

**Open Elective PAPERS (III Semester)**  
**DAVANGERE UNIVERSITY**  
**B.Sc. BIOCHEMISTRY**  
**(KSHCEC-SEP Syllabus: 2026-27 onwards)**  
**SEMESTER-III**  
**24SEPBC-ELECTIVE PAPER-1(A): PLANT BIOCHEMISTRY**

**TOTAL HOURS -32**

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**Course Learning Objectives:**

- a) To know the plant cell structure, plant pigments and organelles involved in photosynthesis.
- b) To understand the process of photosynthesis.
- c) To know the role of nitrogen in plants and nitrogen fixation.
- d) To understand the importance and applications of phytohormones, phytochemicals.
- e) To gain the knowledge of plant defense mechanism.

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**Course Outcome:**

On successful completion of the course, the student will be able to:

- a) To know how the plants synthesize carbohydrates.
  - b) To know the functioning of photosynthetic apparatus and pigments.
  - c) To understand the basic concepts of phytochemistry.
  - d) Get familiarize with the bioactive components present in the medicinal plants.
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**PLANT BIOCHEMISTRY**

**UNIT 1:**

**(8Hrs)**

Chapter 3.1.1

**Introduction to plant cell structure**-Plant cell structure, plastids, Chloroplasts, vacuole, peroxisomes.

Chapter 3.1.2

**Plant pigments**-Structure and functions-Chlorophyll a & b, Xanthophylls-lutein, zeaxanthin, carotenoids - $\beta$ -carotene, phycobilins-phycoerythrins & phycocyanins.

**UNIT 2:**

**(8Hrs)**

Chapter 3.2.1

**Photosynthesis in green plants**-Definition of photosynthesis, Photosystems-I & II, reaction centre, antenna molecules, Electron transport and mechanism of ATP synthesis.

Mechanism of photosynthesis- light reaction (cyclic and non cyclic photophosphorylation), Structure and function of RUBISCO. Calvin cycle, Special adaptations- C4 cycle, crassulacean acid metabolism (CAM), photorespiration.

Chapter 3.2.2

**Nitrogen metabolism**-Role of nitrogen in plants, sources of nitrogen – molecular nitrogen, organic & inorganic nitrogen. Conversion of nitrate into ammonia. Nitrogen fixation - symbiotic and non-symbiotic nitrogen fixation.



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**UNIT 3:****(8Hrs)**

## Chapter 3.3.1

**Plant hormones**-Introduction to plant hormones and their effect on plant growth and development-Auxins, Gibberellins, cytokinins, abscisic acid and Ethylene.

## Chapter 3.3.2

**Nutrition in plants-**

Significance of nutrients in plants: Functions & deficiency- primary (Nitrogen, phosphorus, potassium), secondary nutrients (calcium, magnesium, sulfur) and micronutrients (Zn, Fe, Mn, Mo, Cu, B)

**UNIT 4:****(8Hrs)**

## Chapter 3.4.1

**Secondary plant metabolites**-Phytochemicals- Phenolics, Anthocyanins, carotenoids, alkaloids, terpenoids, their roles in plant physiology and as alternative medicine.

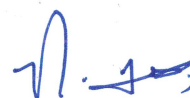
## Chapter 3.4.2

**Plant defense**-plant-pathogen interactions, hypersensitive response, systemic acquired resistance (SAR) and induced systemic resistance (ISR).

Plant stress – Plant response to abiotic stresses-cold, drought, salt and UV.

**Suggested References/Text books:**

1. Lehninger's Principles of Biochemistry. Nelson DL, Lehninger AL, Cox MM. Macmillan Publishers (2008).
2. Peter J. Lea Richard. C. Lee good, Plant Biochemistry and molecular biology, 1999, 2<sup>nd</sup> edition, John Wiley & Sons, NY.
3. Bowsher C, Steer M and Tobin A, Plant Biochemistry, Garland Science 2008.
4. Plant defense:Warding off attackby pathogens, herbivores and parasitic plants, Richard S.S. Jones, Wiley-Blackwell, 2011.
5. Srivastava HS, Plant physiology and Biochemistry, Rastogi publication, 2005.
6. Sinha R K, Modern plant physiology, Narosa publishing house, 2004.
7. Jain, J.L, Fundamentals of biochemistry, S.Chand publication 6<sup>th</sup> Edition, 2005.
8. Lehninger, A.L., Nelson, D.L., Cox, M.M., Principles of Biochemistry, CBS Publishers, 2<sup>nd</sup> Edition, 1993.
9. Lubert stryer, Biochemistry, Freeman and company, 4<sup>th</sup> Edition, 1995.



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**B.Sc. BIOCHEMISTRY**  
**(KSHCEC-SEP Syllabus: 2024-25)**  
**SEMESTER-III**  
**24SEPBC-ELECTIVE PAPER-1(B): MOLECULAR BASIS OF**  
**INFECTIOUS DISEASES**

**TOTAL HOURS -32**

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**Course Learning Objectives:**

- a) To study about the different infectious agents.
- b) To study diseases caused by bacteria, virus, fungi, parasites.
- c) To study pathogenesis, therapeutic agents.
- d) To learn the infection and evasion of microorganisms.
- e) To know the vaccine development for diseases.

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**Course Outcome:** On successful completion of the course, the student will able to:

- a) Explain the classification of infectious agents including bacteria, viruses, protozoa, and fungi.
- b) Describe host-parasite interactions, mechanisms of infection, immune evasion, and types of infections caused by various pathogens.
- c) Analyze the molecular basis, pathogenesis, diagnosis, and control strategies of major bacterial viral, fungal and protozoan diseases.
- d) Explain the drugs and vaccine development for diseases.

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**MOLECULAR BASIS OF INFECTIOUS DISEASES**

**UNIT 1:** **(8Hrs)**

Chapter 3.1.1

**Classification of Infectious agents** - Bacteria, viruses, protozoa and fungi. Past and present emerging and re-emerging infectious diseases and pathogens.

Chapter 3.1.2

Source, reservoir and transmission of pathogens, Antigenic shift and antigenic drift. Host parasite relationship, types of infections associated with parasitic organisms.

**UNIT 2:** **(8Hrs)**

Chapter 3.2.1


Host parasite relationship, types of infections associated with parasitic organisms.

Overview of viral and bacterial pathogenesis. Infection and evasion.

**Overview of diseases caused by bacteria:** Tuberculosis, typhoid, diphtheria, pertussis, tetanus, typhoid and pneumonia.

Chapter 3.2.2

Detailed study of tuberculosis: History, causative agent, molecular basis of host specificity, infection and pathogenicity, diagnostics, therapeutics, inhibitors and vaccines. Drug resistance and implications on public health.

  
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**UNIT 3: (8Hrs)**

Chapter 3.3.1

**Overview of diseases caused by viruses:** AIDS, hepatitis, influenza, rabies, chikungunya, dengue and polio.

Chapter 3.3.2

Detailed study of AIDS, history, causative agent, pathogenesis, diagnostics, drugs and inhibitors.

**UNIT4: (8Hrs)**

Chapter 3.4.1

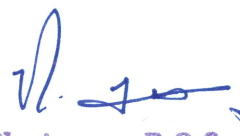
**Overview of diseases caused by parasites:** Detailed study of malaria, history, causative agents, vectors, life cycle, host parasite interactions, diagnostics, drugs and inhibitors, resistance, vaccine development. Other diseases including leishmaniasis, amoebiasis.

Chapter 3.4.2

**Overview of diseases caused by other organisms:** Fungal diseases, general characteristics. Medical importance of major groups, pathogenesis, treatment.

**Suggested References/Text books:**

1. Text book of disease causing microbes, Jaishree Paul
2. Text book of Microbiology with Parasitology, 7<sup>th</sup> edition, Dr Arora.
3. Text book of microbiology and parasitology, 5th edition, B S Nagoba.
4. Text book of Microbiology-C P Baveja.
5. Molecular basis of infectious diseases, S H Gillespie & K B Bamford.
6. Medical microbiology , Patrick R Murray et al
7. Essentials of medical microbiology-Apurba Sankar Sastry
8. Medical Microbiology I and II. Mackie and Mccatney, CharchillLivingston , 14th ed.
9. Medical Microbiology. Rajan, S. ( 2007) MJP Publishers, Chennai.
10. Immunology and Medical Microbiology. R.P.Singh, (2007) Kalyani Publishers; 2 edition.
11. Text Book of Medical Mycology. Jagadish Chandra (1996). Oreint Longman.
12. Textbook of Microbiology, Ananthanarayan, R. and Paniker, C.K.J. (2009). 8th edition, University Press Publication.
13. Medical Microbiology.26th edition.McGraw Hill Publication. Brooks, G.F., Carroll, K.C., Butel, J.S., Morse, S.A. and Mietzner, T.A. (2013). Jawetz, Melnick and Adelberg's
14. Medical Microbiology, Goering, R., Dockrell, H., Zuckerman, M. and Wakelin, D. (2007) Mims'. 4th edition. Elsevier.
15. Microbiology. Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2013) Prescott, Harley and Klein's 9th edition. McGraw Hill Higher Education.
16. Biology of Microorganisms. Madigan, M. T., Martinko, J. M., Dunlap, P. V. and Clark, D. P. (2014).Brock 14th edition. Pearson International Edition



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**Open Elective PAPERS (IV Semester)**

**DAVANGERE UNIVERSITY**

**B.Sc. BIOCHEMISTRY**

**(KSHCEC-SEP Syllabus: 2024-25)**

**SEMESTER-IV**

**24SEPBC-ELECTIVE PAPER-2(A): BIOCHEMICAL TOXICOLOGY**

**TOTAL HOURS -32**

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**Course Learning Objectives:**

- a) To understand basic idea about biochemical basis of various effects of toxins/ pharmaceuticals and an outline of process involved in toxicity testing and drug dosing.
- b) To categorize the classes of toxicants/drugs and know specific examples.
- c) To state the routes of exposure to toxins/drugs.
- d) Explain the processes of absorption, metabolism and elimination of toxins/drugs.
- e) Explain environmental and physiological factors that affect toxicant metabolism.

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**Course Outcome:** On successful completion of the course, the student will able to:

- a) To know the importance of toxicology and toxins dose.
- b) To know the factors affecting dose response.
- c) Explain the metabolism of toxins and detoxification.
- d) Explain the action of toxins on organs.

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**BIOCHEMICAL TOXICOLOGY**

**UNIT 1:**

**(8Hrs)**

Chapter 4.1.1

**Fundamentals of toxicology :** Scope of toxicology; why should we know about toxins/xenobiotics (drugs) and What makes a substance toxic? Grading toxicity, Use of animal studies for toxicity, *in vitro* toxicity, organ toxicity (liver and kidney toxicity). Indicators of toxicity/drug effects; biomarkers.

Chapter 4.1.2

**Toxins dose:** Concentration and site of action, dose response, effect of route of administration, ED, LD /TD. Hazard and risk assessment, risk, acceptable daily intake (ADI) and tolerable daily intake (TDI).

**UNIT 2:**


**(8Hrs)**

Chapter 4.2.1

**Factors affecting toxic responses:** Disposition- Outline of toxin/drug uptake, entry to cells and systemic circulation. Effect of size, shape, solubility, and charge on their uptake.

Chapter 4.2.2

**Metabolism of toxins-** Major sites of absorption, liver, intestine, skin, role of transporters, role of plasma proteins in distribution, plasma levels of toxins/drugs, plasma half-life, excretion-disposition by kidney, biliary excretion.

  
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**UNIT 3:****(8Hrs)**

Chapter 4.3.1

**Detoxification-** types of metabolic changes of foreign compounds, biotransformation/detoxification reactions, phase-1 and, phase -2 reactions, nature of phase- I and phase 2 enzymes.

Chapter 4.3.2

**Targets of toxic damages and biochemical mechanism of toxicity-** Toxins/drugs causing liver, kidney, gall bladder, and lung damage, methods of identifying the damages.

**UNIT4:****(8Hrs)**

Chapter 4.4.1

Examples of biochemical toxicity mechanisms; chemical carcinogens - Benzo[a]pyrene, Tamoxifen.

Liver necrosis- carbon tetrachloride, Valproic acid and Iproniazid.

Chapter 4.4.2


Kidney damage- Chloroform, Antibiotics- gentamycin,

Lung damage- 4- Ipomeanol,

Neurotoxicity- Isoniazid, parquat, primaquine, cyclophosphamide.

**Suggested References/Text books:**

1. Biopharmaceuticals Biochemistry and Biotechnology 2nd Edn. Gary Walsh, John Wiley & Sons, Ltd, England, 2003.
2. Fundamentals of Experimental Pharmacology, Ghosh, M.N. 2nd Edition, Scientific Book Agency, Kolkatta, 1984.
3. Introduction to Biochemical Toxicology, 3<sup>rd</sup> Edu., Ernest Hodgson, Robert C Smart; Wiley-Interscience; , 2001
4. Principles of Biochemical Toxicology; Johns A. Timbrell, 4<sup>th</sup> Edu. 2009, Taylor & Francis
5. Remington Pharmaceutical Sciences, Lippincott, Williams and Wilkins, 2000



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**B.Sc. BIOCHEMISTRY**  
**(KSHCEC-SEP Syllabus: 2024-25)**  
**SEMESTER-IV**  
**24SEPBC-ELECTIVE PAPER-2(B): MICROBIOLOGY**  
**TOTAL HOURS -32**

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**Course Learning Objectives:**

- a) To understand the importance and applications of microbiology.
  - b) To gain the knowledge of microbial nutrition, culture and importance of microorganism in industries and antibiotics.
  - c) To understand role of human microbiome in maintaining homeostasis.
  - d) To study the microorganisms as food.
  - e) To study action of antibiotics and its resistance.
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**Course Outcome:** On successful completion of the course, the student will able to:

- a) Explain importance of microbiology and microorganisms in health and disease.
  - b) Students would be able to understand the role of antibiotics.
  - c) Explain human microbiome and its importance.
  - d) Explain the role of culture media for growth of microorganisms.
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**MICROBIOLOGY**

**UNIT 1:** **(8Hrs)**

Chapter 4.1.1

**Introduction to microbiology**-Definition, History & scope of microbiology. Contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming.

Chapter 4.1.2

**Classification and study of microorganism**- Classification of microorganisms (in brief). Study of microorganisms: Staining micro-organisms – principle and procedure of Gram stain and Acid fast stain. Ultrastructure of a bacterial cell -E.coli

**UNIT 2:** **(8Hrs)**

Chapter 4.2.1

**Microbial growth and nutrition**- Growth of micro-organisms, measurement of growth, Growth curve, phases of growth curve. Factors influencing growth- Nutrition, carbon source, Nitrogen source, Temperature, pH and oxygen.

Chapter 4.2.2

**Microbial culture**-Different constituents of culture medium, types of media and their applications. Batch and continuous culture. Concept of synchronous cultures. Instrumentation in bioreactors.

  
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**UNIT 3:****(8Hrs)**

## Chapter 4.3.1

**Industrial Microbiology**-Production and importance – Alcoholic beverages (Beer and Wine), Fermented products of milk cheese, antibiotic production – penicillin, single cell protein – Spirulina.

## Chapter 4.3.2

**Antibiotics**-Definition, Mechanism of action of penicillin, streptomycin, tetracycline and chloramphenicol. Antibiotic resistance in brief.

**UNIT4:****(8Hrs)**

## Chapter 4.4.1

**Viruses**-Classification based on genetic material with examples.

**Plant viruses**- TMV, morphology, general characteristics and its replication.

**Bacteriophages**:-Morphology, general characteristics, life cycle (lysogeny and lytic cycle) of T-even bacteriophage.

**Animal viruses**-HIV – structure and its replication.

## Chapter 4.4.2

Microorganisms as food - prebiotics, probiotics, synbiotics in health and disease. Human microbiome- distribution, role in human health, gut brain axis, dysbiosis, gut microbiome. Factors affecting the microbiome.

**Suggested References/Text books:**

1. Prescott L.M. Harley J.P. and Klein D.A. Microbiology (5th edition) McGraw Hill, New York. 2008
2. Pelczar Jr, M.J. Chan, E.C.S. and Kreig, N.R. . Microbiology, Mc. Graw Hill. Inc, NewYork.2006.Salle, A.J. Fundamental principles of Bacteriology.(7thedition).Tata McGraw-Hill publishing company Ltd, New Delhi. 1996
3. Stainer, Ingharam, Wheelis and Painter. General Microbiology. 5th Edition. Macmillan Education, London.1987
4. A Text book of Microbiology. Dubey , RC and Maheswari D K . S. Chand & Company Ltd., New Delhi. 2005.

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**THEORY EXAMINATION QUESTION PAPER PATTERN FOR:**  
**BIOCHEMISTRY (OPEN ELECTIVE)**  
**(Semesters III / IV)**

**B.Sc. Semester-III/IV Degree Examination; 2025-26**  
**(Semester Scheme; New Syllabus: 2024-25)**

**SUBJECT: BIOCHEMISTRY**

Paper – \_\_\_\_\_ : \_\_\_\_\_

Paper Code: \_\_\_\_\_

Time: 2 Hours

**Max. Marks: 40**

**Instructions to candidates:**

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

**SECTION-A**

Answer all the following questions:

**(2×5=10)**

- 1.
- 2.
- 3.
- 4.
- 5.


**SECTION-B**


Answer any SIX of the following:

**(5×6=30)**

6. From Unit-I
7. From Unit-I
8. From Unit-II
9. From Unit-II
10. From Unit-III
11. From Unit-III
12. From Unit-IV
13. From Unit-IV

  
**Registrar**  
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**Prof. M. Govindappa**  
**Dean-Science & Technology**  
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SECTION -C

Answer Any Three of the following:

(10×3=30)

10. From Unit-I
11. From Unit-II
12. From Unit-III
13. From Unit-IV



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