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Sri Krishnadevaraya University

AP STATE COUNCIL OF HIGHER EDUCATION

CBCS PATTERN FOR MICROBIOLOGY

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS –Wef: 2020 -2021

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
I	I	MBT - I	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	100	4
		MBP – I	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	50	1
	II	MBT – II	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	100	4
		MBP – II	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	50	1
II	III	MBT –III	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	100	4
		MBP – III	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	50	1
	IV	MBT - IV	IMMUNOLOGY AND MEDICAL MICROBIOLOGY	100	4
		MBP – IV	IMMUNOLOGY AND MEDICAL MICROBIOLOGY	50	1
		MBT - V	MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY	100	4
		MBP - V	MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY	50	1

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ONE SET OF SKILL ENHANCEMENT COURSE PAPERS FROM A, B AND C IN 5TH SEMESTER					
III	V	MBT –AI	MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES	100	4
		MBP -AI	MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES	50	1
		MBT –AII	MICROBIAL BIOTECHNOLOGY	100	4
		MBP -AII	MICROBIAL BIOTECHNOLOGY	50	1
		MBT – BI	HUMAN MICROBIAL DISEASES	100	4
		MBP - BI	HUMAN MICROBIAL DISEASES	50	1
		MBT –BII	DIAGNOSIS AND MANAGEMENTOF HUMAN MICROBIAL DISEASES	100	4
		MBP -BII	DIAGNOSIS AND MANAGEMENTOF HUMAN MICROBIAL DISEASES	50	1
		MBT – CI	MICROBIOLOGY FOR SELF-SUSTENANCE	100	4
		MBP - CI	MICROBIOLOGY FOR SELF-SUSTENANCE	50	1
		MBT –CII	PLANT MICROBIAL DISEASES AND MANAGEMENT	100	4
		MBP -CII	PLANT MICROBIAL DISEASES AND MANAGEMENT	50	1
THIRD PHASE OF APPRENTICESHIP IN ENTIRE 6TH SEMESTER					

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CBCS PATTERN FOR U.G. MICROBIOLOGY

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS – 2020
THIRD YEAR – SEMESTER- V

MBT- AI : MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

TOTAL HOURS: 60 **CREDITS: 4**

UNIT – I: Introduction to biosafety **No. of Hours: 12**

Good laboratory practices - Good microbiological practices.
Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3.
Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration

UNIT – II: Quality control in pharmaceuticals **No. of Hours: 12**

Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products

UNIT – III: Molecular methods for quality control **No. of Hours: 12**

Molecular methods - Nucleic acid probes, PCR based detection, biosensors.
Molecular methods of detection of Salmonella Sp and Botulism toxin in food stuffs

UNIT – IV: Quality control tests in industries **No. of Hours: 12**

Enrichment culture technique, Detection of specific microorganisms - on XLD agar, *Salmonella Shigella* Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar; Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).

UNIT – V : Food safety systems **No. of Hours: 12**

Food preservation methods- Modern industrial techniques- Pasteurisation, vacuum packing, freeze drying, food additives, irradiation, modified atmosphere
Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations
Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water

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MBP AI : MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

TOTAL HOURS: 30 **CREDITS: 1**

1. Sterility tests for Instruments – Autoclave & Hot Air Oven
2. Disinfection of selected instruments & Equipments
3. Sterility test of Air in Laboratory.
4. Sterility testing of Microbiological media
5. Sterility testing of Pharmaceutical products –Antibiotics, Vaccines & fluids
6. Standard qualitative analysis of water.
7. Analysis of food samples for Mycotoxins

SUGGESTED READING

1.Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press

2.Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.

3.Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer

4.Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.

5. Microbiology - A laboratory manual, Cappuccino & Sherman , 6 th Ed, Pearson Education

6. Manual of diagnostic microbiology, Dr.B.J.Wadher & Dr.G.L.Bhoosreddy, First .Ed ., Himalaya publishing house, Nagpur.

7. Pharmaceutical Microbiology – W.B. Hugo

8. Pharmaceutical Microbiology – Purohit

9. Laboratory Exercises in Microbiology, George.A.Wistreich & Max.D.Lechtman, 3 rd Ed, Glencoe press, London.

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020

THIRD YEAR – SEMESTER- V

MBT- AII: MICROBIAL BIOTECHNOLOGY

TOTAL HOURS: 60 **CREDITS:4**

UNIT- I : Scope and applications of Microbia Biotechnology **No. of Hours: 12**

Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology.
Genetically engineered microbes for industrial application: Bacteria and yeast

UNIT- II: Microbial production processes **No. of Hours: 12**

Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine).
Microbial polysaccharides, polyesters and bioplastics.
Microbial production of bio-pesticides
Microbial biosensors

UNIT- III: Biocatalytic processes **No. of Hours: 12**

Microbial based transformation of steroids and sterols.
Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute.
Immobilization methods and their application: Whole cell immobilization

UNIT- IV: Biofuel technology **No. of Hours: 12**

Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass.
Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics.
Mineral recovery, removal of heavy metals from aqueous effluents.

UNIT- V: IPR **No. of Hours: 12**

Outlines of Intellectual Property Rights:
Patents and secret processes –History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent

Copyrights, Trademark

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MBP AII- MICROBIAL BIOTECHNOLOGY

TOTAL HOURS: 30 **CREDITS: 1**

1. Yeast cell immobilization in calcium alginate gels

2. Enzyme immobilization by sodium alginate method

3. Pigment production from fungi (*Trichoderma* / *Aspergillus* / *Penicillium*)

4. Isolation of xylanase or lipase producing bacteria

5. Study of algal Single Cell Proteins

SUGGESTED READING:

1.Ratledge, C and Kristiansen, B. (2001). Basic Biotechnology, 2nd Edition, Cambridge University Press.

2. Demain, A. L and Davies, J. E. (1999). Manual of Industrial Microbiology and Biotechnology, 2nd Edition,
ASM Press.

3. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology, 12, 195–201.

4. Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.

5.Gupta PK (2009) Elements of Biotechnology 2nd edition, Rastogi Publications,

6. Glazer AN and Nikaido H (2007) Microbial Biotechnology, 2nd edition, Cambridge University Press

7.Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press,

8. Stanbury PF, Whitaker A, Hall SJ (1995) Principles of Fermentation Technology 2nd edition., Elsevier Science

9.Crueger W, Crueger A (1990) Biotechnology: A text Book of Industrial Microbiology 2nd edition Sinauer
associates, Inc.

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020

MBT BI – HUMAN MICROBIAL DISEASES

TOTAL HOURS: *60* **CREDITS: 4**

Unit I: Concept of Health and infectious diseases **No of Hours: 12**

Definition and concept of health, disease, Infection, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types;

Host microbe interactions, Germ theory of disease, Koch's postulates-modern interpretation

Unit II: Bacterial diseases **No of Hours: 12**

Pathogenesis, Symptoms, mode of transmission, prophylaxis and control of

Respiratory Diseases: Streptococcus pyogenes, Haemophilus influenzae, Mycobacterium tuberculosis

Gastrointestinal Diseases: Escherichia coli, Salmonella typhi, Vibrio cholerae, Helicobacter pylori Others: Staphylococcus aureus, Bacillus anthracis, Clostridium tetani, Treponema pallidum, Clostridium difficie

Unit III: Viral diseases **No of Hours: 12**

Pathogenesis, Symptoms, mode of transmission, prophylaxis and control of

Polio, Hepatitis, Dengue, AIDS,Influenza, Chikungunya, Japanese Encephelatis.

Unit IV: Protozoan and fungal diseases **No of Hours: 12**

Pathogenesis, Symptoms, mode of transmission, prophylaxis and control of

Malaria, Kala-azar

Cutaneous mycoses: Tinea pedis (Athlete's foot);

Systemic mycoses: Histoplasmosis; Opportunistic mycoses: Candidiasis

Unit V : Cancers and Pandemics **No of Hours: 12**

Microbial mediated cancers

Recent outbreaks of human microbial diseases (Covid-19/ Swine flu/Ebola) – causes, spread and control.

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020

MBP BI – HUMAN MICROBIAL DISEASES

TOTAL HOURS: 30 **CREDITS: 1**

1. Observation of permanent slides of pathogenic organisms covering various bacterial, protozoan and fungal pathogens

2. Symptomatic identification of any four diseases using photographs or case study

SUGGESTED READING

- Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.

- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.

- Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier.

- Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2ndedition, Elsevier India Pvt Ltd.

- Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby.

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020

MBP- BII: DIAGNOSIS AND MANAGEMENTOF HUMAN MICROBIAL DISEASES

TOTAL HOURS: *60* **CREDITS: 4**

UNIT- I: Microscopic and culture methods of Diagnosis **No. of hours: 12**

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria

Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

UNIT- II: Serological and molecular methods of Diagnosis **No. of hours: 12**

Serological Methods - Agglutination, ELISA, immunofluorescence,

Nucleic acid based methods - PCR, Nucleic acid probes.

Kit methods for rapid detection- Typhoid, Dengue and HIV

UNIT- III: Antibiotic resistance **No. of hours: 12**

Judicious use of antibiotics, importance of completing antibiotic regimen, Concept of DOTS, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains.

Importance of antibiotic sensitivity tests, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

Role of Ayurveda, Yoga and naturopathy, Unani, Siddha, and Homeopathy in community health

Unit IV:Epidemeology **No of Hours: 12**

History of epidemeology- cholera case study; Define epidemic endemic pandemic and sporadic

Components of epidemiology: disease frequency (Prevalence,Incidence,calculation of person-time at risk), distribution of disease and determinants of disease. Epidemiological approach, measurements of health indicators (morbidity, mortality)

Unit V: Preventive measures **No of Hours: 12**

General preventive measures, Importance of personal hygiene, environmental sanitation and methods to prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors.

Prevention of Nosocomial infections; Oppurtunistic infections

Vaccines: Importance, types, vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in the Indian context

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020

MBP- BII: DIAGNOSIS AND MANAGEMENTOF HUMAN MICROBIAL DISEASES

TOTAL HOURS: 30 **CREDITS: 1**

1. Collection transport and processing of clinical specimens (Blood, Urine, Stool and Sputum). Receipts, Labeling, recording and dispatching clinical specimens.
2. Isolation of bacteria in pure culture and Antibiotic sensitivity.
3. Identification of common bacteria by studying their morphology, cultural characters, Biochemical reactions, slide agglutination and other tests.
4. Maintenance and preservation of stock culture.

SUGGESTED READING

1. Ananthanarayan R and Paniker CKJ (2009)Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd.
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby. 5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier.

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS – 2020

MBT CI–MICROBIOLOGY FOR SELF-SUSTENANCE

TOTAL HOURS: *60* **CREDITS: 4**

Unit–I: Entrepreneurial skill **No of Hours: 12**

Entrepreneurial skills–Institutes involved, Government support to entrepreneurs, Incubation centers, risk assessment. Scope for small, medium and Large scale industries in Microbiology

Unit–II: Fermentation Products **No of Hours: 12**

Microbial cells as fermentation products-
Bakers yeast, food and feed yeasts, SCP, Bacterial Insecticides, Legume Inoculants, Algae.
Enzymes as fermentation products–
Bacterial and Fungal Amylases, Proteolytic Enzymes, Pectinases, Invertases, and other enzymes.
Fermentation Economics

Unit–III: Biofertilisers and Mushrooms **No of Hours: 12**

Mushroom cultivation–Cultivation of *Agaricus campestris*,Calocyba indica, *Agaricus bisporus,* and *Volvariella volvaciae;* Preparation of compost, filling tray beds, spawning, maintaing optimal temperature, casing, watering, harvesting, storage.

Biofertilizers –Chemical fertilizers versus biofertilizers, organic farming. Production of biofertilisers-*Rhizobium* sp, *Azospirillum*sp, *Azotobacter*sp.

Microbial consortia for composting and as biofertilisers

Unit–IV: Baking and Brewing processes **No of Hours: 12**

Brewing–Media components, preparation of medium, Microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, by products.

Bread making- Yeast activation,

Unit–V:DPR and Patents **No of Hours: 12**

Preparation of DPR (Detailed Project Report)
Patents and secret processes –History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS – 2020

MBP CI– MICROBIOLOGY FOR SELF-SUSTENANCE

TOTAL HOURS: 30 **CREDITS: 1**

1. Preparation of Microbial consortia for composting
2. Field visit and report preparation of Mushroom cultivation unit/ Biofertiliser production centre/or any other
3. Preparation of sample DPR

SUGGESTED READING

1. EntrepreneurialDevelopmentinIndia-ByArora.
2. Sathyanarayana.U, Biotechnology.(2005)1st Ed.BooksandAllied(P)Ltd.
3. StanburyPTandWhitaker,(1984).PrinciplesofFermentationTechnology,Pergamon Press.NY
4. Casida,LEJR,(2019). Industrial Microbiology.NewAge International Publishers
5. K.R.Aneja,ExperimentsinMicrobiology,Plantpathology,TissuecultureandMushroom productiontechnology,6th Ed.SChandPublication.
6. NdukaOkafor.ModernIndustrialMicrobiologyandBiotechnology.2007.CRCPress
7. MichaelJ.Waites,Neil L.Morgan,JohnS. Rockey,GaryHigton.IndustrialMicrobiology: AnIntroduction.2013.WileyBlackwellPublishers.
8. A.H.Patel.IndustrialMicrobiology.2016.2nd Ed.LaxmiPublications,NewDelhi.
9. DubeyRC.ATextbookofBiotechnology.(2014).SChand Publishers.
10. RobertD.Hisrich,MichaelP.Peters,"EntrepreneurshipDevelopment",TataMcGraw Hill

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS – 2020

MBT –CII: PLANT MICROBIAL DISEASES AND MANAGEMENT

TOTALHOURS: 60 **CREDITS:4**

Unit1: Introduction and history of plant pathology **No. of Hours:12**

Conceptofplantdisease-definitionsofdisease,diseasecycle&pathogenicity,symptomsassociatedwith microbial plant diseases, types of plant pathogens, economic losses and social impact of plantdiseases.

Significant landmarks in the field of plant pathology- [Contributions of Anton DeBary,Millardet, Burrill, E. Smith, Adolph Mayer, Ivanowski, Diener, Stakman, H.H. Flor, Van Der Plank (in brief)]

Molecular Koch'spostulates.Contributions of eminent Indian plant pathologists.

Unit 2: Stages in development of a disease **No. of Hours: 12**

Infection,invasion,colonization,dissemination of pathogens and perennation.

Concepts of monocyclic,polycyclic and polyetic diseases, disease triangle & disease pyramid

Forecasting of plant diseases and its relevance in Indian context.

Unit 3 : Host Pathogen Interaction **No. of Hours: 12**

MicrobialPathogenicity- Virulence factors of pathogens: enzymes, toxins (host specific and non specific) growthregulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in diseasedevelopment.

Effects of pathogens on host physiological processes (photosynthesis, respiration,cell membrane permeability, translocation of water and nutrients, plant growth andreproduction).

DefenseMechanismsin Plants- Concepts of constitutive defense mechanisms in plants, inducible structural defenses (histological-cork layer, abscission layer, tyloses, gums), inducible biochemical defenses [hypersensitive response (HR), systemic acquired resistance (SAR), phytoalexins, pathogenesis related (PR)proteins, plantibodies, phenolics,quinones, oxidative bursts].

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Unit4: Control of Plant Diseases **No. of Hours: 12**

Principles & practices involved in the management of plant diseases by different methods, viz.regulatory - quarantine, crop certification, avoidance of pathogen, use of pathogen freepropagativematerial

Cultural - host eradication, crop rotation, sanitation, polyethylene traps and mulches chemical - protectants and systemic fungicides, antibiotics, resistance of pathogens to chemicals. Biological-suppressive soils, antagonistic microbes-bacteria and fungi, trap plants

Unit5: Specific Plant diseases **No. of Hours:12**

Study of some important plant diseases giving emphasis on its etiological agent, symptoms, epidemiology and control

Important diseases caused by fungi- White rust of crucifers, Downy mildew of onion, Late blight of potato

Powdery mildew of wheat, Ergot of rye, Black stem rust of wheat, Loose smut of wheat,

Wilt of tomato,

Red rot of sugarcane, Early blight of potato

Important diseases caused by phytopathogenic bacteria- Angular leaf spot of cotton,

bacterial leaf blight of rice, crown galls, bacterial cankers of citrus

Important diseases caused by phytoplasmas: Aster yellow

Important diseases caused by viruses: Papaya ring spot, tomato yellow leaf curl, banana bunchytop

Important diseases caused by viroids: Potato spindle tuber, coconut cadang cadang

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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS – 2020

MBP –CII: PLANT MICROBIAL DISEASES AND MANAGEMENT

TOTALHOURS: 30 **CREDITS: 1**

1. Demonstration of Koch's postulates in fungal, bacterial and viral plant pathogens.

2. Study of important diseases of crop plants by cutting sections of infected plant material- *Albugo, Puccinia, Ustilago, Fusarium, Colletotrichum.*

SUGGESTED READINGS

1. AgriosGN.(2006).PlantPathology.5thedition.Academicpress,SanDiego,
2. LucasJA.(1998).PlantPathologyandPlantPathogens.3rdedition.BlackwellScience,Oxford.
3. MehrotraRS.(1994).PlantPathology. TataMcGraw-HillLimited.
4. RangaswamiG.(2005).DiseasesofCropPlantsinIndia.4thedition.Prentice HallofIndiaPvt.Ltd., NewDelhi.
5. SinghRS.(1998).Plant Diseases Management.7thedition.Oxford&IBH,NewDelhi.

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The syllabus of B.Sc. MICROBIOLOGY (CBCS) revised by The APSCHE in 2020 has been reviewed by the undersigned BOS members of Microbiology, U.G Course, S.K University. This syllabi of Fifth semester has been approved with necessary corrections.The syllabus, Pg.No. 1 to 14 of this document is approved w.e.f the current academic year 2022-23 for the students admitted from academic year 2020-21 onwards.

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Recommended Format for Question Paper

MICROBIOLOGY

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

Section-A

Answer any **FIVE** of the following questions. ***[5X5=25]***

1 Contents of **Unit-I**

2 Contents of **Unit-II**

3 Contents of **Unit-III**

4 Contents of **Unit-IV**

5 Contents of **Unit-V**

6 Contents of **Unit-I to Unit V**

7 Contents of **Unit-I to Unit V**

8 Contents of **Unit-I to Unit V**

Section-B **[5X10=50]**

Answer **FIVE** questions

9 a Contents of **Unit-I**

(OR)

9 b Contents of **Unit-I**

10 a Contents of **Unit-II**

(OR)

10 b Contents of **Unit-II**

11 a Contents of **Unit-III**

(OR)

11 b Contents of **Unit-III**

12 a Contents of **Unit-IV**

(OR)

12 b Contents of **Unit-IV**

13 a Contents of **Unit-V**

(OR)

13 b Contents of **Unit-V**

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Recommended Format for Practical Examination

Microbiology

Time: 3 Hours *Max. Marks :75*

1. Major Experiment.....20 M
2. Minor Experiment.....10 M
3. Spotters.....5x2= 10 M
4. Record.....10 M

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