.

6. Protein Microarrays, edited by Mark schena, Jones and Bartlet publisher, 2005.

7. Microbial Functional Genomics, Jizhong Zhou, Dorothea K. Thompson, Ying Xu, James M. Tiedje, A John Wiley & Sons, Inc., Publication, 2004.

8. Microarrays for an Integratiul J. But. Kho and Atte, Published in India by Ane Books, 2003.

9. Gene Cloning and DNA analysis An Introduction, Sixth Edition, T. A. Brown, Wiley Blackwell publications, A John Wiley & Sons, Inc., Publication, 2010.

RB080901T-MICROBIAL METABOLISM

UNIT -I

Nutritional Categories of microorganisms based on carbon and energy sources, Metabolite Transport- Passive and facilitated, Primary and secondary active transport, Group translocation (phosphotransferase system), symport, antiport and uniport, electrogenic and electro neutral transport, transport of Iron.

UNIT -II

Microbial Growth- Definition balanced and unbalanced growth, growth curve, the mathematics of growth, Generation time, specific growth rate, batch and continuous culture, synchronous growth, diauxic growth curve. Types of Culture media, Isolation of pure cultures.

UNIT- III

Brief account of photosynthetic and accessory pigments - chlorophyll, bacteriochlorophyll, rhodopsin, carotenoids, phycobiliproteins; Carbohydrates- anabolism. Autotrophy, oxygenic, anoxygenic photosynthesis – autotrophic generation of ATP; fixation of CO₂, Calvin cycle, C₃, C₄ pathway. Chemolithotrophy: sulphur, iron, hydrogen, nitrogen oxidations, methanogenesis, luminescence.

UNIT- IV

Respiratory metabolism, Embden-Mayer Hoff pathway, Entner Doudroff pathway, glyoxalate pathway, Krebs cycle, oxidative and substrate level phosphorylation, reverse TCA cycle, gluconeogenesis, Pasteur effect; Fermentation of carbohydrates, homo and heterolactic fermentations.

UNIT -V

Biosynthesis of peptidoglycan, polysaccharides, major amino acids, polyamines, Lipids, Nucleotides: Purines and Pyrimidines; Assimilation of nitrogen; Dormancy and germination; Microbial Differentiation, sporulation and morphogenesis, Cell division cycle in *E.coli* and yeast.

Suggested Readings

1. Doelle H.W. 1969. Bacterial Metabolism. Academic Press.

2. Gottschalk G. 1979. Bacterial Metabolism. Springer Verlag. Moat AG. 1979. Microbial Physiology. John Wiley & Sons.

3. Sokatch JR. 1969. Bacterial Physiology and Metabolism. Academic Press.

MICROBIAL METABOLISM (LAB)

- Determination of viable number of Bacterial cells in a given sample.
- Determination of bacterial growth by turbidity measurements (Bacterial growth curve).
- To study the microscopic measurements.
- To study the types of growth (synchronous, diauxic, batch).
- Effects of incubation temperature on the growth of microorganisms.
- To study the lethal effect of temperature.
- Effects of different pH on the growth of microorganisms.
- To study the bacterial growth under aerobic, microaerophilic and anaerobic conditions.
- Effect of salt concentration on the growth of microorganisms.
- Preparation of selective and differential media for the growth of microorganisms.
- Fermentation of different carbohydrates. Morphological, Physiological and Biochemical tests of selected bacterial cultures.

RB080802-MICROBIAL GENETICS

UNIT -I

Mendel's work on transmission of traits; Genetic Variation; Molecular basis of Genetic Information; Mitosis and Meiosis; Linkage and crossing over; Molecular mechanism of crossing over; Recombination and recombination frequency.

UNIT- II

Mutations-Induced versus Spontaneous mutations, Suppressor mutations, Molecular basis of Mutations, mutant enrichment; Complementation tests; recombination tests and gene replacements; Cloning genes by complementation and marker rescue; DNA repair mechanisms, Mutation and Microbial evolution.

UNIT -III

Molecular mechanism of gene transfer by conjugation. Regulation of gene transfer by conjugation. Mapping bacterial genomes using Hfr strains. Transfer systems in gram positive bacteria. Ti plasmid and application.

UNIT- IV

Transformation and transduction: Natural transformation and competence. Molecular basis of natural transformation; Regulation of competence in *B. subtilis*. Artificially induced competence. Generalized versus specialized transduction, Mapping bacterial genes by transduction; Tetrad analysis in fungi, Positive and negative gene regulation and attenuation, using the *lac*, *gal*, *trp* and *ara* operons, with emphasis on recent advances.

UNIT -V

Lytic cycle of T4 and T7 bacteriophages, Regulation of expression of genes in phage T4 and T7. Replication and packaging of filamentous phages M13. Benzer's experiments with the rII genes of phage T4 to construct phage genetic linkage maps. Lambda phage – Lytic and lysogenic cycles. Other lysogenic phages – P1 and Phi x174. Transposons and gene regulation. Yeast Ty-1 transposon. Phase variation in bacteria, Transplantation (Synthetic genome).

MICROBIAL GENETICS-LAB

Microbial Genetics:

- Inactivation of microorganisms by different mutagens.
- Production, isolation and characterization of mutants.
- Determination of mutation rate.
- Isolation, characterization and curing of plasmids.
- Preparation of competent cells,
- Transformation of *E. coli*. using plasmid DNA
- Transfer of plasmid by conjugation, electroporation. T
- tetrad and random spore analysis

RB081080T- FOOD AND DAIRY MICROBIOLOGY

UNIT -I:

Important microbes involved in spoilage of food, meat, poultry, vegetables and dairy products; food preservation. Microbial deterioration of cereals, pulses, fish and sea-foods during storage; Common food borne pathogens, diseases caused by them and their symptoms, food borne illness, prevention and complication of food borne diseases outbreaks, epidemiology

UNIT -II:

Bacterial and mycotoxins, Important microbes secreting toxins, chemical nature of important toxins; their role in food poisoning; physiology and mechanism of action, modification and detoxification; prevention and control of toxin contamination.

UNIT- III-

Microbial biomass: Single cell proteins and myco-protein; Use of microbial enzymes in food; Food quality monitoring, Fermented foods and traditional fungal foods (shoya, miso, tempe etc.). Fermented vegetable, meat and milk products (cheeses, butter and yoghurt).

UNIT -IV

Use of microbial enzymes in food; low calorie sweeteners, Flavour modifiers; Food additives; Food quality monitoring, biosensors and immune-assays, Indian fermented foods.

UNIT -V

Role of microbes in milk and dairy products, Microbiological examination of milk, standard plate count, direct microscopic count and reductase test, composition of milk, sources of contamination of milk, types of microbes in milk, pasteurization of milk, ability of milk to causedisease; Manufacture of cheeses, butter, yoghurt and fermented milk.

Suggested Readings:

1. Butt, TM, Jackson CW and Magan N (2004). Fungi as Biocontrol agent. CABI Publishing, UK.
2. Adams (2004). Food Microbiology.
3. Prajapati (2007). Fundamentals of Dairy Microbiology.
4. John C, Ayres OM, William ES (2004). Microbiology of Foods. W. H. Freeman and Co.
5. Robinson (Latest Edition). Dairy Microbiology.
6. Jay JM (2000). Modern Food Microbiology. Van Nostraaand Reinhold Co., New York.
7. Andrew Proctor (2011). Alternatives to conventional food processing, RSC pub.
8. Frazer WC and Westhoff DC (2014). Food Microbiology. Mcgraw Hill, New York.
9. B.D. Singh (2015). Biotechnology, Kalyani Publication

FOOD MICROBIOLOGY-LAB

- Isolation of Lactobacilli from curd or milk sample,
- Detection of number of bacteria in milk by SPC,
- Determination of quality of milk sample by methylene blue reductase test (MBRT), Microbiological examination of different food samples;
- Production of Sauerkraut by microorganisms, Determination of antibacterial activity of lactic acid bacteria using agar well diffusion method.
- Statutory, recommended and supplementary tests for microbiological analysis of various foods: Baby foods, canned foods, milk and dairy products, eggs, meat, vegetables, fruits, cereals, surfaces, containers and water.

RB081002T-AGRICULTURAL MICROBIOLOGY

UNIT – I

Microbes and Plant interactions: Rhizosphere-microbial flora, rhizosphere influence on plant growth, plant pathogens and rhizosphere; ectotrophic and endotrophic micorrhizal associations and importance; phyllosphere- ecology of phyllosphere flora and importance. Spermosphere Nitrogen fixation : Ecology and biology of non-symbiotic and symbiotic nitrogen fixers, infection and nodulation, associative symbiosis, mechanism of nitrogen fixation, role of nitrogenase and hydrogenase, methods for evaluation of biological nitrogen fixation, significance of nitrogen fixation. Biofertilizers : Cultivation and mass production of Rhizobium and Azotobacter, phosphate solubilizing bacteria, blue-green algae, carrier based inoculants. Methods of application.

UNIT – II

Decomposition of waste agricultural products : Microbiology and biochemistry of decomposition of cellulose, hemi-cellulose, starch, pectin, lignin, chitin. Factors governing the decomposition. Microbial pesticides for biocontrol of pests and pathogens : Introduction, useful microbes (bacteria, fungi and viruses), production, formulation, economics, safety, advantages and disadvantages. Principles of Plant Pathology : Brief history and development of plant pathology (contributions of pioneers). Types of plant diseases and their significance. Symptoms of plant diseases. Basic procedures in the diagnosis of plant diseases. Host-pathogen interactions-virulence factors of pathogens and defense mechanisms of plants against pathogens. Environmental effects on disease

development and disease epidemiology. Control of plant diseases by various approaches.

UNIT – III

Plant diseases: Symptoms, etiology, epidemiology / disease cycle and control measures with reference to the following: Fungal : damping of seedlings, Phytophthora root and stem rots, downy mildew of grapes, powdery mildew of cucurbits, rust of groundnut, Fusarium wilts, red rot of sugarcane, tikka disease of groundnut, blast disease of rice. Bacterial: Citrus canker, blight of rice, angular leaf spot of cotton. Viral and viroid – rice tungro, sugarcane mosaic/ streak, potato leaf roll and spindle tuber viroid diseases, tomato/tobacco leaf curl, okra yellow vein mosaic, yellow mosaic of grain legumes, pigeon pea sterility mosaic, peanut bud and stem necrosis, citrus tristeza and yellow mosaic, papaya ringspot, banana bunchy top. Phytoplasmal: Little leaf of brinjal.

UNIT – IV

Diseases of animals (symptoms, etiology, pathogenesis, epidemiology and prevention and control) : Poultry: Viral-New castle, infectious bursal, Marek's, egg drop syndrome, avian influenza, infectious laryngotracheitis; Bacterial – Avian pasteurellosis, salmonellosis; Fungal – Aspergillosis, Aflatoxicosis. Fish: Viral – infectious pancreatic necrosis, viral haemorrhagic septicemia, infectious haemorrhagic necrosis, Bacterial-Pseudomonas, Chondrococcus, Vibrio, Nocardial infections. Prawn: Viral-Monodon baculovirus, yellow head, white spot diseases; Bacterial – vibrio sp. and Pseudomonas sp. caused diseases; Fungus- Larval mycosis caused by Fusarium sp., Red disease caused by mycotoxins; Protozoa – Microsporidia, Zoothamnium caused diseases. Mulberry and Silkworm diseases: Mulberry: Fungal – Leaf spot, powdery mildew, rust; bacterial blight. Silkworm: Viral- Nuclear polyhedrosis, cytoplasmic polyhedrosis; Bacterial – Septicemia, Sotro; Fungal- White and green muscardine, aspergillosis; protozoan- pebrine.

AGRICULTURAL MICROBIOLOGY LAB

- Isolation and characterization of microorganisms from soil
- Isolation and characterization of microorganisms from Water
- Isolation and characterization of microorganisms from air samples
- Isolation of halophiles/acidophiles/methanogens
- Isolation of Rhizobia from root nodule using Yeast Extract Agar Medium (YEMA).

RB080902T-MOLECULAR BIOLOGY AND R-DNA TECHNOLOGY

UNIT- I

1. Introduction of molecular biology and genetics. 2. Genome organization – genome, c-value, c-value paradox, genome complexity, 3. DNA Replication Prokaryotic and eukaryotic DNA replication, mechanism of DNA replication, enzymes and accessory proteins involved in DNA replication. 4. DNA Repair.

UNIT -II

1. Transcription Prokaryotic transcription and eukaryotic transcription, RNA polymerase, General and specific transcription factors, regulatory element and mechanisms of transcription regulation.
2. Transcriptional and post transcriptional gene silencing.

3. Modification of RNA 5'-cap formation, transcription termination, 3' end processing and polyadenylation, splicing, Editing, Nuclear export of mRNA, mRNA stability.
4. Translation Prokaryotic and eukaryotic translation, the translation machinery, mechanisms of initiation, elongation and termination, regulation of translation.

UNIT -III

1. Co- and post-translational modifications of proteins.
2. Protein localization and transport Synthesis of secretory and membrane, import into nucleus. Mitochondria E. R., Golgi complex, chloroplast, and peroxisomes, Receptor mediated endocytosis.
3. Antisense and ribozyme technology Molecular mechanism of antisense molecules, inhibition of splicing, polyadenylation and translation. Disruption of RNA structure and capping biochemistry of ribozyme; hammerhead, hairpin and other ribozymes, strategies for designing ribozyme, application of antisense and ribozyme technologies.
4. Pedigree analysis.

UNIT IV

- 1 Recombination: Homologous recombination - Holiday junction, site specific recombination - FLP/FRT and Cre lox recombination, Rec A and other recombinases
2. Genetic and physical mapping.
3. Southern, Northern and florescence in situ hybridization for genome analysis.
4. Chromosome micro-dissection and micro-cloning.
5. Molecular markers in genome analysis, RFLP, RAPD, AFLP, STS, SCAR (Sequence characterized amplified regions), microsatellite, SSCP, QTL.

Suggested Readings:

1. Principles of Gene Manipulations Old and Primrose Blackwell Scientific Publications.
2. DNA Cloning: A Practical Approach by D.M. Glover and B.D. Hames, IRL Press, Oxford.
3. Molecular Biotechnology, S.B. Primrose. Blackwell Scientific Publishers, Oxford.
4. Genetic Engineering and Introduction to Gene Analysis and Exploitation in Eukaryotes, S.M. Kingsman and A.J. Kingsman, Blackwell Scientific Publications, Oxford.
5. PCR Technology - Principles and Applications for DNA Amplification, Henry A. Erlich (Ed.) Stockton Pres
6. Molecular Biotechnology: Principles and Applications of Recombinant DNA, Bernard R. Glick and Jack J. Pasternak, ASM Publications.

MOLECULAR BIOLOGY AND RDT-LAB

- Isolation of plasmid and genomic DNA, Plasmid as cloning vector,
- Restriction enzymes and their role in biotechnology,
- Ligation method
- Expression of recombinant proteins using bacterial, animal and plant vectors,
- Agrobacterium-mediated gene transformation,
- Preparation of competent cells and transformation,
- Study microbial cell and enzyme immobilization. Designing of gene specific primers.
- Estimation of protein, RNA and DNA;
- SDS-PAGE of proteins; DNA isolation;

- Purification; polymerase chain reaction; DNA restriction analysis; RFLP and RAPD analysis; Transformation of *E. coli* using plasmid DNA,
- Genetic improvement of isolated industrially important microorganisms for production of microbial metabolites.
- Comparative studies of ethanol production using different substrates,
- Production of antibiotics and microbial enzymes.
- To study agarose gel electrophoresis of genomic DNA,
- To study genomic DNA isolation from bacteria and fungi, DNA isolation from humus-rich soil samples and diversity study using 16S rDNA primers,
- To study restriction profile of isolated DNA and plasmid samples,
- Isolation of plasmids from *E. coli* DH5α cells,
- Isolation of DNA fragments which carry promoter sequence,
- Synthesis and codon modification of bacterial hemoglobin gene,
- Agrobacterium mediated gene transformation studies in fungi,
- To prepare chemically competent cells of *E. coli* DH5α and determine their transformation efficiency,
- To amplify the laccase/phytase/xylanase gene by Polymerase Chain Reaction,
- To clone the laccase/cellulase/phytase/xylanase amplicon into the TA cloning vector pGEM-T.

RB080905-PRODUCTS AND PROCESS DEVELOPMENT

UNIT-I

Bioprocess technology: Microbial growth patterns and kinetics in batch culture, Microbial growth parameters. Quantitative analysis of microbial growth by direct & indirect methods, Role of diffusion in Bioprocessing, Different regulatory mechanisms involved in controlling the catabolic and anabolic processes of microbes. Basic concepts of computer modelling and optimization in bioprocess applications.

UNIT-II

Bioreactor design: General requirements of fermentation process, types of fermentation and fermenters; batch, fed batch and continuous. Solid state and submerged fermentation: Microbial growth kinetics-Monod equation, Stoichiometry of cell growth-mass and energy balances, yield coefficients, growth limiting substrate and yield factors, factors of optimization, rheology of fermentation fluids, Oxygen transfer kinetics.

UNIT-III

Details of the process, parameters and materials - for industrial production of Antibiotics (penicillin, streptomycin and their derivatives), Biopharmaceuticals (Insulin/Interferon), Role of microbes in milk and dairy products, Food fermentation- bread, cheese, vinegar, yogurt, sour milk, oriental fermented foods. Production of starter culture (LAB) for dairy industries. Microbial biomass: Single cell proteins and myco-protein.

UNIT-IV

Biofertilizers and biopesticides Plant Growth Promoting Rhizobacteria (PGPR) – mycorrhiza, Mass production of biofertilizers and quality control. Biopesticides - microbial pesticides, Bioconversion of waste for fuels: production of CH₄, bioethanol, biogas and other hydrocarbons, biodiesel and H₂ as fuel by microbes; Immobilization of microbial enzymes and whole cells and their applications in industries. Industrial enzymes production: Cellulases, Xylanases, Proteases, & Amylases

UNIT-V

Fundamentals of Bioentrepreneurship: decision making for starting a venture, sources of financial assistance, approaching the sources for loan, statutory and legal requirements of starting a company, assessment of market demand for product, developing distribution channels: pricing/policies/ competition/ promotion/ advertising, negotiation strategy with various agencies, Humanresource development

Suggested Readings:

1. Cruger, W. and Anneliese Cruger, A. 2005. Biotechnology, A text book of industrial Microbiology, Panima Publishers, New Delhi, 2nd Edition
2. Casida, L.E. 2010. Industrial Microbiology, Willey Eastern Ltd, New Delhi, 1st Edition
3. Stanbury, P.F. and Whitaker, A. 2005. Principles of Fermentation Technology, Pergamon Press, Oxford, 2nd Edition
4. Okafar, N. 2007. Modern Industrial Microbiology and Biotechnology, 1st Edition

RB081006-BIOENTREPRENEURSHIP

UNIT -I

Principles of Management: Introduction, Definition: Principles and decisions on starting a venture, Sources of financial assistance: Making a business proposal, approaching loan from bank and other financial institutions, budget planning and cash flow management, Basics in accounting practices: Balance sheet, P & L account, double entry book keeping, estimation of income, expenditure, profit, income tax.

UNIT -II

Human Resource Development (HRD): Recruitment and selection process, Leadership skills, Managerial skills, Organization structure, Training, Team building, Team work; Marketing: Assessment of market demand for potential products of interest; Market conditions, segments, prediction of market changes, Identifying needs of customers including gaps in the market.

UNIT -III

Entrepreneur: Meaning of entrepreneur, Evaluation of the concept, function of an entrepreneur types of entrepreneur, evolution of entrepreneurship, development of entrepreneurship, stages in entrepreneurial process, role of entrepreneurs in economic development in India; Entrepreneurship- its barriers.

UNIT -IV

Small scale industry: Definition, characteristics, need and rationale, objectives, scope, role of SSI in economic development, advantages of SSI, steps to start an SSI- Government policy towards SSI, different policies of SSI, Government support for SSI during 5 year plans. Impact of liberalization, privatization, globalization on SSI, effect of WTO/ GATT, supporting agencies of Government for SSI, meaning & nature of support, objectives and functions, types of help, Definitions: ancillary industry and tiny industry.

UNIT -V

Institutional support: Different schemes, TECKSOK, KIADB, KSSIDC, KSIM, DIC single window agency SISI, SIDBI, KSFC. Preparation of project: Meaning of project; Project identification project selection. Project report, need and significance of report, contents, formulation, guidelines by Planning Commission for Project report; Network analysis; Errors of project report, Project appraisal, Identification of Business Opportunities, Market feasibility study, technical feasibility study, Financial Feasibility study & Social feasibility study.

References:

1. Tripathi PC, Reddy PN. Principles of Management, Tata Mc Graw Hill.
 2. Vasant Desai. Dynamics of Entrepreneurial Development & Management, Himalaya Publishing House
 3. Poornima M Charanthmath. (2005). Entrapreneurship Development – Small Business Enterprises, Pearson Education – (2&4)
 4. Robert Lusier, Management Fundamentals – Concepts, Application, Skill Development, Thomson.
 5. Khanka SS, Entrepreneurship Development, S Chand & Co.
 6. Stephon Robbins. (2003). Managemen, 17th Edition, Pearson Education/ PHI
- Web sources

1. <https://www.edx.org/learn/entrepreneurship>
2. <https://elearningindustry.com/entrepreneurship-and-elearning-top-5-elearning-options-newbie-entreprene>
3. <https://www.startupindia.gov.in/content/sih/en/reources/1-d-listing.html>
4. https://swayam.gov.in/nd2_cec19_mg39/preview
5. <https://nptel.ac.in/courses/110/106/110106141/>
6. <https://www.coursera.org/browse/business/entrepreneurship>

RB080904T-PHARMACEUTICAL MICROBIOLOGY

UNIT-I

Antibiotics and synthetic antimicrobial agents: Antibiotics and synthetic antimicrobial lactams, tetracyclines, ansamycins, macrolid antibiotics) Antifungal agents (Aminoglycosides, antibiotics, antitumor substances. Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolone antimicrobial agents. Chemical disinfectants, antiseptics and preservatives. Mechanism of action of antibiotics: Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis) Molecular principles of drug targeting. Drug delivery system in gene therapy, Bacterial resistance to antibiotics, Mode of action of bacterial killing by quinolinones, Bacterial resistance to quionolinones, Mode of action of non – antibiotic antimicrobial agents. Penetrating defenses – How the antimicrobial agents reach the targets (cellular permeability barrier, cellular transport system and drug diffusion).

UNIT-II

Microbial production and Spoilage of pharmaceutical Products Microbial contamination and spoilage of pharmaceutical products (sterile injectibles, non injectibles, ophthalmic preparations and implants) and their sterilization. Manufacturing procedures and in process control of pharmaceuticals. Other pharmaceuticals produced by microbial fermentations (Streptokinase, Streptodornase). New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.

UNIT-III

Regulatory practices, biosensors and applications in Pharmaceuticals Financing R&D capital and

market outlook. IP, BP, USP. Government regulatory practices and policies, FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Rational drug design. Immobilization procedures for pharmaceutical applications (liposomes). Macromolecular, cellular and synthetic drug carriers. Biosensors in Pharmaceuticals. Application of microbial enzymes in pharmaceuticals.

UNIT-IV

Quality Assurance and Validation Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry. Regulatory aspects of quality control. Quality assurance and quality management in pharmaceuticals ISO, WHO and US certification. Sterilization control and sterility testing (heat sterilization, D value, z value, survival curve, Radiation, gaseous and filter sterilization). Chemical and biological indicators. Design and layout of sterile product manufacturing unit. Designing of Microbiology laboratory, Safety in microbiology laboratory.\

PRACTICAL— PHARMACEUTICAL MICROBIOLOGY

- Spectrophotometric / Microbiological methods for the determination of Griesofulvin.
- Bioassay of chloremphenicol by plate assay method or turbidimetric Assay method.
- Treatment of bacterial cells with cetrinide, phenol and detection of Leaky substances such as potassium ions, aminoacids, purines, Pyrimidines and pentoses due to cytoplasmic membrane damage.
- To determine MIC, LD 50 of Beta-lactum/aminoglycoside/ tetracycline/ansamycins.
- Sterility testing by *Bacillus stearothermophilus*
- Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations).
- Determination of D value, Z value for heat sterilization in pharmaceuticals. 8. Determination of antimicrobial activity of a chemical compound (Phenol, resorcinol, thymol, formaldehyde) to that of phenol under Standardized experimental conditions.