SEMESTER - V

SEC- III ANIMAL BIOTECHNOLOGY

1. **Course Description**

Programme: BSc
Course Code: U24/BIT/SEC/501
Course Type: SEC-3
No. of credits: 2

Max. Hours: 30Hrs
Hours per week: 2Hrs
Max. Marks: 50

2. **Course Objectives**

- To outline the basic principles of animal cell culture and gene manipulation techniques.
- To demonstrate the applications of animal biotechnology in the production of transgenic animals with desirable characteristic features.

3. **Course Outcomes**

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

CO1: Define and describe the basics of animal cell culture techniques and development of transgenic animals **(REMEMBER, UNDERSTAND)**

CO2: Compute and compare the applications of animal biotechnology in therapeutics, as selectable markers and in stem cell technology **(APPLY, ANALYZE)**

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4. Course Content

MODULE I: BASICS OF ANIMAL TISSUE CULTURE AND TRANSGENIC ANIMALS **(15 Hrs)**

- Introduction to Animal cell culture: scope, facilities for animal cell culture, equipment- inverted microscope, buffer systems-CO2 incubator, culture vessels.
- Contamination: contamination, types – viral, bacterial, fungal, yeast, mycoplasma. Detection techniques.
- Sterilization techniques: aseptic practices, sterilization techniques and equipment used- heat sterilization, radiation sterilization, filtration.
- Various types of cell culture: Primary cell culture- steps, subculture- monolayer and suspension cultures.
- Stimulating natural condition for growing cell: media- natural, artificial, synthetic
- Molecular pharming, Transgenic animals and their applications, methods used for transgenesis with reference to transgenic mice, cattle, sheep, goats, pigs, chicken, and fish.
- Transfection methods: calcium phosphate precipitation, DEAE-Dextran mediated transfection, electroporation, and microinjection.
- Cell lines: Origin, nomenclature, characteristics, types (finite, continuous) and maintenance.
- Commonly used cell lines and their applications (CHO cell lines, BHK cell lines, SPO2 cell line, Vero cell lines, HEK cell lines).

MODULE II: APPLICATIONS OF ANIMAL BIOTECHNOLOGY **(15 Hrs)**

- Selectable markers: DHFR, TK, HGPRT genes in purine pyrimidine synthesis, importance in selection process and HAT medium selection.
- Reporter genes - GFP, luciferase genes and importance in selection.
- Stem cell technology: Differentiation - Totipotent, pluripotent, and multipotent stem cells and their sources. Embryonic stem cells, adult stem cells and Stem cell banking.
- Production of Monoclonal antibodies: hybridoma technology. Monoclonal antibodies versus polyclonal antibodies.
- Applications of Monoclonal antibodies: therapeutics, diagnostics, biochemical analysis and purification, diagnostic imaging, miscellaneous applications.
- Applications, Advantages, and disadvantages of animal tissue culture.

5. Reference books

1. Basant Kumar Sinha, Rinesh Kumar (2008). *Principles of animal cell culture.* Lucknow, Uttar Pradesh: International Book Distributing Co.
2. R. Ian Freshney. (2005) *Culture of Animal Cells: A Manual of Basic Technique, Fifth Edition*:John Wiley & Sons, Inc.
3. Purohit, S. (2005). *Biotechnology: Fundamentals and applications* (4th edition.). Jodhpur, India: Agrobios.
4. M M, Ranga. (2002). *Animal Biotechnology*: Agrobios.

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global (Module 1 & 2)	The worldwide applicability of animal biotechnology in a variety of domains, such as environmental management, conservation and medicine is reflected in the curriculum. Animal biotechnology plays a significant role in improving food security, human health, environmental sustainability, and biodiversity conservation on a worldwide scale by tackling important issues and opportunities in these areas.

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Introduction to animal cell culture- media and to maintain aseptic environment	Students will be given demonstration on preparation of animal cell culture media and to establish cell lines in the laboratory.
Employability	Development and maintenance of cell lines	Field trip to research institutes will enhance their experiential learning
Entrepreneurship	Module I and II	Students will be engaged in a research project which employs animal cell culturing methods.

7. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Formative Assessment - FA (40%)	Summative Assessment - SA (60%)
CIA-20 marks **Article writing/ presentations/Case studies/Quiz**	**End Semester exam-30 Marks**

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b) Model Question Paper- End Semester Exam

ANIMAL BIOTECHNOLOGY

MODEL QUESTION PAPER

Course Code: U24/BIT/SEC/501 **Max. Marks: 30**
Credits: 2 **Time: 1 Hr**

SECTION – A

I. Answer any Six out of the following: **6 x 5 = 30 M**

1. Classify the types of contamination in animal cell culture
2. Compare the types of primary cell culture methods
3. Describe the properties of finite and continuous cell lines
4. Illustrate the process of microinjection
5. Distinguish between the various types of reporter genes
6. How would you apply monoclonal antibodies in diagnostics, therapeutics, and protein purification?
7. List out about various sources of stem cell banking and its applications
8. Summarize the applications of animal cell culture

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SEMESTER-END MODEL QUESTION PAPER

SECTION A - ANSWER ANY 6 OUT OF 8
6 Q X 5 M = 30 M
(To compulsorily have **FOUR** questions from **each** module)

Question Number	Question	Question	CO	BTL (Blooms Taxonomy Level)
1	Module 1	Classify the types of contamination in animal cell culture	CO 1	II
2	Module 1	Compare the types of primary cell culture methods	CO 1	II
3	Module 1	Describe the properties of finite and continuous cell lines	CO 1	I
4	Module 1	Illustrate the process of microinjection	CO 1	II
5	Module 2	Distinguish between the various types of reporter genes	CO 2	IV
6	Module 2	How would you apply monoclonal antibodies in diagnostics, therapeutics and protein purification?	CO 2	III
7	Module 2	List out about various sources of stem cell banking and its applications	CO 2	IV
8	Module 2	Contrast the applications of animal cell culture	CO 2	IV

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Prepared by	Checked & verified by	Approved by
4/3/24 (Mini Fernandez) Name and Signature of the teaching faculty	4/3/24 (Ms. Shouni Nivedita) Name and Signature of HoD	Name and Signature of Principal

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SEMESTER-V
APPLIED MICROBIOLOGY

1. Course Description:

Programme: B.Sc.
Course Code: U24/MIC/DSE/501
Type of course: DSE
No. of credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. Course Objectives:

- This course will help the students gain basic knowledge about fermentation technology, concepts of screening of microbes, media preparation, bioreactor design, optimization and microbial productions.
- Overview of downstream processing would enable the students develop skills to meet the requirements of an Industry.

3. Course Outcomes:

CO 1: Gain knowledge about industrially important microbes and understand the concepts of screening and assay methods. (L II)

CO 2: Understand the design and working of fermenter, media and sterilization methods. (L II)

CO 3: Apply different methods of downstream processing strategies to recover products from fermentation broth. (L II)

CO 4: Evaluate different metabolites and analyze the biochemistry and media factors for an effective fermentation process. (L V)

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4. Course Content :

MODULE I - BIOPROCESS TECHNOLOGY: **(15 Hrs)**

Definition, scope and History of Industrial Microbiology.

Microorganisms of industrial importance -Yeast , Molds, Bacteria, Actinomycetes.

Screening and isolation of industrially useful microbes.

Assay methods- Physico- chemical methods, Biological methods.

MODULE II- FERMENTER DESIGN AND STERILIZATION: **(15 Hrs)**

Design and Preparation of Media for Bioprocesses. Basic design of fermenter. Industrial Sterilization of equipment, media, and air. Scale up.

MODULE III- TYPES OF FERMENTATION PROCESS AND DSP: **(15 Hrs)**

Batch, Fed-batch and Continuous process.

Submerged and surface fermentations (Solid and Liquid).

Direct, dual and multiple fermentations.

Downstream processing: Foam separation, Removal of solid waste, precipitation, Filtration, Centrifugation.

Cell Disruption - Physical and chemical methods; Solvent extraction: membrane separation; Chromatography: Affinity and ion exchange, Crystallization and Drying.

MODULE IV- MICROBIAL PRODUCTION: **(15 Hrs)**

General concepts for enzyme production.

Production of Amylase.

Organic solvent – Ethanol.

Organic acid- Citric acid.

Antibiotic- Penicillin.

Growth factor: Vitamin B12.

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5. Resources:

Text books:

1. L.E.Casida, (2010), Industrial microbiology, New age international publishers.
2. A.H.Patel,(2012), IndustialMicrobiologyby, 2nd edition , Mac MillanIndiapvt ltd.
3. Whittaker, Stanbury and J. Hall ,(1997),Principles of fermentation technology , 2nd edition, Aditya books.
4. Ed. Cruger&Cruger, (2005) Biotechnology (a text book of industrial microbiology), 2nd edition, ,Pancina publishers.
5. Michael J Waites,(2001), Industrial Microbiology-Blackwell Science Ltd.

Reference Books:

1. S. Ram Reddy, M.A Singara Charya. A Text Book of Microbiology (Applied Microbiology), Volume IV. Himalaya publishing house.
2. J.H. Peppler & D. Perlman Microbial Technology, 2nd edition, Academic Press.
3. Arnold, (2004), Manual of Industrial Microbiology and Biotechnology, 2nd edition, ASM press.
4. Gopal Reddy et al, (2008), Laboratory experiments in microbiology, 3rd edition, Himalaya publishers.
5. S.M. Reddy, S. Ram Reddy (2000), Microbiology A Laboratory manual, BSC Publishers and Distributor.

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6. Syllabus Focus:

a) Relevance to Local, Regional, National, and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Local	Basic concepts of fermentation
Regional	Fermentation types feasibility
National	Recovery of samples, downstream processing
Global	Scale-up of fermentation techniques

b). Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module I	Will acquire knowledge in Isolation techniques
ED	Module II, III & IV	Will acquire knowledge in starting a fermentation industry
EMP	Module II, III & IV	To work in fermentation industries – maintenance, processing, and downstream processing

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7. Pedagogy:

S. No	Student Centric Methods Adopted	Type/Description of Activity
1	Video/Power point presentation	Participative Learning
2	Research article presentation	Experiential Learning
3	Case studies	Problem Solving
4	Models	Experiential Learning

8. Course Assessment Plan:

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Cos	Continuous Internal Assessments – CIA (40%)	End Semester Examination (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Model Presentation	
CO4	CIA-2 Quiz, Assignment	

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b) Question Paper Pattern:

APPLIED MICROBIOLOGY

MODEL QUESTION PAPER-THEORY

Course Code: U24/MIC/DSE/501 **Max Marks: 60**
Credits: 4 **Time: 2 Hrs**

SECTION – A

Answer the following **4 x 10 = 40 M**

1. Describe about different types of Microorganisms of Industrial Importance.
OR
2. Describe the Methods of screening and isolation of industrially useful microbes.

3. Explain about the Basic design of a Fermenter.
OR
4. Explain the design and preparation of media for bioprocesses.

5. Explain and elucidate the various types of fermentations and their respective metabolic processes.
OR
6. Describe various steps of downstream processing in fermentation technology.

7. Explain the Production of Ethanol and its applications.
OR
8. Describe in detail the Production of Citric acid.

SECTION – B

Answer any FOUR **4 x 5 = 20 M**

9. Explain the History of Industrial Microbiology
10. Describe industrial sterilization of equipment, media and air.
11. How would you explain about Scale-up
12. Justify the different methods of cell disruption
13. Explain about the features of Fed-batch
14. Describe in brief about amylase production.

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SECTION A - INTERNAL CHOICE
4 Q X 10 M = 40 M

Question Number	Module	Question	CO	BTL(Blooms Taxonomy Level)
1	Module 1	Describe about different types of Microorganisms of Industrial Importance.	CO 1	Level I
2	Module 1	Describe the Methods of screening and isolation of industrially useful microbes	CO 1	Level I
3	Module 2	Explain about the Basic design of a Fermenter	CO 2	Level II
4	Module 2	Explain the design and preparation of media for bioprocesses	CO 2	Level II
5	Module 3	Explain and elucidate the various types of fermentations and their respective metabolic processes	CO 3	Level II
6	Module 3	Describe various steps of downstream processing in fermentation technology	CO 3	Level I
7	Module 4	Explain the Production of Ethanol and its applications	CO 4	Level II
8	Module 4	Describe in detail the Production of Citric acid	CO 4	Level I

SECTION B - ANSWER ANY 4 OUT OF 6
4 Q X 5 M = 20 M
(To compulsorily have **ONE** question from **each** module)

9	Module 1	Explain the History of Industrial Microbiology	CO 1	Level II
10	Module 2	Describe industrial sterilization of equipment, media and air	CO 2	Level I
11	Module 3	How would you explain about Scale-up	CO 3	Level II
12	Module 3	Justify the different methods of cell disruption	CO 3	Level IV
13	Module 3	Explain about the features of Fed-batch	CO 3	Level II
14	Module 4	Describe in brief about amylase production	CO 4	Level I

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SEMESTER-V

APPLIED MICROBIOLOGY

Course Code: U24/MIC/DSE/501/P
Type of course: DSE
No. of credits: 1

Max. Hours: 30
Hours per week: 2
Max. Marks: 50

Course Objectives:

- The course will enable students to apply strategies for development of microbial strains, process optimization, large scale production and product recovery of microbial products and therapeutic proteins.

Course Outcomes:

CO 1: Acquire knowledge about various industrially relevant microbial products and their production process.

CO 2: Evaluate the source for microorganisms of industrial importance from the environment.

CO3: Apply strategies of product recovery to a fermentation broth.

CO4: Carry out lab scale production of alcohol and citric acid.

List of Practicals

1. Screening for - amylase producing organisms.
2. Screening for organic acid producing microorganisms.
3. Screening for antibiotic producing microorganisms by crowded plate technique.
4. Production of ethanol by flask fermentation method.
5. Estimation of sugars by DNS method.
6. Estimation of alcohol by $K_2Cr_2O_7$ by colorimetry method.
7. Calculation of fermentation efficiency of ethanol.
8. Production of citric acid by fungal fermentation and recovery.
9. Estimation of Citric acid by titrimetry.
10. Estimation of Penicillin by Iodometry

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MODEL QUESTION PAPER-PRACTICAL

Course Code: U24/MIC/DSE/501/P **Max.Marks:50**

No. of credits: 1 **Time: 2Hrs**

I. MAJOR: **20 M**

1. Fermentation was carried out using 100 ml fermentation broth. The amount of initial sugar was estimated to be 15gm.Estimate the amount of final sugar in the broth which is diluted 10 times by plotting a standard graph. Calculate the sugar utilized, theoretical yield and fermentation efficiency. Given practical yield is 0.79gm. Concentration of standard glucose is 1mg/ml

II. MINOR: **10M**

1. Fermentation was carried out for the production of citric acid. Estimate the amount of citric acid in the given sample.

   OR

2. Estimate the amount of Penicillin by Iodometry.

III. Identify the spots A- E and write few significant points. **5x 2= 10M**

IV. Record **5 M**

V. Viva **5M**

Prepared by Faculty	Checked &Verified by HoD	Approved by the Principal
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SEMESTER - V

BIOTECHNOLOGY FOR HUMAN WELFARE

1. **Course Description**

Programme: BSc **Max. Hours:60**
Course Code: U24/BIT/DSE/502 **Hours per week: 4**
Course Type: DSE-IB **Max. Marks: 100**
No. of credits: 4

2. **Course Objectives**

- To interpret and apply the knowledge of genetically modified foods, food safety, revival of marine ecosystems, techniques to develop healthcare and food products obtained through fisheries.
- To assess the role of nanomedicines and nanodevices in disease diagnosis and to develop good entrepreurship skills.

3. **Course Outcomes:**

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

CO1: Identify and distinguish between organic and GM foods and their benefits **(REMEMBER, ANALYZE)**

CO2: Summarize the applications of biotechnology in aqua/marine culture and to assess the impact of biofouling. **(UNDERSTAND, EVALUATE)**

CO3: Translate, develop, and evaluate the applications of Nanodevices and Nanomedicines in drug delivery **(UNDERSTAND, APPLY, EVALUATE)**

CO4: Interpret, design, and develop marketing and export of biotechnological products **(UNDERSTAND, APPLY, CREATE)**

4. Course Content

MODULE -I: FOOD BIOTECHNOLOGY **15Hrs**

- Genetically modified foods: organic foods, types of organic food- organic vegetables and fruits, organic meat, organic dairy products, organic fish.
- Identifying organic food and GM food- coding and labels on foods.
- Nutritional and environmental benefits of organic foods and GM foods. Organic food preservatives- hazards of chemical preservatives, examples of natural preservatives- vinegar, salt, sugar, alcohol.
- Genetic modification in food industry- background, history, risks, applications and future.
- Controversies over GM foods-march against Monsanto.

MODULE -II: MARINE BIOTECHNOLOGY **15Hrs**

- Biotechnology in marine science- history of marine biotechnology, application in aquaculture.
- Cell lines: development of cell lines of shrimp- Primary lymphoid cell line, PMO and fish- ZF4, ZEM2S, BF-2 and applications.
- Biofouling- impact. Antifouling methods- biocides, nontoxic coatings, energy methods, other methods.
- Indicator organisms- coliform and non-coliform bacteria, fungi, molds, helminth eggs.
- Probiotics in aquaculture- lack of probiotics and effects.
- Diseases in marine organisms: application of biotechnology in disease diagnosis; prevention and control; Gene probes.

MODULE III: INTRODUCTION & APPLICATIONS OF NANOBIOTECHNOLOGY

15Hrs

- Introduction to nanobiotechnology: – nanodevices & techniques – micro & Nano systems – synthesis & characterization of nanoscale
- Nano molecules in proteins, lipids, RNA & DNA – peptide coupled nanoparticles – proteins nanodevices – cell nanotechnology – cell motility – nanomotors& cellular navigation – chemotaxis – transmembrane signaling – nanoscale artificial platform
- Nanotechnology in drug delivery – nanoscale devices for drug delivery – micelles – protein targeting – protein interaction with other molecule – microarray – genomic chips – nano biosensors – nano biochips – Nanotechnology for cancer diagnosis & treatment.

MODULE -IV: MARKETING AND EXPORT OF BIOTECHNOLOGICAL PRODUCTS

15Hrs

- External trade in Agricultural products, Present status, policy and prospects under WTO regime, Export import policy, Regulation of Agricultural marketing system
- Infrastructural facilities for exporting efficiency, Biotechnological Products in India, Quality parameters and quarantine procedures of export- Market integration:
- Biotech industries & institutes in India & world, Concepts of Biotech Park/ Biotech Hub to different small scale and large scale Agro-based products. Study the production techniques of biotech products.
- Collecting the information on export import data on biotech products, quality standards for export and their potential-Analyse data in relation to demand supply.
- Comparison between non biotechnological products and biotechnological products. Safety and licensing for import and export of biotechnological products.

5. Reference books

1. George, K., & Richard, T. (2012). *Introduction to Marine Biology*: Brooks Cole.
2. Castro, P., & Huber, M. (2010). *Marine biology* (8th ed.). New York: McGraw-Hill.
3. Primrose SB and Twyman RM. (2006). *Principles of Gene Manipulation and Genomics*, 7th edition: Blackwell Publishing, Oxford, U.K.
4. H.S. Chawla. (2002*). Introduction to Plant Biotechnology*. Science Publishers.
5. Carol, L., & Timothy, P. (1997). *Biological Oceanography*: Butterworth-Heinemann.
6. S.S. Bhojwani, M.K. Razdan. (1996). *Plant Tissue Culture: Theory and Practice*. Elsevier
7. J D, Watson. (1992). *Recombinant DNA*. New york: Scientific American Books
8. Agriculture Marketing in India by Acharya and Agrawal 1999, Oxford IBH, N. Delhi. Principles of Marketing by Kotlar and Armstrong 1997, Prentice-Hall, N. Delhi.

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global (Modules 1,2 & 3)	Modern drug delivery methods made possible by nanotechnology revolutionizing medical treatment and reduce side effects. Development of agriculture, food safety, processing, nutritional enhancement, and utilization of bioactive substances from marine organisms in medicine and cosmetics are among the uses of food and marine biotechnology.
National (module 4)	Assist nation in realizing the potential of biotechnology to promote employment, economic growth, create jobs, improve healthcare, and address challenges such as food security, environmental sustainability, and public health.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill development	Modules 1,2	Presentations by the students on distinguishing between organic and GM foods, Group discussions on the pros and cons of GMOs. Lab sessions on identification of indicator organisms like bacteria, fungus etc
Employability	Modules 3,4	Synthesis and analysis of nanoparticles and nanodrugs in pharma industry and health care sectors. Quality control, marketing and export of biotechnological products

7. Pedagogy

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	Participative Learning	Seminar
2.	Participative Learning	Presentation
3.	Experiential Learning	Quiz
4.	Participative Learning	Group Discussion
5.	Experiential Learning	Research Projects
6.	Experiential Learning	Internship opportunities
7.	Problem Solving	Case Studies

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8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1 Written Exam	Written Exam
CO2	CIA-1 Assignment/Case study/Group discussions/Quiz	
C03	CIA-2 Written Exam	
C04	CIA-2 Assignment/Presentation	

b) Model Question Paper- End Semester Exam

MODEL QUESTION PAPER- THEORY

Course Code: U24/BIT/DSE/502 **Max Marks: 60**
Credits: 4 **Time: 2 Hrs**

SECTION – A

I. Answer the following **4 x 10 = 40 M**

1. Define Genetically modified foods. Outline its applications and limitations.

OR

2. How do you make a distinction between organic and GM foods. Discuss their applications and limitations
3. Explain the methods and impact of Biofouling.

OR

4. How can you assess the role of probiotics in aquaculture. Add a note on its effect.
5. How would you classify different types of Nanoparticles.

OR

6. How would you apply Nanotechnology in drug delivery and cancer diagnosis.
7. Summarize the present status and production techniques of biotech products in India

OR

8. How can you make a distinction between non biotechnological products and biotechnological products. Add a note on their safety and licensing issue for import and export.

SECTION – B

II. Answer any <u>four</u> of the following **4 x 5 = 20 M**

9. Outline coding and labelling of GM foods
10. What conclusion can be drawn from march against Monsanto
11. Describe Marine cell lines with suitable examples
12. Explain different indicator organisms in aqua culture
13. How can you use Nanoscale artificial platform
14. How would you elaborate on regulation of agricultural marketing system

SEMESTER-END MODEL QUESTION PAPER

SECTION A - INTERNAL CHOICE 4Q X 10 M = 40 M				
Question Number	**Question**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Define Genetically modified foods. Outline its applications and limitations.	CO 1	I
2	Module 1	How do you make a distinction between organic and GM foods. Discuss their applications and limitations	CO 1	IV
3	Module 2	Explain the methods and impact of Biofouling	CO 2	II
4	Module 2	How can you assess the role of probiotics in aquaculture. Add a note on its effect	CO 2	V
5	Module 3	How would you classify different types of Nanoparticles.	CO 3	II
6	Module 3	How would you apply Nanotechnology in drug delivery and cancer diagnosis	CO 3	III
7	Module 4	Summarize the present status and production techniques of biotech products in India	CO 4	II
8	Module 4	How can you make a distinction between non biotechnological products and biotechnological products. Add a note on their safety and licensing issue for import and export	CO 4	IV

SECTION B - ANSWER ANY 4 OUT OF 6

4 Q X 5 M = 20 M

(To compulsorily have **ONE** question from **each** module)

9	Module 1	Outline coding and labelling of GM foods	CO 1	I
10	Module 1	What conclusion can be drawn from march against Monsanto	CO 1	IV
11	Module 2	Discuss Marine cell lines with suitable examples	CO 2	II
12	Module 2	Explain different indicator organisms in aqua culture	CO 2	II
13	Module 3	How can you Nanoscale artificial platform	CO 3	III
14	Module 4	How would you elaborate on regulation of agricultural marketing system	CO 4	VI

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SEMESTER-V

BIOTECHNOLOGY FOR HUMAN WELFARE- PRACTICAL

1. Course description

Programme: B.Sc **Max. Hours: 30**

Course Code: U24/BIT/DSE/502/P **Hours per week:2**

Course Type: DSE-IB **Max. Marks: 50**

No. of credits: 1

2. Course Objective:

- To analyze food adulterations and summarize the importance of nanoparticles as antimicrobial agent.

3. Course Outcomes:

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

CO1: Interpret, determine, and compare various food contaminants and detect adulterations in food. **(UNDERSTAND, ANALYSE)**

CO2: Prepare nanoparticles for assessing its antimicrobial properties **(CREATE, EVALUATE)**

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PRACTICAL SESSIONS

1. To determine vitamin C content in a citrus fruit.
2. Isolation and identification of important marine fungi.
3. Direct microscopic examination of food contaminants.
4. Determination of purity of milk using methyl reductase test.
5. Determination of adulteration in food samples
6. Synthesis of silver nanoparticles
7. Effect of nanoparticles on bacterial growth
8. Visit to biotech company to understand marketing and production strategies

Spotters:

1. Common food contaminants
2. Methyl reductase test
3. Types of nanoparticles
4. Chemical preservatives
5. Marine fungi
6. Food adulteration
7. Graph showing effect of nanoparticles on bacterial growth
8. Marketing strategies of biotechnological products

SEMESTER-V

BIOTECHNOLGY FOR HUMAN WELFARE- PRACTICAL

Course Code: U24/BIT/DSE/502/P **Max. Marks: 50**
Credit: 1 **Time: 2Hrs**

I. MAJOR: (20M)

Determine the purity of the given sample by methyl reductase method. Write the principle and procedure and report the results

II. MINOR: (10M)

Examine the contaminants from the given samples and report the results.

III. IDENTIFY THE GIVEN SPOTTERS: (10M)

IV. VIVA (5M)

V. RECORD (5M)

Prepared by	Checked & verified by	Approved by
4/3/2024 [Deepa Stoitha] **Name and Signature of the teaching faculty**	4/3/24 (Ms. Shouni Nivedita) **Name and Signature of HoD**	**Name and Signature of Principal**

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

SEMESTER – V

SKILL ENHANCEMENT COURSE - III

CHEMINFORMATICS

1. Course Description

Programme: B.Sc.
Course Code: U24/CHE/SEC/301
Type of course: SEC
No. of credits: 2

Max. Hours: 30
Hours per week: 2
Max. Marks: 50

2. Course Objectives

- To provide a basic learning in the emerging area of chemical sciences and usage of cheminformatics in the industry.

3. Course Outcome

This SEC paper will help students to enhance their overall skills

CO 1: Introduce students to different methods of cheminformatics, provide examples on the use of cheminformatics in modern drug research.

CO 2: Gain practical experience through exercises with representative methods used in cheminformatics.

4. **Course Content**

MODULE I: COMPUTER AIDED DRUG DESIGN **10 Hrs**

Introduction to CADD, Drug design and discovery, Lead Compounds, Lead optimization, Pharmacophore, Pharmacokinetics, ADME property, Toxicity. Prodrugs and Soft drugs, Introduction to Ligand-Based and Structure Based Drug design.

MODULE II: PRACTICE OF CHEMISTRY SOFTWARE **20 Hrs**

1. Construction of small molecules.
2. Energy minimization and generation of SMILES Notation.
3. Property calculation.
4. Searching RCSB for protein information, download protein and Literature search.
5. Protein preparation.
6. Active site identification and grid Generation.
7. Docking of ligands.
8. Protein ligand interaction studies.

5. References

1. Leach A.R., Gillet V.J., (2007): *An introduction to Chemoinformatics*. Springer: The Netherlands.
2. Gasteiger, J. & Engel, T. (2003) *Chemoinformatics: A text-book*. Wiley-VCH.
3. Gupta, S. P. (2011) *QSAR & Molecular Modelling*. Anamaya Pub.: New Delhi.

6. Syllabus Focus

a. Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Local	Optimizing and Energy minimization of existing drugs, development of new materials with enhanced properties
Regional	Designing new drugs from SAR drive innovation in computational and medicinal chemistry
National	Formulating symbiosis, understanding drug activities in the regulation of pharmacodynamic and pharmacokinetic properties, innovation in healthcare
Global	Improved energy efficiency and sustainability, development of new synthetic strategies, broad implications for industries and technologies

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b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module 1	Medicinal chemists play a crucial role in the drug discovery process through the selection and synthesis of compounds that establish structure–activity relationships by using softwares.
EMP	Module 2	Involves the study of the effects of drug interactions on the target systems.

7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1	Participative Learning	Online search engines for ADMET properties.
2	Experiential Learning	Practice of Chemistry software.

8. Course Assessment Plan

a. Weightage of Marks in Formative and Summative Assessments

Formative Assessment - FA (40%)	Summative Assessment - SA (60%)
CIA-20 marks Mini project/Assignment/ Problem solving/Case studies	End Semester exam-30 Marks

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b. Question Paper Pattern

EXTERNAL- MODEL QUESTION PAPER

PRACTICAL

Course Code: U24/CHE/SEC/301
Credits: 2

Max Time: 1 Hr
Max. Marks: 25

Answer the following.

1. Write about Molecular docking by iGEM Docking software and interpret the results. (CO 2) **L2** — 10M
2. Write a short note on generation of SMILES Notation. **(CO1) L1** — 5M
3. Viva — 5M
4. Record

Prepared by	Checked & verified by	Approved by
Name and Signature of the teaching faculty	Name and Signature of the HoD	Name and Signature of Principal
Dr. K. Susmitha Dr. M. Bhargavi M.Bhargavi	Dr. D. Sumalatha D. Sumalatha	Dr. Uma Joseph

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SEMESTER V

GENERIC ELECTIVE

CHEMISTRY OF COSMETICS AND FOOD TECHNOLOGY

1. Course Description

Programme: B.Sc
Course Code: U24/CHE/GE/501
Course Type: GE
No. of credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. Course Objectives

- To learn the history of cosmetics and the importance of self grooming
- To learn the chemistry involved in cosmetics,chemicals/ natural products present in them. their usage in personal care.
- To understand the significance of various technological methods of food for better health.

3. Course Outcomes

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

CO1: Identify the types of cosmetics and learn about their chemistry.
CO2: Articulate the ingredients present in personal care products and apply it in their preparation.
CO3: Understand water purification process, and role of additives in food
CO4: Analyze the adulterants in food samples; learn steps involved in food processing and preservation

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4. Course Content

MODULE I: CHEMISTRY OF COSMETICS **15 hrs**

History of cosmetics, classification of cosmetics, professional image of self grooming, beauty and wellness.

Cosmetics emulsions: cream, cleansers, powders, moisturisers, sun screen, acne and anti aging creams.

Chemical peels and peeling agents, lasers and light devices, Electro Chemistry, bath salts, gels, soaps, bubble baths and scrubs.

MODULE II: PERSONAL CARE **15 hrs**

Skin Care

General Anatomy and Physiology of skin, Structure of skin, Growth and nutrition, dermal fillers

Hair Care

Structure of hair, growth of hair, Cosmetics used for hair – Shampoos, conditioners, Bleaches, hair dyes, hair gels, hair perms and hair relaxers/straighteners.

Nail Care

Structure of nail, cosmetics used for nail – Nail lacquer, nail polish remover, Manicure and Pedicure, nail care techniques.

Eye Care

Cosmetics used for the eye – eyebrow pencil, eye liner, eye shadows, mascaras. Eye concealer and eye creams.

Practical – Cosmetics Preparations

1. Preparation of Cold cream
2. Preparation of Talcum Powder.
3. Preparation of Bath salt.
4. Preparation of Lip Balm
5. Preparation of Nail Polish Remover
6. Preparation of Hand Wash.

MODULE III: INTRODUCTION TO FOOD, FOOD ADDITIVES & WATER PURIFICATION **15 Hrs**

Introduction - Food: source, functions of food- food groups- food guide- basic five food groups, usage of the food guide- food in relation to health- objectives of cooking.

Food Additives: Food additives: artificial sweeteners- saccharin, cyclomate, aspartame- food flavours- esters, aldehydes and heterocyclic compounds. Antioxidants. Food colours- changes in cooking, Restricted use. Spurious colours.Emulsifying agents, preservatives- leavening agents.Baking powder- Yeast. Taste Enhancers- MSG- vinegar.

Water: Purification processes- Ion exchangers , reverse osmosis, activated charcoal treatment. Use of chlorination, ozone and UV light disinfection. Specification of drinking water.

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MODULE IV: FOOD ADULTERATION, PROCESSING & PRESERVATION 15 hrs

Adulterants: Common adulterants in different foods- milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages.

Contamination with toxic chemicals- pesticides and insecticides. Methods involved in the analysis of detection and prevention of food adulteration.

Food deterioration, chemical methods of preservation and processing, and by freezing.

Heat processing of milk – pasteurization.Preservation of milk.Deep freeze preservation. Spray drying technique- milk powder, infant food preparation.

Practicals:

1. Estimation of total hardness of water.

2. Testing for the presence of adulterants in food samples.

5. References

1. Perry Romanowski, *Beginning Cosmetic Chemistry*, Allured Pub Corp.2009.
2. Dr. Ramesh Kumari, *Chemistry of Cosmetics*, Prestige Publishers.
3. Srilakshmi B., *Food Science*, New age International Pvt. Ltd. Publishers, III ed. 2003.
4. Shakuntala Manay N. and Shadaksharaswamy M. *FOODS: Facts and Principles*. New Age. International Pvt. Ltd. Publishers, II ed. 2002.
5. Norman N. Potter, *Food Science*, CBS publishers and distributors, New Delhi. 1994.
6. Swaminathan M. *Text Book on Food Chemistry*, Printing and Publishing CO., Ltd., Bangalore. 1993.
7. Swaminathan M. *Advanced Text Book on Food and Nutrition*, volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.

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6. Syllabus Focus

a. Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Local	Knowledge of cosmetic and food chemistry helps to have a well groomed healthy life
Regional	Learning the concepts of cosmetology and processing involved in the food industry, helps to choose the best products.
National	Acquire knowledge to identify and choose better health products.
Global	The widespread increase in the adoption of skin care and personal care products rise along with the global ageing population.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module 1 & 2	Students are taught to prepare various cosmetics using natural products and non toxic chemicals
EMP		
SD	Module 3 & 4	Students are trained to check the quality parameters of food and water samples.
EMP		

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7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiments	Students are taught to prepare cosmetics
2.	Presentations	Students present the toxic chemicals involved in various cosmetics products, and their alternatives
3.	Case studies	Students are made to evaluate various market samples of the same product.

8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination- 60%
CO1	CIA 1 Written exam 10 M	Written Exam
CO2	Practical Skill test 10 M	
CO3	CIA 1 Written exam 10 M	
CO4	Practical Skill test 10 M	

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b. Model Question Paper- End Semester Exam

CHEMISTRY OF COSMETICS AND FOOD TECHNOLOGY
B.SC. III YEAR SEMESTER -V

TIME: 2hrs **Course Code: U24/CHE/GE/501**
Max. Marks: 60

SECTION –A (Essay Questions)

I.Answer the following **4X10 =40 Marks**

1. Classify cosmetics on the basis of their raw materials. (**L2**) 10M

OR

2. a) Outline the history of cosmetics. (**L2**) 5 M
b) Discuss the importance of self grooming and professional image. (**L2**) 5 M
3. a) Describe the structure of the nail with the help of a neat diagram. (**L1**) 5 M
b) List out the ingredients used in Shampoos. (**L1**) 5 M

OR

4. a) Describe chemical peels and types of peeling agents? (**L2**) 5 M
b) Explain the structure and growth cycle of hair. (**L2**). 5 M
5. a)Classify foods based on their function. (**L4**) 5 M
b) Explain the advantages of cooking. (**L2**) 5 M

OR

6. a) Define reverse osmosis. How does it help in water purification? (**L3**) 5 M
b) Emphasize the significance of chlorination of water. (**L2**) 5 M
7. a) Define food adulteration . Write any two tests to determine adulteration of food of your choice. (**L3**) 5 M
b) Illustrate the methods involved in the preservation of milk. (**L3**) 5 M

OR

8. a) Write a brief note on contamination of food by toxic chemicals. (**L1**) 5 M
b) Discuss about the various factors which lead to food deterioration. (**L2**) 5M

SECTION – B (Short answer questions)

II. Answer any four questions. **4 X 5 = 20 Marks**

9. What is the scope of beauty and wellness? (**L1**)
10. How do fillers work? (**L1**)
11. Outline five functions of talcum powder? (**L2**)
12. How is UV radiation used in water purification plants? (**L4**)
13. Elaborate the role of leavening agents in the food industry. (**L5**)
14. Explain Chemical methods of food preservation. (**L5**)

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St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
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FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
PRACTICAL SYLLABUS CBCS-2024
SEMESTER -V
EXPERIMENTS IN MEDICINAL & SUSTAINABLE CHEMISTRY
CHEMISTRY PRACTICALS – ELECTIVES 2

Program: B.Sc. Max. Hours: 30 Hrs
Course Code: U24/CHE/DSE/502/P Max. Marks: 50
Course: DSE 2 Hours per week: 2 Hrs
No. of Credits: 1

Course Objectives

- To apply the knowledge of synthetic methods in Chemistry to prepare drugs, nanoparticles.
- To design chemical products and processes for Green Chemistry.

Course Outcomes

CO1: Synthesize drugs, nanoparticles and developing green and sustainable methods.
CO2: Cut down the stream of chemicals pouring into the environment.

Synthesis and analysis

1. Preparation of Aspirin (conventional and green method)
2. Preparation of Paracetamol.
3. Preparation of Thiobarbeturic acid.
4. Preparation of Fluorescein.

Green Methods for the preparation of the following:

1. Preparation of Acetanilide.
2. Preparation of p-Bromo acetanilide.
3. Preparation of Dihydropyrimidinone.

Synthesis of Nanoparticles:

1. Preparation of nano silver.
2. Preparation of nano ZnO.
3. Preparation of Ferrofluid.
4. Preparation of nano CuO.

References

1. Krupadanam.D, VijayaPrasad.D, Varaprasad Rao.K, Reddy.K.L.N, Sudhakar.C, (2001), *Drugs,* Universities Press (India) Limited.
2. Patrick.G, (2001), Medicinal Chemistry, BIOS Scientific Publications
3. Ahluwalia V.K ,*Green Chemistry :Greener Alternatives for Synthetic Organic Transformation* :Narosa Publishing House
4. Ahluwalia V.K ,*Green Chemistry : Environmentally benign reaction* : Ane books Pvt.Ltd,2006
5. Kulkarni.K.S, (2011), *Nanotechnology- Principles & Practices*, Co-Published by Springer International Publishing Company, Switzerland, New Delhi, Capital Publishing Company.

6. Syllabus Focus

a. Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Local	To develop products that benefit the environment either directly or indirectly.
Regional	Nanotechnology helps in improving many technology and industry sectors and even revolutionize.
National	The concepts of Green Chemistry reduces the use of energy and fuel by using renewable inputs wherever possible
Global	Recent advances in Medicinal Chemistry, Green Chemistry and Nanotechnology provide reliable synthetic pathways for sustainable development goals.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	All	Educational tour to industries/factories to make students learn outside the classroom
ED	All	Case studies relevant to the problems, challenges and help students to develop solutions
EMP	All	Systematic and sustained effort to adapt specific skills for improving career goals

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Field Trips
2.	Participative Learning	Role play
3.	Problem solving	Research Projects

8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1-Written Exam	Written Exam
CO2	CIA1-Written Exam	
CO3	CIA2- Case Study	
CO4	CIA2- Presentations (poster/ ppt)	

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b. Model Question Paper - End Semester Exam

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FACULTY OF SCIENCE – DEPARTMENT OF CHEMISTRY

B.Sc. III YEAR SEMESTER -V

MEDICINAL & SUSTAINABLE CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/502**

Max. Marks: 60 **Credits: 4**

SECTION –A (Essay Questions)

SECTION A - INTERNAL CHOICE			**4 X 10 M = 40M**	
Question Number	**Question**		**CO**	**BTL**
1	**Module 2**	a) Evaluate the structure of Penicillin G & discuss its commercial production 5M b) Explain briefly about diluents and stabilizing agents with examples. 5M **OR**	**CO 2**	**(Level I, V)**
2	**Module 2**	Outline the synthetic route and brief therapeutic action of i) Ciprofloxacin ii) Aspirin iii) Salbutamol iv) Omeprazole 10M	**CO 2**	**(Level II)**
3	**Module 1**	a) Summarize briefly about agonist and antagonist. 5M b) What are anaesthetic and antipyretic drugs? 5M **OR**	**CO 1**	**(Level I, II)**
4	**Module 1**	Describe in detail about ADME. 10M	**CO 1**	**(Level I)**
5	**Module 3**	a) List out the basic principles of green chemistry. 5M b) Simplify the atom economy? Calculate atom economy using suitable examples. 5M **OR**	**CO 3**	**(Level I, IV)**
6	**Module 3**	a) Assess the need for green chemistry. 5M b) Interpret the selection of solvents in green synthesis. 5M	**CO 3**	**(Level V)**

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7	Module 4	a) Give two methods for synthesis of Nanoparticles. 5M b) Compose a note on carbon nanotubes.5M **OR**	CO 4	(Level I, VI)
8	Module 4	a) Elaborate a note on Zeolites? 5M b) Compile the principle and working of STM. 5M	CO 4	(Level VI)
SECTION B – (Short answer questions) **ANSWER ANY 4 OUT OF 6**				**4 X 5M = 20 M**
9	Module 1	How would you explain drugs acting on the renal system?	CO 1	(Level II)
10	Module 2	Build a short note on clinical trials.	CO 2	(Level III)
11	Module 1	What are chemotherapeutic agents? Discuss about antimalarial drugs.	CO 1	(Level I)
12	Module 2	Construct briefly about computer aided drug designing.	CO 2	(Level III)
13	Module 3	Analyze the role of phase transfer catalyst in green synthesis.	CO 3	(Level IV)
14	Module 4	Give any four applications of Nanomaterials.	CO 4	(Level I)

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b. Model Question Paper - End Semester Exam

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FACULTY OF SCIENCE – DEPARTMENT OF CHEMISTRY

b. MODEL PAPER - B.Sc. III YEAR SEMESTER -V

MEDICINAL & SUSTAINABLE CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/502**

Max. Marks: 60

SECTION –A (Essay Questions)

I. Answer the following **4X10=40 Marks**

1. a) Evaluate the structure of Penicillin G & discuss its commercial production(CO2) **L5** 5M
   b) Explain briefly about diluents and stabilizing agents with examples. (CO 2) **L1** 5M

OR

2. Outline the synthetic route and brief therapeutic action of 10M
   i) Ciprofloxacin ii) Aspirin iii) Salbutamol iv) Omeprazole (CO 2) **L2**
3. a) Summarize briefly about agonist and antagonist. (CO 1) **L2** 5M
   b) What are anaesthetic and antipyretic drugs? (CO 1) **L1** 5M

OR

4. Describe in detail about ADME. (CO 1) **L1** 10M
5. a) List out the basic principles of green chemistry. (CO3) **L1** 5M
   b) Simplify atom economy? Calculate atom economy using suitable examples.(CO3) **L4** 5M

OR

6. a) Assess the need for green chemistry. (CO3) **L5** 5M
   b) Interpret the selection of solvents in green synthesis. (CO3) **L5** 5M
7. a) Give two methods for synthesis of Nanoparticles. (CO4) **L1** 5M
   b) Compose a note on carbon nanotubes. (CO4) **L6** 5M

OR

8. a) Elaborate a note on Zeolites? (CO4) **L6** 5M
   b) Compile the principle and working of STM. (CO4) **L6** 5M

SECTION –B (Short Answer Questions)

II. Answer any four. **4x5=20 Marks**

9. How would you explain drugs acting on the renal system? (CO 1) **L2**
10. Build a short note on clinical trials. (CO 2) **L3**
11. What are chemotherapeutic agents? Discuss about antimalarial drugs. (CO 1) **L1**
12. Construct briefly about computer aided drug designing.(CO2) **L3**
13. Analyze the role of phase transfer catalyst in green synthesis. (CO3) **L4**
14. Give any four applications of Nanomaterials. (CO4) **L1**

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c. Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	1	2	10	2	5
2	15	2	2	10	2	5
3	15	3	2	10	1	5
4	15	4	2	10	1	5

5. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions(hrs)
1	2,5	Understanding	15
2	1,7	Applying & Analysing	15
3	2,7	Remembering	15
4	4	Creating & Evaluating	15

Prepared by	Checked & verified by	Approved by
Shikha Chander M. Deepthi Name and Signature of the teaching faculty Dr. Shikha Chander M. Deepthi	D. Sumalatha Name and Signature of the HoD Dr. D. Sumalatha	Name and Signature of the Principal Dr. Uma Joseph

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SEMESTER-V

CRITICAL HEALTH CARE MANAGEMENT

1. Course Description:

Programme: B.Sc
Course Code: U24/MIC/GE/501
Course Type: GE
No.of credits: 4

Max.Hours: 60
Hours per week:4
Max.Marks: 100

2. Course Objectives:

- To understand fundamental concepts in healthcare, including medical emergencies and patient care.
- To develop practical skills in healthcare , communication, and decision making for effective healthcare management.

3. Course Outcomes:

CO1: Understand key terminology related to critical care practices. (L II)

CO2:Demonstrate an understanding of the ethical dilemmas in critical health situations.(L III)

CO3: Apply critical thinking skills to assess and prioritize patient needs in emergency situations.(L III)

CO4:Analyze the effectiveness of critical care protocols and interventions.(L IV)

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4. Course Content:

MODULE I - MEDICAL CATASTROPHE: **(15 Hrs)**

Introduction to Natural Medical disasters.

What is medical catastrophe? How to cope with it.

Blood Pressure levels and blood sugar levels.

Heart attacks, strokes and bone fractures.

MODULE II - GENERAL HEALTH CONDITIONS: **(15 Hrs)**

Drowning, snake bites, animal bites.

Burns, fire accidents, accidents, sudden attacks, Migraine, Thyroidism.

Conditions like dizziness, epilepsy.

Case studies related to each of the above conditions.

MODULE III -WOMEN'S HEALTH AND MANAGEMENT: **(15 Hrs)**

Menstrual Hygeine.

Pregnancy care and Actions to reduce maternal mortality.

Post partum physical health care.

Breast cancer, cervical cancer, PCOS.

Case studies related to each of the above conditions.

MODULE IV- CHILD HEALTH: **(15 Hrs)**

High fever, nose bleeding, sun stroke.

Indigestion Problems – abdominal pain.

Asthma attacks, Chocking.

Case studies related to each of the above conditions.

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5. References

1.Textbook of Critical Care, 8th Edition, Jean-Louis Vincent, Frederick A. Moore,Rinaldo Bellomo and John J. Marini

2. Textbook of Health Management , S C Mohapatra, Meghkanta Mohapatra, Vishwakant Mohapatra, 2023, IP Publications.

Prepared by Faculty	Checked & Verified by HoD	Approved by the Principal
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SEMESTER – V

ENVIRONMENTAL MICROBIOLOGY

1. Course Description:

Programme: B.Sc.
Course Code :U24/MIC/DSE/502
Course Type: DSE
No. of credits: 4

Max. Hours : 60
Hours per week : 4
Max. Marks: 100

2. Course Objectives:

- To understand the contribution of microorganisms in Water and different types of sewage treatment.
- To familiarize students with the microbes used as bio fertilizers for various crop plants and to understand their advantages over chemical fertilizers.

3. Course Outcomes:

CO1: Understand the role of microbes in water and of sewage treatment process. (LII)

CO2: Evaluate the role of microorganisms in biogeochemical cycle.(LV)

CO3: Analyse the importance of plant growth promoting microorganisms and understand the role of biofertilizers and its applications in crop fields. (LIV)

CO4: Understand the nitrogen fixing bacteria as bio fertilizers.(LII)

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4. Course Content:

MODULE I - INTRODUCTION TO AIR AND WATER MICROFLORA: **(15 Hrs)**

Air microflora, air sampling techniques .Treatment and safety of drinking (potable) water, Criteria for potability of water, Purification of water. Sewage treatment- composition of sewage, objectives of sewage treatment.Microbiology of polluted water, sewage treatment (Primary treatment, Secondary treatment- Trickling Filters, Activated sludge, oxidation ponds, Advanced Treatment methods, Anaerobic treatment, Composting.

MODULE II -BIOGEOCHEMICAL CYCLES & MICROBIAL INTERACTIONS: **(15Hrs)**

Role of micro-organisms in Carbon cycle, Nitrogen cycle, Phosphorus cycle,

Microbial interactions-mutualism, competition, commensalism, antagonism, parasitism, predation.

MODULE III - SOIL MICROFLORA AND PGPR : **(15Hrs)**

Rhizomicrobiome and Phyllomicrobiome, Plant growth promoting microorganisms- *Mycorrhiza, Rhizobium, Azospirillum, Azotobacter, Cyanobacteria, Frankia and PSM.*

Biofertilizer- Preparation of Rhizobial inoculants, Cyanobacterial Biofertilisers.

MODULE VI- BIOFERTILIZERS : **(15Hrs)**

General account of the microbes used as biofertilizers for crop plants and their advantages. Symbiotic N2 fixers: Rhizobium - Isolation, characterization, identification, Classification, inoculum production and field application.

Frankia - Isolation, characterization - actinorrhizal nodules - non-leguminous crop symbiosis.

Non - Symbiotic N2 fixers - Azospirillum - Free living - Azotobacter - free isolation, characterization, mass inoculum production and field application.

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5. Resources:

Text Books :

1. S. Ram Reddy, M.A SingaraCharya,A Text Book of Microbiology (Applied Microbiology), Volume IV . Himalaya publishing house.
2. Dubey , Maheshwari,(1999),Text book of Microbiology ,1st Edition,S.Chand Publishers.
3. R.C.Dubey ,(1993),Textbook of Biotechnology,1st Edition,S.Chand publishers.

Reference Books:

1. Alexander Martin , Text Book of Soil Microbiology,Krieger Publications.
2. Arun K SharmaBiofertilizers for sustainable Agriculture,Agrobios publishers.
3. K. Vijaya Ramesh by Environmental Microbiology by (MJP Publishers)
4. Madigan et al by Brock Biology of Micro organisms
5. Bitton, G. Waste water microbiology, 3rd Edition,Wiley Blackwell Publishers.
6. Henze, M.Waste water treatment – Biological and chemical process by Henze, M.Springer-Verlag Berlin Heidelberg.
7. Martin Alexander Biodegradation and Bioremediation second(2001),Academic Press.
8. F. Mason (1996). Biology of freshwater pollution. Third edition. Longman Group 356p
9. Gopal Reddy et al,(2008),Laboratory experiments in Microbiology,3rd edition , Himalaya publishers.
10. Prescott, Harley and Klein Wim. Laboratory Exercises in Microbiology Mc.Graw Hill Publishers.
11. R.C Dubey, D.K Maheshwari,(2012), Practical Microbiology ,S Chand and Company, New Delhi.
12. Cappuccino, Sherman, Microbiology Laboratory Manual , Pearson Education.

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6.Syllabus Focus:

a) Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global Development Needs	Microbial ecology, soil health, sustainable agriculture, and biofertilizers—addressing global challenges for environmental microbiology curriculum.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
ED	Module IV	Production of Biofertilizers

7.Pedagogy:

S. No	Type / Description of Activity	Student Centric Methods Adopted
1.	Interactive class session	Participative Learning
2.	Field trip /Industry	Experiential Learning
3.	Group Discussion	Participative Learning

8.Course Assessment Plan:

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

COs	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Presentation, Quiz	
CO4	CIA-2 Assignment	

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b) Question Paper Pattern:

ENVIRONMENTAL MICROBIOLOGY
MODEL QUESTION PAPER- THEORY

Course Code: U24/MIC/DSE/502 **Max Marks: 60**
Credits: 4 **Time: 2 Hrs**

SECTION –A

I. Answer the following **4X10=40 M**

1. Describe various methods of primary and secondary sewage treatment.
OR
2. Assess the challenges associated with the removal of pathogenic microorganisms during sewage treatment. Propose and critically evaluate microbial based strategies.

3. Explain briefly the role of microorganisms in Nitrogen cycle.
OR
4. Compare different types of microbial interactions.

5. Describe the different steps involved in the preparation of Rhizobial inoculants.
OR
6. Explain different plant growth promoting microorganisms.

7. Explain about isolation and characterization of Rhizobium.
OR
8. Describe in detail about the field applications of Azospirillum.

SECTION –B

II. Answer any FOUR **4x5=20 M**

9. Explain about Air sampling techniques.
10. Describe about Carbon cycle.
11. What is Rhizomicrobiome?
12. What are Biofertilizers?
13. Explain Antagonism.
14. Describe about Azotobacter.

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SECTION A - INTERNAL CHOICE				4Q X 10 M = 40 M
Question Number	**Module**	**Question**	**CO**	**BTL(Blooms Taxonomy Level)**
1	Module 1	Describe various methods of primary and secondary sewage treatment.	CO 1	Level I
2	Module 1	Assess the challenges associated with the removal of pathogenic microorganisms during sewage treatment.Propose and critically evaluate microbial based strategies	CO 1	Level V
3	Module 2	Explain briefly the role of microorganisms in Nitrogen cycle.	CO 2	Level II
4	Module 2	Compare different types of microbial interactions.	CO 2	Level II
5	Module 3	Describe the different steps involved in the preparation of Rhizobial inoculants	CO 3	Level I
6	Module 3	Explain different plant growth promoting microorganisms.	CO 3	Level II
7	Module 4	Explain about isolation and characterization of rhizobium.	CO 4	Level II
8	Module 4	Describe in detail about the field applications of Azospirillum.	CO 4	Level I
SECTION B - ANSWER ANY 4 OUT OF 6 **4 Q X 5 M = 20 M** (To compulsorily have **ONE** question from **each** module)				
9	Module 1	Explain about Air sampling techniques	CO 1	Level II
10	Module 2	Describe about Carbon cycle	CO 2	Level I
11	Module 3	What is Rhizomicrobiome	CO 3	Level I
12	Module 4	What are Biofertilizers	CO 4	Level I
13	Module 2	Explain Antagonism	CO 2	Level II
14	Module 3	Describe about Azotobacter	CO 3	Level I

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SEMESTER V

ENVIRONMENTAL MICROBIOLOGY PRACTICAL

1. Course Description:

Course Code: U24/MIC/DSE/502/P **Max. Hours: 30**

Course Type: DSE **Hours per week: 2**

No. of credits: 1 **Max. Marks: 50**

2. Course Objectives:

- To demonstrate and analyse basic laboratory skills and techniques related to the cultivation, isolation, staining and identification of microorganisms.
- To learn Standard Coliform Test and Biological oxygen demand of water samples

3. Course Outcomes:

CO 1: Isolate and identify Rhizosphere , Phyllosphere and Rhizobia from plants.

CO 2: Perform Standard Coliform Test and Biological oxygen demand of water samples.

CO3: Isolate and identify Antagonist , *Azospirillum* and *Azotobacter* from soil samples.

CO4: Understand practical aspects of production of biofertilizers.

List of Practicals

1. Isolation of Rhizosphere microflora.
2. Isolation of Phyllosphere microflora.
3. Isolation of Rhizobia from root nodules.
4. Standard Coliform Test.
5. Biological oxygen demand.
6. Isolation of microorganisms from air by petriplate exposure method.
7. Isolation of antagonistic microorganisms by crowded plate technique.
8. Isolation of *Azospirillum*.
9. Isolation of *Azotobacter*.
10. Isolation of microorganisms from soil by dilution plate technique.

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MODEL QUESTION PAPER – PRACTICAL

Course Code: U24/MIC/DSE/502/P **Max Marks: 50**
Credits: 1 **Time: 2 Hrs**

I. MAJOR: **20 M**

1. Perform Biological Oxygen Demand on the given water sample, report the D2 Value and calculate BOD (D1 value of the sample is provided).

II. MINOR **10M**

2. Isolation of Rhizosphere microflora has been performed and plates provided. Identify and report the organisms by staining techniques.

(OR)

3. Isolation of microorganisms from air by Petri plate exposure method has been performed and plates provided. Identify and report the organisms by staining techniques.

III. Identify the spots A- E and write few significant points. **5x 2= 10M**
IV. Record **5 M**
V. Viva **5M**

Prepared by Faculty	Checked &Verified by HoD	Approved by the Principal
Ms.K.Swathi	Dr.P.Roselin	Dr.Uma Joseph

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SEMESTER - V

FORENSIC SCIENCE

1. Course Description

Programme: B.Sc
Course Code: U24/BIT/GE/501
Course Type: GE
No. of credits: 4

Max. Hours: 60 hrs
Hours per week: 4 hrs
Max. Marks: 100

2. Course Objectives

- To provide knowledge about basic principles of Forensic Science, various branches, functions, nature, and scope of Forensic Science.
- To emphasize the importance of scientific methods in crime detection.
- To make the students review and apply skills gained in policing and criminal investigation.

3. Course Outcomes

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

CO1: Define and interpret the application of Forensic Science, documentation of evidences and crime scene management **(REMEMBER, UNDERSTAND)**

CO2: Describe the importance of autopsy in crime investigation and analyse various medico-legal aspects of offences (**UNDERSTAND, ANALYZE)**

CO3: Assess various interrogative techniques used in crime investigation (**EVALUATE)**

CO4: Analyse and deduce the importance of techniques used in DNA Profiling, crime scene photography and sketching (**ANALYZE, EVALUATE)**

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4. Course Content

MODULE I: CRIMINAL JUSTICE SYSTEM & FORENSIC SCIENCE **(15 Hrs)**

- Forensic Science – Introduction & History, Organization of Forensic Science Laboratories and other allied institutions (FSL, CFSL, GEsQD, FPB etc)
- Role of Forensic Science in crime investigation
- Types of Crime scene
- Processing of crime scene- Photo / video graphing and sketching
- Searching of crime scene- Collection, preservation, packing and forwarding of physical evidence
- Chain of custody
- Probative value of physical evidence
- Reconstruction of scene of crime
- Investigation of crime
- Modus operandi
- Court Testimony Introduction, Admissibility of expert testimony
- Expert and lay witnesses and Giving testimony as an Expert.

MODULE II: FORENSIC MEDICINE **(15 Hrs)**

- Personal identification of living and dead
- Postmortem examination (autopsy) – External examination & Internal examination
- Postmortem changes and their importance in determination of time after death
- Mechanical injuries, Thermal injuries, Medico legal aspects of injuries
- Sexual offences– Rape, Unnatural sexual offences; Abortion; Infanticide, Medico legal aspects, Linkage with forensic science laboratory.

MODULE III: INTERROGATION TECHNIQUES **(15 Hrs)**

- Polygraph/Lie Detector Test: Objectives, theoretical basis, stages of examination (Pre-test, In-test, post-test
- Questioning techniques, Stim test, Limitations, Admissibility in the court of law, NHRC guidelines
- Brain Fingerprinting/Brain-Mapping: Principle, Importance, History, process, reliability, case studies, admissibility
- Narco-analysis: Principle, History, drugs used, procedure, reliability, admissibility, limitations, Indian scenario, case studies, etc

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MODULE IV: CRIME SCENE LAB **(15 Hrs)**

- Sketching of crime scene.
- Photography of crime scene.
- Collection and packing of physical evidence at the scene of crime.
- Extraction of DNA from blood.
- Quality check and quantitation of DNA
- Complete DNA Fingerprinting technique.
- Case studies

5. Reference books

1. Dr. K. S. Narayan Reddy. (2010). *Textbook of Medical Jurisprudence & Toxicology.*
2. James, S. H. and Nordby, J. J. (2005 & 2003). *Forensic Science: An Introduction to Scientific and Investigative Techniques*: CRC Press.
3. James, P.J. (2005). *Encyclopedia of Forensic and Legal Medicine*: Elsevier.
4. Sharma, B. R.(2003). *Forensic Science in Criminal Investigation and Trials*: Universal Pub.
5. Modi, J. P. (2001). *Textbook of Medical Jurisprudence & Toxicology:* N.M. Tripathi Publication.
6. Pillay, V.V. (2001). *Handbook of Forensic Medicine and Toxicology*. (XII Edition): Paras Publication.
7. Turner, P.C., Mclennan, A.G., Bates, A.D. & White, M.R.H. (2001). *Instant notes in Molecular Biology* (II Edition): Viva Books Pvt. Ltd.
8. Parikh, C.K. (1999). *Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology*. New Delhi: CBS Pub.
9. Robertson, J. (1999*). Forensic Examination of Hair.* Taylor and Francis.
10. Saferstein R. (1998). *Criminalistics – An Introduction to Forensic Science*. (V Edition). Prentice Hall

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global (Module 1, 2, 3 & 4)	The global importance of forensic science is reflected in its curriculum, which covers topics such as criminal justice, humanitarian aid, historical study, and human rights advocacy. Students who receive an education in forensic science are prepared to make a global contribution to justice, truth-seeking, and human dignity by gaining multidisciplinary knowledge and useful skills.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Searching and processing of crime scene	A mock crime scene will be constructed and various methods of searching the crime scene and processing of evidence will be demonstrated.
Employability	Module 4	Students will be taken for a field visit to a forensic science laboratory

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Interactive classroom games
2.	Experiential Learning	Quiz
3.	Participative Learning	Group discussion
4.	Participative Learning	Role play
5.	Participative Learning	Presentation
6.	Problem solving	Case studies

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1- Group discussions/ Role play/Quiz	Written Exam
CO2	CIA1- Presentation/ Case studies	
CO3	CIA-2- Written Exam	
CO4	CIA-2- Written Exam	

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b) Model Question Paper- End Semester Exam

FORENSIC SCIENCE
MODEL QUESTION PAPER

Course Code: U24/BIT/GE/501 **Max. Marks: 60**
Credits: 4 **Time: 2 Hrs**

SECTION – A

I. Answer the following. **4 x 10 = 40 M**

1. How would you describe the role of forensic science in crime scene investigation

OR

2. How would you classify the types of crime scene
3. How can you summarize the post mortem examination?

OR

4. Summarize the various medico legal aspects of injuries.
5. Explain about narco analysis.

OR

6. Explain polygraph test.

7. List the different steps of DNA fingerprinting

OR

8. Determine the applications of forensic science

SECTION –B

II. Answer any Four of the following: **4 x 5 = 20 M**

9. Describe about chain of custody
10. Illustrate the process of personal identification of living and dead
11. Compare the various types of questioning techniques
12. Classify the different types of photographs in forensic photography
13. Explain about brain mapping
14. Illustrate the process of DNA extraction from blood

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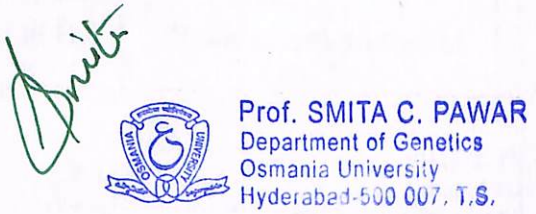
SEMESTER-END MODEL QUESTION PAPER

SECTION A - INTERNAL CHOICE 4 Q X 10 M = 40 M				
Question Number	**Question**	**Question**	**CO**	**BTL(Bloom's Taxonomy Level)**
1	Module 1	How would you describe the role of forensic science in crime scene investigation	CO 1	I
2	Module 1	How would you classify the types of crime scene	CO 1	II
3	Module 2	How can you summarize the post mortem examination	CO 2	II
4	Module 2	Summarize the various medico legal aspects of injuries	CO 2	II
5	Module 3	Explain about nacro analysis	CO 3	V
6	Module 3	Explain polygraph test	CO 3	V
7	Module 4	List the different steps of DNA fingerprinting	CO 4	IV
8	Module 4	Determine the applications of forensic science	CO 4	V

SECTION B - ANSWER ANY 4 OUT OF 6 4 Q X 5 M = 20 M (To compulsorily have **ONE** question from **each** module)				
9	Module 1	Describe about chain of custody	CO 1	I
10	Module 2	Illustrate the process of personal identification of living and dead	CO 2	II
11	Module 3	Compare the various types of questioning techniques	CO 3	V
12	Module 4	Classify the different types of photographs in forensic photography	CO 4	IV
13	Any Module	Explain about brain mapping	CO 3	V
14	Any Module	Explain the process of DNA extraction from blood.	CO 4	V



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FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
THEORY SYLLABUS CBCS-2024
SEMESTER -V
INSTRUMENTAL METHODS OF ANALYSIS

1. Course Description

Program: B.Sc.
Course Code: U24/CHE/DSE/501
Course: DSE- 1
No. of Credits: 4

Max. Hours: 60 Hrs
Max. Marks: 100
Hours per week: 4 Hrs

2. Course Objectives

- To understand the importance of separation techniques such as solvent extraction and to explore the principles and procedures of chromatographic techniques including paper, thin layer,
- To learn the principles of column, ion exchange chromatography, HPLC and GLC.
- To delve into the principle and instrumentation of UV/Visible spectrophotometry, and its application to the quantitative analysis of various ions.
- An approach towards the principle and application of electroanalytical analysis.

3. Course Outcomes

CO1: Understand various separation techniques and choose the most appropriate analytical technique for a variety of samples.
CO2: Explain the theoretical principles of various separation techniques in chromatography and their typical applications.
CO3: Interpret the theoretical principles of selected instrumental methods with spectrophotometric methods.
CO4: Review and assessment of electro analytical methods.

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4. Course Content

MODULE I: CHROMATOGRAPHY I — 15 Hrs

Solvent Extraction- Principle, Methods of extraction: Batch extraction, continuous extraction and counter current extraction. Application – Determination of Iron (III).

Chromatography: Classification of chromatographic methods, principles of differential migration, adsorption phenomenon, nature of adsorbents, solvent systems.

Thin layer Chromatography (TLC): Advantages, preparation of plates, development of the chromatogram, Detection of the spots, factors affecting R_f values and applications.

Paper Chromatography: Principle, choice of paper and solvent systems, development of chromatogram – ascending, descending, radial and two dimensional chromatography and applications.

MODULE II: CHROMATOGRAPHY II — 15 Hrs

Column Chromatography: Principle, Types of stationary phases, Column packing – Wet packing technique, Dry packing technique. Selection criteria of mobile phase (solvents) for eluting, polar, non-polar compounds and its applications.

Ion exchange chromatography: Principle, cation and anion exchange resins, its application in separation of ions.

Gas Chromatography: Theory and instrumentation (Block Diagram), Types of stationary phases and carrier gases (mobile phase).

High performance liquid chromatography: Theory and instrumentation, stationary phases and mobile phases. Analysis of paracetamol.

MODULE III: COLORIMETRY AND SPECTROPHOTOMETRY — 15 Hrs

General features of absorption – spectroscopy, transmittance, absorbance, and molar absorptivity. Beer Lambert's law and its limitations, difference between Colorimetry and Spectrophotometry.

Instruments – Single beam UV- Visible Spectrophotometer, Double beam UV- Visible Spectrophotometer. Lamps used as energy sources. Verification of Beer's law. Estimation of iron in water samples by thiocyanate method. Estimation of (i) Chromium and (ii) Manganese in steel.

IR Spectrophotometer: Principle, Sources of Radiations, Sampling, Block diagram of FT-IR Spectrophotometer.

MODULE IV: ELECTROANALYTICAL METHODS — 15 Hrs

Types of Electroanalytical Methods.

I) Interfacial methods – a) Potentiometry: Principle, Electrochemical cell, Electrodes- (i) Indicator and (ii) Reference electrodes – Normal Hydrogen Electrode, Quinhydrone Electrode,

Saturated Calomel Electrode. Numerical Problems. Application of Potentiometry – Assay of Sulphanilamide

b) Voltammetry – three electrode assembly; Introduction to types of voltammetric techniques, micro electrodes, over potential and Polarization.

II) Bulk methods – Conductometry, Conductivity Cell, Specific Conductivity, Equivalent Conductivity. Numerical problems. Applications of conductometry. Estimation of Cl - using $AgNO_3$. Determination of Aspirin with KOH.

5. References

1. David Krupadanam, *Analytical Chemistry*, Universities Press (India) Limited.
2. S. M. Khopkar, *Basic concepts of Analytical Chemistry*, New Age International Publishers.
3. Gurdeep R. Chatwal, Sham K. Anand, *Instrumental methods of Chemical analysis*, Himalaya Publishing House.
4. D.A. Skoog, F.J. Holler, T.A. Nieman, *Principles of Instrumental Analysis*, Engage earning India Edn.
5. D. A. Skoog, D.M. West, F.J. Holler, *Fundamentals of Analytical Chemistry* 6 th Edn., Saunders College Publishing, Fort worth (1992).
6. Cooper, T.G. *The Tools of Biochemistry*, John Wiley and Sons, N.Y. USA.16, 1977.
7. Vogel, A. I. *Vogel's Qualitative Inorganic Analysis* 7th Edn, Prentice Hall.
8. Vogel, A. I. *Vogel's Quantitative Chemical Analysis* 6th Edn, Prentice Hall.
9. Gary D. Christian, *Analytical Chemistry* 7th edition. (2004).
10. B. K. Sharma, *Industrial Chemistry* (including Chemical Engineering). edn. (1997).

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FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
PRACTICAL SYLLABUS CBCS-2024
SEMESTER -V
~~CHEMISTRY PRACTICALS – ELECTIVES 1~~ Experiments in Physical Chemistry & Sustainable Chemistry

Program: B.Sc.
Course Code: U24/CHE/DSE/501/P
Course: DSE 1 & 2
No. of Credits: 1

Max. Hours: 30 Hrs
Max. Marks: 50
Hours per week: 2 Hrs

Course Objectives

- To equip the students with required analytical skills for potentiometry, TLC and determination of partition coefficient.
- To investigate analytes with the use of scientific instruments.

Course Outcomes

CO 1: Acquire the skills to determine partition coefficient, perform TLC and potentiometric titrations.
CO 2: The techniques such as spectroscopy, electrochemical analysis provides adequate knowledge and applications.

Distribution Experiments:

1. Distribution of partition coefficient of acetic acid in water and butanol.
2. Distribution of benzoic acid in benzene and water.

Potentiometry:

3. Titration of strong acid vs strong base (HCl vs NaOH)

4,

Thin Layer Chromatography :

4. Determination of Rf values and identification of Organic compounds: preparation of and separation of 2,4-dinitrophenylhydrazone of acetone and acetophenone using toluene and light petroleum (40:60)
5. Separation of ortho & para-nitroaniline mixtures.

Electrochemistry

6 Titration of Strong acid Vs Strong base (HCl Vs NaOH)
~~6~~ 7. Determination of dissociation constant (Ka) of acetic acid by conductivity measurements

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Colorimetry

7. Verification of Beer's Law using $KMnO_4$ and determination of the concentration of the given solution.

Adsorption

8. Adsorption of acetic acid on animal charcoal, Verification of Freundlich adsorption isotherm.

Reference Books

1. Khosla, B. D.; Garg, V. C. &Gulati, A. Senior Practical Physical Chemistry, R.
2. Chand & Co.: New Delhi (2011).
3. Mendham, J, *Vogel's Quantitative Chemical Analysis:* Pearson, 2009.
4. Analytical Chemistry 7th edition by Gary D. Christian (2004)
5. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall. 11. Vogel, A. I.
6. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.

(9) Green Synthesis of Acetanilide

(10) Green Synthesis of (P-Bromo acetanilide) Aspirin

(11) Green Synthesis of Dihydropyrimidinone

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6. Syllabus Focus

a. Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Local	To produce graduates with sound theoretical knowledge and technical skills.
Regional	To motivate students towards research.
National	To address the challenges with their innovative contributions for the benefit of mankind.
Global	To instill the essence of professionalism, ethical commitment to become researchers with core human values.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	1,2,3,4	Upskilling, cross skilling and reskilling
ED	1,2,3,4	Guest lecture Skill test involving creative thinking and problem solving
EMP	1,2,3,4	Using an engaging curriculum for career exploration

7. Pedagogy

S.No.	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Science Experiments
2.	Participative Learning	Presentation
3.	Problem solving	Research Projects

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8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments & End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination- 60%
CO1	CIA1-Written Exam	Written Exam
CO2	CIA1-Written Exam	
CO3	CIA2- Mini Project	
CO4	CIA2- Paper Presentation	

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b. Model Question Paper - End Semester Exam

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(An Autonomous College Affiliated to Osmania University)
Faculty of Science – Department of Chemistry
MODEL PAPER - B.Sc. III YEAR SEMESTER -V
INSTRUMENTAL METHODS OF ANALYSIS
Course Code: U24/CHE/DSE/501

TIME: 2 Hrs
Max. Marks: 60

SECTION –A

I.Answer the following **4X10=40 Marks**

1. Evaluate the principle of paper chromatography and development of chromatogram by four methods. (CO1) **L5** 10M

OR

2. a) Explain the Craig's counter current process of solvent extraction. (CO2) **L1** 5M
   b) Summarize a short note on Soxhlet extraction technique. (CO1) **L2** 5M

3. a) Apply the theory involved in Gas chromatography and draw the block diagram. (CO2) **L3** 5M
   b) Give the analysis of paracetamol by HPLC (CO3) **L1** 5M

OR

4. Describe the principle of Ion exchange chromatography. Give an account of cation and anion exchange resins. (CO1) **L2** 10M
5. a) Estimation of iron in water sample samples by thiocyanate method. (CO3) **L6** 5M
   b) Explain the instrumentation of the double beam spectrophotometer. (CO3) **L1** 5M

OR

6. Analyse the Principle, Sources of Radiations, Sampling technique in IR spectrophotometry. (CO3) **L4** 10M
7. a) Describe the working of Calomel electrode with a neat diagram (CO4) **L2** 5M
   b) How chloride ions are estimated using silver nitrate by conductometry. (CO4) **L1** 5M

OR

8. Determine the EMF of a cell initially of an acid- base titration where 25 ml 0.1 M of HCl is titrated potentiometrically against standard 0.1 M NaOH using hydrogen electrode as indicator electrode and saturated calomel electrode as reference electrode. What would be the EMF after the addition of 20, 25 and 30 ml of NaOH solution? (CO4) **L5** 10M

SECTION –B

II. Answer any four. **4x5=20 Marks**

9. Illustrate any two applications of TLC (CO2) **L2**
10. Give an account of different types of column packing. (CO1) **L1**
11. Distinguish between Colorimetry and Spectrophotometry. (CO3) **L4**
12. Classify chromatographic methods and explain any two. (CO1) **L1**
13. Outline a short note on three electrode assembly. (CO4) **L2**
14. Explain the instrumentation and principle of HPLC. (CO2) **L1**

b. Model Question Paper - End Semester Exam

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Faculty of Science – Department of Chemistry
B.Sc. III YEAR SEMESTER -V
INSTRUMENTAL METHODS OF ANALYSIS

TIME: 2 Hrs **Course Code: U24/CHE/DSE/501**
Max. Marks: 60 **Credits: 4**

SECTION –A

SECTION A - INTERNAL CHOICE				**4 X 10 M = 40M**
Question Number	**Question**		**CO**	**BTL**
1	**Module 1**	Evaluate the principle of paper chromatography and development of chromatogram by four methods. 10M **OR**	**CO 1**	**(Level V)**
2	**Module 1**	a) Explain the Craig's counter current process of solvent extraction. 5M b) Summarize a short note on Soxhlet extraction technique. 5M	**CO 1**	**(Level I, II)**
3	**Module 2**	a) Apply the theory involved in Gas chromatography and draw the block diagram. 5M b) Give the analysis of paracetamol by HPLC 5M **OR**	**CO 2**	**(Level I, III)**
4	**Module 2**	Describe the principle of Ion exchange chromatography. Give an account of cation and anion exchange resins. 10M	**CO 2**	**(Level II)**
5	**Module 3**	a) Estimation of iron in water sample samples by thiocyanate method. 5M b) Explain the instrumentation of the double beam spectrophotometer. 5M **OR**	**CO 3**	**(Level I,VI)**
6	**Module 3**	Analyze the principle, sources of radiations, sampling technique in IR spectrophotometry. 10M	**CO 3**	**(Level IV)**

7	**Module 4**	a) Describe the working of Calomel electrode with a neat diagram 5M b) How chloride ions are estimated using silver nitrate by conductometry. 5M **OR**	**CO 4**	**(Level I, II)**
8	**Module 4**	a) What is the principle and instrumentation of potentiometry 5M b) Explain the three electrode assemblies of voltammetry. 5M	**CO 4**	**(Level I)**
SECTION B – (Short answer questions) **ANSWER ANY 4 OUT OF 6** **4 X 5M = 20 M**				
9	**Module 2**	Illustrate any two applications of TLC	**CO 2**	**(Level II)**
10	**Module 1**	Give an account of different types of column packing.	**CO 1**	**(Level I)**
11	**Module 3**	Distinguish between Colorimetry and Spectrophotometry.	**CO 3**	**(Level IV)**
12	**Module 1**	Classify chromatographic methods and explain any two.	**CO 1**	**(Level I)**
13	**Module 4**	Calculate the equivalent conductivity 0.1N concentrated sulphuric acid solution given specific conductivity is equal to $4 \times 10^{-2} Sm^{-1}$.	**CO 4**	**(Level II)**
14	**Module 2**	Explain the instrumentation and principle of HPLC.	**CO 2**	**(Level I)**

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FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
THEORY SYLLABUS CBCS-2024
SEMESTER -V
MEDICINAL & SUSTAINABLE CHEMISTRY

1. Course Description

Program: B.Sc.
Course Code: U24/CHE/DSE/502
Course: DSE 2
No. of Credits: 4

Max. Hours: 60 Hrs
Max. Marks: 100
Hours per week: 4 Hrs

2. Course Objectives

- To introduce students to the action of drugs on biological systems.
- To explain & discuss the drug formulation, synthetic routes and discovery process.
- To study the effects of chemical synthesis upon the environment and the importance of developing green techniques.
- Introduce students to the importance of nanoparticles, their properties and applications.

3. Course Outcomes

CO 1: Learn and understand the action of drugs on biological systems.
CO 2: Discuss the synthetic routes and therapeutic activity for some commonly used drugs.
CO 3: Acquire the ability to design green synthetic routes replacing conventional pathways.
CO 4: Apply the knowledge of Nanotechnology to synthesize, characterize Nanoparticles and explain their properties.

4. Course Content

MODULE I: MEDICINAL CHEMISTRY I **12 Hrs**

Terminology in Medicinal Chemistry **2 Hrs**
Disease, Drug, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics, metabolites, antimetabolites, agonist, antagonist and therapeutic index.

Nomenclature **1 Hr**
Chemical name, Generic name and Trade names. Trade names for the given generic names – (i) Aspirin (ii) Amoxycillin (iii) Ciprofloxacin (iv) Paracetamol (v) Mebendazole.

ADME **3 Hrs**
a) Absorption: Definition, absorption of drugs across the membrane – active and passive absorption, routes of administration of drugs. b) Distribution: definition and effect of plasma protein binding. c) Metabolism: definition, phase I and phase II reactions. d) Elimination: definition and renal elimination.

Classification of Drugs
Classification of Drugs based on therapeutic action–Chemotherapeutic agents, and Pharmacodynamic agents (brief explanation for the following)
(i) Chemotherapeutic agents **1 Hr**

Antimalarials – Chloroquine; Antibiotic – Amoxicillin; Antitubercular drugs – isoniazid; Antiprotozoals – metronidazole: Antibacterial – Sulphanilamide; Anthelmintics – Albendazole.

(ii) Pharmacodynamic agents **5 Hrs**

(a) Drugs acting on CNS: General (thiopental sodium)and local anaesthetics (Benzocaine),Analgesics (Ibuprofen),Antipyretics (Aspirin, Paracetamol), Sedatives & Hypnotics (Phenobarbital), Anticonvulsants (Diazepam), Anti-psychotics (Chlorpromazine) and Antidepressants (Fluoxetine).

(b) Drugs acting on PNS: Adrenergic (Salbutamol, Propranolol) & Cholinergic (Carbachol, Diphenhydramine) Drugs.

(c) Drugs acting on Cardiovascular System-Antihypertensive Drugs (Captopril, Nifedipine)

(d) Drugs acting on renal system- Diuretic drugs (Furosemide, Acetazolamide)

MODULE II: MEDICINAL CHEMISTRY II **11 Hrs**

SAR studies **1 Hr**

Introduction to Structure Activity Relationship Studies, Lead modification strategies.SAR of benzodiazepines.

Antibiotics **1 Hr**

Discovery- Isolation of Penicillin, Structure of Penicillin G, Penicillin-V, Penicillin-O &Amoxycillin.

Synthetic route and brief therapeutic action of the following drugs: **4 Hrs**

Chemotherapeutics: Chloroquine, Ciprofloxacin, Sulphanilamide, Metronidazole.

Drugs to treat metabolic disorders: Paracetamol, Salbutamol, Omeprazole, Mephensin, Aspirin, Thiobarbituric acid, L-Dopa, Phenobarbital, Oil of wintergreen, Nifedipine

Formulations **2 Hrs**

(a) Introduction: Need of conversion of drugs into medicine. Additives & their role (Brief account only). (b) Classification of Drug formulations: Oral, parenterals and topical dosage forms – advantages and disadvantages.

Brief Overview of Drug Development Process: **3 Hrs**

(a) Lead drug-Definition & example (b) Drug design-i) Based on Lead compound ii) Based on Target Structure(De novo drug design) iii) Computer aided Drug Design (Molecular modelling) (c) Drug Testing-Clinical trials.

MODULE III: GREEN CHEMISTRY **15 Hrs**

Principles of Green Chemistry and some real world cases

What is Green Chemistry? Twelve principles of Green Chemistry with their explanation and examples. Atom economy, Evaluation of the type of the reaction: Rearrangements, Addition, Substitution, elimination and Pericyclic reactions. Selection of solvent: Aqueous phase reactions, Reactions in ionic liquids, Solid supported synthesis, Solvent free reactions (solid phase reactions). Green catalysts: Phase transfer catalysts (PTC), Biocatalysts. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy.

Microwave assisted reactions in water: Oxidation of toluene and alcohols, Claisen rearrangement, Pinacol pinacolone rearrangement.

Microwave assisted reactions in organic solvents, Diels-Alder reaction and Decarboxylation reaction, Fries rearrangement.

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Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine), Cannizaro reaction, Strecker synthesis, Friedal crafts acylation.
Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).

MODULE IV: NANOTECHNOLOGY 15 Hrs

Nanotechnology: Introduction, types of crystalline nano materials, synthesis of nano materials- physical, chemical and biological methods (one method each).
Characterization of nanoparticles using electron microscope, tunneling microscope and X-ray diffraction. (Elementary treatment only)
Properties of nanomaterials-structure of nanomaterials, mechanical, electrical conductivity, optical, melting point, luminescence, magnetic properties
Special nanomaterials- fullerenes, carbon nanotubes, porous silicon, zeolites, aerogels, self-assembled nanoparticles, their preparation and structure.
Applications-- Electronics, energy, automobiles, fuel cells, home appliances, Nanolithography, defense, medicine, nanotechnology and environment.

5. References

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5. Ahluwalia V.K & Kidwai M, *New Trends in Green Chemistry:* Springer,1 edition (29thFeb 2004)
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16. T. Pradeep *Nano: The Essentials* , McGraw-Hill Education.
17. CNR Rao et.al. *Chemistry of nanomaterials: Synthesis, Properties and applications*
18. Gurdeep R. Chatwal *Chemistry and industry*
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6. Syllabus Focus

a. Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Local	To develop products that benefit the environment either directly or indirectly.
Regional	Nanotechnology helps in improving many technology and industry sectors and even revolutionize.
National	The concepts of Green Chemistry reduces the use of energy and fuel by using renewable inputs wherever possible
Global	Recent advances in Medicinal Chemistry, Green Chemistry and Nanotechnology provide reliable synthetic pathways for sustainable development goals.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	All	Educational tour to industries/factories to make students learn outside the classroom
ED	All	Case studies relevant to the problems, challenges and help students to develop solutions
EMP	All	Systematic and sustained effort to adapt specific skills for improving career goals

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Field Trips
2.	Participative Learning	Role play
3.	Problem solving	Research Projects

8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1-Written Exam	Written Exam
CO2	CIA1-Written Exam	
CO3	CIA2- Case Study	
CO4	CIA2- Presentations (poster/ ppt)	

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b. Model Question Paper - End Semester Exam

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FACULTY OF SCIENCE – DEPARTMENT OF CHEMISTRY

B.Sc. III YEAR SEMESTER -V

MEDICINAL & SUSTAINABLE CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/502**

Max. Marks: 60 **Credits: 4**

SECTION –A (Essay Questions)

SECTION A - INTERNAL CHOICE			**4 X 10 M = 40M**	
Question Number	**Question**		**CO**	**BTL**
1	**Module 2**	a) Evaluate the structure of Penicillin G & discuss its commercial production 5M b) Explain briefly about diluents and stabilizing agents with examples. 5M **OR**	**CO 2**	**(Level I, V)**
2	**Module 2**	Outline the synthetic route and brief therapeutic action of i) Ciprofloxacin ii) Aspirin iii) Salbutamol iv) Omeprazole 10M	**CO 2**	**(Level II)**
3	**Module 1**	a) Summarize briefly about agonist and antagonist. 5M b) What are anaesthetic and antipyretic drugs? 5M **OR**	**CO 1**	**(Level I, II)**
4	**Module 1**	Describe in detail about ADME. 10M	**CO 1**	**(Level I)**
5	**Module 3**	a) List out the basic principles of green chemistry. 5M b) Simplify the atom economy? Calculate atom economy using suitable examples. 5M **OR**	**CO 3**	**(Level I, IV)**
6	**Module 3**	a) Assess the need for green chemistry. 5M b) Interpret the selection of solvents in green synthesis. 5M	**CO 3**	**(Level V)**

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7	**Module 4**	a) Give two methods for synthesis of Nanoparticles. 5M b) Compose a note on carbon nanotubes.5M **OR**	**CO 4**	**(Level I, VI)**
8	**Module 4**	a) Elaborate a note on Zeolites? 5M b) Compile the principle and working of STM. 5M	**CO 4**	**(Level VI)**
SECTION B – (Short answer questions) **ANSWER ANY 4 OUT OF 6**			**4 X 5M = 20 M**	
9	**Module 1**	How would you explain drugs acting on the renal system?	**CO 1**	**(Level II)**
10	**Module 2**	Build a short note on clinical trials.	**CO 2**	**(Level III)**
11	**Module 1**	What are chemotherapeutic agents? Discuss about antimalarial drugs.	**CO 1**	**(Level I)**
12	**Module 2**	Construct briefly about computer aided drug designing.	**CO 2**	**(Level III)**
13	**Module 3**	Analyze the role of phase transfer catalyst in green synthesis.	**CO 3**	**(Level IV)**
14	**Module 4**	Give any four applications of Nanomaterials.	**CO 4**	**(Level I)**

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b. Model Question Paper - End Semester Exam

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FACULTY OF SCIENCE – DEPARTMENT OF CHEMISTRY

b. MODEL PAPER - B.Sc. III YEAR SEMESTER -V

MEDICINAL & SUSTAINABLE CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/502**

Max. Marks: 60

SECTION –A (Essay Questions)

I. Answer the following **4X10=40 Marks**

1. a) Evaluate the structure of Penicillin G & discuss its commercial production(CO2) **L5** 5M

   b) Explain briefly about diluents and stabilizing agents with examples. (CO 2) **L1** 5M

OR

2. Outline the synthetic route and brief therapeutic action of 10M
   i) Ciprofloxacin ii) Aspirin iii) Salbutamol iv) Omeprazole (CO 2) **L2**
3. a) Summarize briefly about agonist and antagonist. (CO 1) **L2** 5M

   b) What are anaesthetic and antipyretic drugs? (CO 1) **L1** 5M

OR

4. Describe in detail about ADME. (CO 1) **L1** 10M
5. a) List out the basic principles of green chemistry. (CO3) **L1** 5M

   b) Simplify atom economy? Calculate atom economy using suitable examples.(CO3) **L4** 5M

OR

6. a) Assess the need for green chemistry. (CO3) **L5** 5M

   b) Interpret the selection of solvents in green synthesis. (CO3) **L5** 5M
7. a) Give two methods for synthesis of Nanoparticles. (CO4) **L1** 5M

   b) Compose a note on carbon nanotubes. (CO4) **L6** 5M

OR

8. a) Elaborate a note on Zeolites? (CO4) **L6** 5M

   b) Compile the principle and working of STM. (CO4) **L6** 5M

SECTION –B (Short Answer Questions)

II. Answer any four. **4x5=20 Marks**

9. How would you explain drugs acting on the renal system? (CO 1) **L2**
10. Build a short note on clinical trials. (CO 2) **L3**
11. What are chemotherapeutic agents? Discuss about antimalarial drugs. (CO 1) **L1**
12. Construct briefly about computer aided drug designing.(CO2) **L3**
13. Analyze the role of phase transfer catalyst in green synthesis. (CO3) **L4**
14. Give any four applications of Nanomaterials. (CO4) **L1**

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c. Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	1	2	10	2	5
2	15	2	2	10	2	5
3	15	3	2	10	1	5
4	15	4	2	10	1	5

5. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions(hrs)
1	2,5	Understanding	15
2	1,7	Applying & Analysing	15
3	2,7	Remembering	15
4	4	Creating & Evaluating	15

Prepared by	Checked & verified by	Approved by
Shikha Chander M. Deepthi Name and Signature of the teaching faculty Dr. Shikha Chander M. Deepthi	D. Sumalatha Name and Signature of the HoD Dr. D. Sumalatha	Name and Signature of the Principal Dr. Uma Joseph

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SEMESTER - V

MICROBIAL METABOLITES

1. **Course Description:**

Programme: B.Sc **Max. Hours:30**

Course Code: U24/MIC/SEC/501 **Hours per week:2**

Course Type: SEC **Max. Marks:50**

No. of credits:2

2. **Course Objectives:**

- To explain the concepts of microbial metabolites emphasizing on the importance of industrially important microbial products.
- To explore microbial metabolites production and their application.

3. **Course Outcomes:**

CO1:Understand the mechanism and production of primary and secondary microbial metabolites.

CO2: Acquire the knowledge of mechanism, production and application of organic acids, aminoacids and enzymes.

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4. Course Content:

MODULE I- INTRODUCTION TO PRIMARY AND SECONDARY METABOLITES AND CONTROL MECHANISMS: **(15 Hrs)**

Microbial products as primary and secondary metabolites; trophophase- Idiophase relationships in production of secondary metabolite.

Role of secondary metabolites in physiology of organisms producing them; Metabolic control mechanisms: substrate induction; catabolic regulation; feedback regulation; Bypassing/ disorganization of regulatory mechanisms for overproduction of primary and secondary metabolite.

MODULE II-PRODUCTION OF SOLVENTS, BEVERAGES AND ORGANIC ACIDS:

(15 Hrs)

Production of wine, Production of organic acid: Acetic acid , Amino acids: Use of amino acids inindustry; methods of production;Production of individual aminoacids :L-Glutamic acid.

Enzymes: commercial applications; production of Amylases, laccases. Antibiotics: Beta-Lactam antibiotics; aminoacid and peptide antibiotics; Carbohydrate antibiotics; streptomycin. Bioplastics (PHB; PHA).

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5. References:

Text books:

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6. Syllabus Focus:

a) Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global Development Needs	Explore microbial metabolites pivotal role in addressing global development needs, fostering sustainable solutions for progress.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
ED	Module I	Production of wine

7. Course Assessment Plan:

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Continuous Internal Assessments CIA - 20%	End Semester Examination-30%
Written Exam	Written Exam

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b) Model Question Paper:

MICROBIAL METABOLITES
INTERNAL EXAM

Max. Marks: 20
Time: 1 Hrs

1. Assignment/SBT

MICROBIAL METABOLITES
MODEL QUESTION PAPER- SEM END EXAM

Course Code: U24/MIC/SEC/501 **Max.Marks: 30**

No. of credits: 2 **Time: 1Hrs**

I. Major **(8marks)**

1. Demonstrate the staining of the polyhydroxy Butyrate granules .

II. Minor **(5 marks)**

1. Identify the given media plates for the production of amylase

III. Comment on given specimens C, D and E **(3x4=12 marks)**

IV. Viva / Record **(5 marks)**

Prepared by Faculty	Checked &Verified by HoD	Approved by the Principal
K. Swathi **Ms.K.Swathi**	**Dr.P.Roselin**	**Dr.Uma Joseph**

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SEMESTER - V

PLANT BIOTECHNOLOGY THEORY

1. **Course Description**
   Programme: BSc
   Course Code: U24/BIT/DSE/501
   Course Type: DSE-IA
   No. of credits: 4

   Max. Hours:60
   Hours per week: 4
   Max. Marks: 100

2. **Course Objectives:**

- To interpret the techniques employed to grow plant cells, tissues, or organs under sterile invitro conditions on a defined nutrient medium.
- To adapt the students with different techniques of plant tissue culture and conservation of economically significant plant species
- To develop expertise in theoretical and practical aspects of plant transformation techniques.

3. **Course Outcomes**

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

CO1: Identify, summarize, and apply knowledge in starting a plant tissue culture laboratory, preparation of nutrient media and culturing of single cells **(REMEMBER, UNDERSTAND, APPLY)**

CO2: Interpret, analyse, and assess the stages of micro propagation and production of haploid plants **(UNDERSTAND, ANALYSE, EVALUATE)**

CO3: Describe, apply, and develop the concepts of somatic hybridization, cybridisation and germplasm conservation for crop improvement. **(UNDERSTAND, APPLY, CREATE)**

CO4: Summarize, apply, and design transformation techniques to produce transgenic plants **(UNDERSTAND, APPLY, CREATE)**

Prof. SMITA C. PAWAR
Department of Genetics
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4. Course Content

MODULE I: BASICS OF PLANT TISSUE CULTURE (15 Hrs)

- Introduction to Plant tissue culture.
- History of tissue culture techniques.
- General techniques-laboratory space, culture room, sterilization (Flame sterilization, Autoclaving, Filter sterilization, Wiping with 70% Ethanol, Surface sterilization).
- Media composition for plant tissue culture- MS media, White media and B5 media.
- Callus and Suspension cultures- Initiation of Callus culture, suspension cultures, Batch cultures, continuous cultures, immobilized cell cultures, Sub culturing.
- Estimation of Growth, Synchronization of cells, cloning.
- Isolation of single cells, Culture of single cells (Filter paper raft-nurse tissue technique, Microchamber technique, Microdrop method, Bergmann's plating technique and thin layer liquid medium culture technique).
- Cell Viability test

MODULE II: MICROPROPAGATION AND HYBRID SORTING (15 Hrs)

- Micro/clonal propagation- Meristem culture, Culture medium, Environmental conditions during culture.
- Stages of Micropropagation: Four stages- Selection and preparation of mother plants (stage 0), Culture initiation (stage 1), Multiplication (stage 2) – Proliferation of axillary buds, Induction of adventitious buds, bulbs and protocorms, Somatic Embryogenesis- Developmental pattern of Somatic Embryogenesis, Rooting of shoots (stage 3), Transfer of Plantlets to soil (stage 4)- in vitro and ex vitro hardening.
- Advantages and limitations of Micropropagation, Applications of Micropropagation.
- Haploid production- Androgenesis, Culture medium- N6 medium, MS, LS media, and Nitsch medium, Environmental conditions during culture.
- Pretreatments, Cytological and biochemical changes, Factors affecting Androgenesis.
- Advantages and limitations of Androgenesis, Applications of Androgenesis.
- Gynogenesis: Culture medium- N6 medium, MS, LS media, and Nitsch medium, Environmental conditions during culture, Factors affecting Gynogenesis, Advantages and limitations of Gynogenesis, Applications in plant breeding.
- Invitro pollination: Explant preparation, Nutrition and culture conditions, Culture medium- Nitsch medium, Growth regulators used in invitro pollination (eg: Brassica oleracea), Applications of Invitro pollination.
- Invitro fertilization using Millicell- CM dish in maize.

MODULE III: TECHNOLOGY FOR DISTANT HYBRIDISATION (15 Hrs)

- Protoplast isolation: introduction to Somatic Hybridization.
- Protoplast isolation- Enzyme activities, selection of plant tissues for protoplast isolation, purification, and culture.
- Protoplast fusion: Strategies to induce protoplast fusion (High pH-high Ca2+ treatment, Polyethylene glycol, Electrofusion).
- Selection of hybrid cells (visual markers, fluorescent dyes, complementation, Transgenic selectable markers, Culture of the entire fusion mixture) Regeneration of hybrid plants
- Advantages and limitations of somatic hybridization, Applications in crop improvement.
- Cybridization-Cybrids, strategies to produce cybrids, Applications of cybridization.
- Germplasm conservation/genetic resources- Cryopreservation, Stages involved in Cryopreservation (Choice of material, Preculture, Cryoprotection, Freezing, Storage, Thawing, Reculture). Improved methods of cryopreservation (vitrification, droplet method, encapsulation- dehydration, encapsulation-vitrification, simplified freezing procedures). Slow-growth cultures, effects on genetic constitution, Advantages, and limitations of cryopreservation. Applications of cryopreservation.

MODULE IV: PLANT TRANSFORMATION TECHNIQUES (15 Hrs)

- Production of Transgenic plants- Gene constructs- Promoter, cap site, leader sequence, initiation codon, exons, introns, stop codons and transcriptional termination site.
- Vectors- Co-integrate *p*Ti vectors and binary vector.
- Agrobacterium mediated gene transfer- Plasmid vectors used for plant cell transformation, Molecular biology of Agrobacterium infection, Properties of Crowngall cells, Ti plasmids, Organisation of T-DNA, Organisation of vir region, Transfer of T-DNA, integration of T-DNA into plant genome, coculture with tissue explants, In planta transformation.
- Particle gun bombardment method using helium pressure and microprojectiles.
- Genome editing-TALENs, CRISPR CAS9 technology.
- Applications of Transgenic plants, Herbicide resistance: Glyphosate action, Strategies for Glyphosate resistance (overproduction of EPSPS enzyme, Glyphosate tolerant EPSPS enzyme, Glyphosate oxidoreductase).

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5. Reference books

1. B D Singh. (2014). *Plant Biotechnology*: Kalyani Publishers.
2. P K Gupta. (2010). *Plant biotechnology*: Rastogi Publications.
3. M.W. Fowler and G.S. Warren.*Plant Biotechnology: The Genetic Manipulation of Plants.*(II Edition): Oxford University Press.
4. H.S. Chawla. (2002*). Introduction to Plant Biotechnology*: Science Publishers.
5. Kirsi-MarjaOksman-Caldentey and Wolfgang H. Barz.(2002).*Plant Biotechnology and Transgenic Plants*:CRC Press.
6. S.S. Bhojwani, M.K. Razdan. (1996). *Plant Tissue Culture: Theory and Practice:* Elsevier.

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
National (Modules 1,2, & 3)	Plant biotechnology guarantees food security, enhances human health, supports sustainable agriculture, fosters economic growth, protects the environment, and benefits research for both developed and developing nations.
Global (Modules 3&4)	Addresses urgent global development requirements like conservation, biodiversity, disease resistance, climate change adaptation, nutritional enhancement, and crop improvement.

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill development	Module 1 & 4	Hands on training in preparation of nutrient media for plant tissue culture, Induction of callus and estimating the growth of tissue cultured cells in invitro conditions. Student's research project on cultural characteristics of agrobacterium species and in planta transformation
Employability	Module 2	Experiential learning of Ex-vitro hardening methods and establishment of tissue cultured plants in green houses.
Entrepreneurship development	Module 3	Presentation by the students on various germplasm conservation techniques

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Seminar
2.	Experiential Learning	Science Experiments
3.	Participative Learning	Group Discussion
4.	Experiential Learning	Field trip
5.	Experiential Learning	Art Projects
6.	Participative Learning	Presentation
7.	Participative Learning	Workshop
8.	Problem solving	Case studies
9.	Problem solving	Research projects

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8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1 Written Exam	Written Exam
CO2	CIA-2 Quiz/ Art projects/ Group discussion/Assignments	
CO3	CIA-1 Written Exam	
CO4	CIA-2 Presentation/ Case studies	

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b) Model Question Paper- End Semester Exam

MODEL QUESTION PAPER- THEORY

Course Code: U24/BIT/DSE/501 **Max. Marks: 60**
Credits: 4 **Time: 2 Hrs**

SECTION – A

I. Answer the following. **4 x 10 = 40 M**

1. Explain the composition of MS media used in plant tissue culture.

OR

2. How would you summarize Suspension culture.
3. How would you evaluate the applications of haploid production in plant breeding.

OR

4. What are the various features and stages of Micropropagation. Add a note on its advantages and limitations.
5. How can you make use of somatic hybridization technique in crop improvement.

OR

6. How would you improve preservation of genetic resources by germplasm conservation methods.
7. How would you use Agrobacterium tumefaciens for gene transfer to produce transgenic plants.

OR

8. How can you elaborate on the production of BT crops. Add a note on its applications and limitations.

SECTION –B

II. Answer Any <u>Four</u> of the following: **4 x 5 = 20 M**

9. Outline different Cell viability tests
10. Describe the factors affecting gynogenesis
11. How would you use Electrofusion to produce somatic hybrids
12. Illustrate the process of Particle gun bombardment technique
13. Describe the process of invitro fertilization
14. How would you design a Binary vector system.

SEMESTER-END MODEL QUESTION PAPER

SECTION A - INTERNAL CHOICE 4 Q X 10 M = 40 M				
Question Number	**Question**	**Question**	**CO**	**BTL(Blooms Taxonomy Level)**
1	Module 1	Explain the composition of MS media used in plant tissue culture.	CO 1	II
2	Module 1	How would you summarize Suspension culture	CO 1	II
3	Module 2	How would you evaluate the applications of haploid production in plant breeding	CO 2	V
4	Module 2	What are the various features and stages of Micropropagation. Add a note on its advantages and limitations.	CO 2	IV
5	Module 3	How can you make use of somatic hybridization technique in crop improvement.	CO 3	III
6	Module 3	How would you improve preservation of genetic resources by germplasm conservation methods?	CO 3	VI

7	Module 4	How would you use Agrobacterium tumefaciens for gene transfer to produce transgenic plants	CO 4	III
8	Module 4	How can you elaborate on the production of BT crops. Add a note on its applications and limitations.	CO 4	VI
SECTION B - ANSWER ANY 5 OUT OF 7 4Q X 5 M = 20 M (To compulsorily have ONE question from each module)				
9	Module 1	Outline different Cell viability tests	CO 1	I
10	Module 2	Describe the factors affecting gynogenesis	CO 2	II
11	Module 3	How would you use Electrofusion to produce somatic hybrids	CO 3	III
12	Module 4	Illustrate the process of Particle gun bombardment technique	CO 4	III
13	Module 2	Describe the process of invitro fertilization	CO 4	II
14	Module 4	How would you design a Binary vector system	CO4	VI

PLANT BIOTECHNOLOGY- PRACTICAL

1. Course description

Programme : B.Sc
Course Code: U24/BIT/DSE/501/P
Course Type: DSE-I A
No. of credits: 1

Max. Hours: 30
Hours per week: 2
Max. Marks: 50

2. Course Objective:

- To implement various plant tissue culture methods to produce sterile, disease-free plants followed by ex-vitro hardening process.

3. Course Outcomes:

CO-1: To interpret and apply practical skills in media preparation, sterilization, and culturing of explants on MS media. **(UNDERSTAND, APPLY)**

CO-2: To demonstrate, compare and examine fused protoplast cells and polyploidy in onion root tips. **(APPLY, ANALYSE)**

CO-3: To compare and assess plant pigments by column chromatography **(ANALYSE, EVALUATE)**

PRACTICAL SESSIONS

1. MS Media preparation.
2. Surface sterilization of explants.
3. Callus initiation, Suspension culture.
4. Micro propagation of Banana, Ornamental plants.
5. Protoplast isolation: Observation of Brownian movements (Hibiscus leaf).
6. Protoplast fusion using PEG method.
7. Encapsulation of shoot bud by calcium alginate method.
8. Study of polyploidy in onion root tips by colchicine treatment.
9. Separation of plant pigments using column chromatography

Spotters:

1. Callus cultures
2. Sterilization techniques: autoclave and hot air oven
3. Somatic embryos
4. Synthetic seeds
5. Meristem culture
6. Plant regeneration
7. Cell suspension cultures
8. Isolation of protoplasts
9. Particle bombardment (Gene gun)
10. Binary or co-integrate vectors
11. Golden rice

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SEMESTER-IV

PLANT BIOTECHNOLOGY-PRACTICAL

Course Code: U24/BIT/DSE/501/P
Credits: 1

Max. Marks: 50
Time: 2 Hrs

I. MAJOR: (20 M)

Prepare a slide of fused protoplast cell using PEG method. Write the principle and procedure for the experiment. Report the results.

II. MINOR: (10 M)

Generate synthetic seeds by encapsulation technique. Write the principle and procedure of Encapsulation. Report the results

III. IDENTIFY THE GIVEN SPOTTERS: (10M)

IV. VIVA : (5 M)

V. RECORD: (5 M)

Prepared by	Checked & verified by	Approved by
4/3/24 (V. Deepa Switha) **Name and Signature of the teaching faculty**	4/3/24 (Ms. Shouni Niveditha) **Name and Signature of HoD**	**Name and Signature of Principal**

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