



# GOVT. COLLEGE FOR WOMEN PARADE GROUND JAMMU

(Erstwhile Maharahi Mahila College) Estd 1944  
(NAAC Re-ACCREDITED A GRADE)

Autonomous College under University of Jammu  
College for Potential for Excellence (2016)

## Pattern for Examination

Each Skill Course shall comprise of theory and practical components. These shall be referred as Skill Theory course and Skill Practical course.  
Each course (Skill Theory and Skill Practical) shall be of two credits.

### Skill theory course

#### Evaluation strategy

##### A) Internal assessment

1. Internal assessment (10 Marks) as per the adopted procedure for other courses.
2. No marks have been earmarked for attendance, however the eligibility criterion for appearing in the end semester examination shall remain the same as is followed in other courses.

##### B) External end semester Examination

1. Maximum Marks=40.
2. Question paper shall have three (A, B and C) sections
  - i) Section A shall comprise of 4 questions of 2 mark each.
  - ii) 2 questions shall be set from each unit of the prescribed course content.
  - iii) All questions shall be compulsory.
  - i) Section B shall comprise of 4 questions of 5 mark each
  - ii) 2 questions shall be set from each unit of the prescribed course content.
  - iii) All questions shall be compulsory.
  - i) Section C shall comprise of 3 questions of 12 mark each.
  - ii) 1.5 questions shall be set from each unit of the prescribed course content.
  - iii) Students shall be asked to attempt only one question of 12 marks from this section.

### Skill Practical course

#### Evaluation strategy

##### A) Internal assessment

1. Internal assessment (25 Marks) as per the adopted procedure for other courses.
2. 5 marks have been earmarked for attendance, and the eligibility criterion for appearing in the end semester examination shall remain the same as is followed in other courses.

##### B) External end semester Examination

Mahak Tyagi  
HOD Biotech



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Maximum Marks =25.

Procedure of the external examination shall be same as is followed in other practical courses.

## SEMESTER III

### Core Course

**Course Title: Cell and Molecular Biology**

**Course Code: UBTTTC-301**

**Course Credits: 06**

#### Learning Outcomes

- The course aims to make students well versed with structural and functional information about the cell.
- The students will be educated about various concepts of genetics and important cellular processes like replication, transcription and translation.
- Various aspects of the course like gene regulatory mechanisms and applied genetics are of importance for the students.

#### **UNIT – I**

Cell theory, Structure of pro-and eukaryotic cells; cell wall in plants and microbes; structure and function, Plasma membrane; transport through membrane, Cell organelles; Nucleus, Mitochondria, Chloroplast and endoplasmic reticulum. Basic concept of cell signaling. Chromosome structure and function. Chemical components of a cell; Catalysis and use of energy by cells.

#### **UNIT – II**

An overview of cell cycle; Components of cell cycle control system and its regulation. Mendelian Genetics, interaction of genes, Recombination, Bacterial genetic system; transformation, transduction and conjugation, Mutations; molecular basis, Overview of transposable elements in bacteria and plants. Structural and numerical alterations of chromosomes.

#### **UNIT – III**

Central dogma, Model organisms to study Molecular biology. Nucleic acids; DNA and RNA as a genetic material, experimental basis. DNA structure: Direct and indirect methods for analysis of DNA. Direct method; X-ray crystallography, autoradiography and electron microscopy to study DNA. Indirect methods Spectroscopy and Agarose gel electrophoresis. Factors determining structure of DNA, Hydrogen bonding in DNA, Hydrophobic interactions in DNA, base stacking, different forms of DNA: A, B, Z, Satellite DNA, Shapes of DNA; Linear and Circular DNA.

*Maharaj Tufel*



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### UNIT – IV

General features of DNA replication and basic rules of replication. Semiconservative mode of DNA replication Experimental basis, Replication in prokaryotes, initiation, elongation and termination. Replication in eukaryotes Initiation, elongation and termination Transcription in prokaryotes, Initiation, elongation and termination. Transcription in eukaryotes initiation, elongation and termination. RNA processing in eukaryotic cells; capping, polyadenylation, pre-mRNA splicing.

### UNIT – V

Regulation of gene expression in prokaryotes operon concept, inducible and repressible operons., Translation: structure and function of ribosomes, mRNA, tRNA, rRNA; Protein synthesis in prokaryotes initiation, elongation and termination. Translation in eukaryotes initiation, elongation and termination. Post Translational Modifications(PTMs).

### Books recommended

1. Alberts, B. Bray, D. Lewis, J. Raff, M., Roberts K. and Watson J.D (2014). Molecular Biology of Cell (6<sup>th</sup> edition), Garland Publishing Inc., New York.
2. Dranell, J. Lodish, H and Baltimore, D. (2021). Molecular Cell Biology(9<sup>th</sup> edition), WH Freeman and Co. New York, NY.
3. Das, H.K (2010). Textbook of Biotechnology (4<sup>th</sup> edition), Wiley DreamteckIndia Pvt. Ltd, India.
4. Wilson, K. and Walker, J. (2018). Principles And Techniques of Biochemistry and Molecular Biology (8<sup>th</sup> edition), Hofmann A, Cambridge University Press.
5. Singh, B. D. (2020) Biotechnology Expanding Horizons Latest Edition 2021, Kalyani Publishers, India.
6. Karp, Gerald, and Nancy L. Pruitt. (2015). Cell and molecular biology: concepts and experiments (8<sup>th</sup> edition). New York: John Wiley & Sons.

### Practical

1. Introduction to Spectrophotometry, (UV/Vis) Spectrophotometer: Principle, Working and Result Interpretation
2. Estimation of unknown concentration of copper (II) ions in a CuSO<sub>4</sub> solution using Vis spectrophotometer.
3. Determination of the  $\lambda_{max}$  (maximum absorbance) of a given sample solution using spectrophotometer.
4. Demonstration of DNA isolation from plants using plant DNA isolation Kit
5. Agarose gel electrophoresis as separation technique for DNA analysis.

*Mahalle Tufkani*



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6. Quantification of DNA by UV spectrophotometer.
7. Estimation of purity of DNA by UV spectrophotometer
8. To separate and study plant pigments by paper chromatography and calculation of R<sub>f</sub> values.
9. Quantification of DNA using agarose gel by normalization
10. Demonstration for quantification of DNA using PCR (Thermocycler) machine.

### Books recommended

1. Green, M. R., and Sambrook J. (2012). Molecular cloning. A laboratory Manual 4<sup>th</sup> ed., Cold Spring Harbor Laboratory Press.
2. Carson, S., Miller, H., Srougi, M. and Witherow, D. S. (2019). Molecular Biology Techniques 4<sup>th</sup> ed., © Academic Press.
3. Plummer D.T. (2006) An Introduction of Practical Biochemistry. 3<sup>rd</sup> ed. Tata McGraw Hill Publishers Co. Ltd., New Delhi.
4. Singh R. and Sawhney, S.K. (2009). Introduction to Practical Biochemistry. Narosa Publisher.

*Mahab Tufeli*



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### Skill Enhancement Course (SEC) –I

**Course Title: Environmental Biotechnology**

**Course Code: UBTTS-301**

**Course Credits: 02+02**

#### Learning Outcomes

- Environment Biotechnology aims at providing the students with an understanding of various issues related to environment.
- The focus is on the scope and importance of environmental biotechnology and recent biotechnological advances.
- Additionally, the focus is also on the adverse health effect of Xenobiotics which plays an important role in addressing public health challenge.
- A practical hand on adds to the better understanding and exposure level of the students.

#### **UNIT -I**

- I. Components of Environment: Abiotic (Hydrosphere, Lithosphere, Atmosphere) and Biotic (Biosphere), Environmental Problems: Global Warming, Acid rain, Ozone depletion, deforestation.
- II. Pollution-Air, water and land pollution: Causes and control strategies. Scope & importance of environmental biotechnology.

#### **UNIT -II**

- I. Biotechnological interventions: Air pollution abatement, Solid waste management strategies, Conventional waste water treatment methods.
- II. Xenobiotics and use of Bio-fertilizers, bioinsecticide, biofungicide and bioherbicides. Recent Environmental Biotechnological advances: Bioplastics, biofuels, biosensors and bioindicators.

#### **Books recommended**

1. A K Chatterjee. (2011). Introduction to Environmental Biotechnology. 3<sup>rd</sup> edition. PHI Learning Private Limited, New Delhi.
2. S. N. Jogdand. (2015). Environmental biotechnology. 4<sup>th</sup> edition. Himalaya Publishing House, Private Limited.
3. Bruce E. Rittmann, Perry L. McCarty. (2020). Environmental Biotechnology: Principles and Applications. McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto.

*Mahale Tushar*



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### **Practicals:**

1. To perform the solid waste collection and segregation in different bins (red, blue, green) for proper waste disposal.
2. Experiment involving production of bioenergy from waste (Biodegradable) by conversion to biogas.
3. Performing the preliminary treatment (Bar screening) as an effective step for waste water treatment.
4. Experiment involving use of earthworm (*Lumbricusterrestris*) in improving soil fertility (Vermitechnology).
5. To study the effect of excessive fertilizers on the growth and development of plants.
6. To study the effect of metal toxicity on the growth and development of plants.
7. To prepare biofertilizer using the garden and household waste.
8. Use of biobeds in the waste water treatment from agricultural practices.
9. Visit to nearby pond for study of eutrophication due to use of pesticide and insecticides.
10. Visit to a waste water treatment plant to understand primary, secondary and tertiary clarification.

### **Books recommended**

1. Environmental biotechnology: principles and applications (2020). Bruce E. Rittmann and Perry L. McCarty.
2. Environmental Biotechnology: Concepts and Applications (2005). Hans-Joachim Jördening (Editor), Josef Winter. (Wiley-Blackwell Publisher).

*Mahale T. J.*



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## SEMESTER IV

### Core Course

**Course Title: Enzymology and Bioprocess Technology**

**Course Code: UBTTCC401**

**Course Credits: 06+02**

#### Learning Outcomes

- The course deals with the study and understanding of enzymes as biological catalysts and their biological significance.
- The students learn about various aspects of enzymology like enzyme kinetics, characteristics and structural organization of enzymes and various enzyme catalyzed reactions.
- The students are given an insight into various biophysical and biochemical techniques currently being employed.

#### **UNIT – I**

Biophysical and biochemical techniques: Principle, theory and applications of centrifugation, chromatography, types of chromatography; column, paper, TLC, ion exchange chromatography and affinity chromatography. Theory, principle and applications of Spectrophotometry (UV-VIS) and electrophoresis.

#### **UNIT – II**

History of Enzymology, Enzyme vs chemical catalysts, general characteristics of enzymes, enzyme specificity, Nomenclature and classification of enzymes and their significance, Holoenzyme, apoenzyme, coenzymes, prosthetic group; Enzyme activity units, IU, katal, specific activity, enzyme assay methods, structure of enzyme proteins, Nature of active site, general mechanisms of enzyme action,

#### **UNIT – III**

Enzyme kinetics, Michaelis-Menten equation,  $K_m$ ,  $V_{max}$ , equilibrium and steady state approaches for enzyme kinetics study, Lineweaver-Burk plots, enzyme inhibition reversible. Irreversible forms of inhibitions, Competitive, non-competitive, uncompetitive and mixed inhibition; Approaches for Isolation and purification of enzymes, Applications of enzymes in industries-food processing, dairy, textile, brewery, leather, detergent.

*Maharaj Tufelu*



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## UNIT – IV

Introduction to Bioprocess technology, Concept of Fermentation vs bioprocess, Microbial growth kinetics; types of fermentation processes: batch, continuous, fed batch; media for industrial processes, sterilization of media and air, Bioreactors, design and types of bioreactors; Agitation and aeration, impeller and sparger. Bioprocess monitoring and control, scale up, various bioprocess parameters, Effect of pH, temperature medium components on products synthesis.

## UNIT – V

Bioprocess based products-antibiotics-penicillin; organic acids-citric acid, single cell protein; Downstream processing, steps involved in downstream processing, separation of cells and broth, filtration, centrifugation, chromatography, solvent extraction, effluent treatment and disposal, BOD, COD.

### Books recommended

1. Shuler, M.L. and Kargi, G. (2015). Bioprocess Engineering: Basic Concepts 2<sup>nd</sup> ed., Prentice Hall, Englewood Cliffs.
2. Stanbury, P.F. and Whitaker, A. (2016). Principles of Fermentation Technology, 3<sup>rd</sup> ed., Pergamon Press, Oxford.
3. Doran, P.M. (2012). Bioprocess Engineering Principles. 2<sup>nd</sup> edition. Academic Press, New York.
4. Tripathi, G. (2018). Enzyme Biotechnology. Techno science Publications, Jaipur, India.
5. Palmer, T. and Bonner, P. (2008). Enzymes Biochemistry, Biotechnology, Clinical Chemistry. 2<sup>nd</sup> ed., Horwood Publishing Chichester, England.
6. Nicholas, P. and Stevens, L. (2009). Fundamental of Enzymology. 3<sup>rd</sup> ed., Oxford University Press, New York.

### Practicals

1. Estimation of  $\alpha$ -amylase activity from saliva.
2. Effect of temperature and pH on enzyme activity.
3. Study of enzyme kinetics.
4. Enzyme purification by salt precipitation.
5. Enzyme purification by chromatography.
6. Enzyme purification by electrophoresis.
7. Isolation of yeast from fruits.
8. Study of microbial growth kinetics.
9. Determination of thermal death point and thermal death time.
10. Ethanol production by fermentation in shake flask.

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### Books recommended

1. Plummer D. (2006). Introduction of Practical Biochemistry. 3<sup>rd</sup> ed., TataMcGraw Hill Publishers Co. Ltd., NewDelhi.
2. Singh R. and Sawhney, S.K. (2009). Introduction to Practical Biochemistry. Narosa Publications, NewDelhi.
3. Wilson, K. and Walker, J. (2013). Practical Biochemistry, Principles and techniques (7<sup>th</sup> edition), Cambridge University Press.

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## Skill Enhancement Course (SEC)-II

**Course Title: Food Biotechnology**

**Course Code: UBTTS-401**

**Course Credits: 02+02**

### Learning Outcomes

- The course deals with the understanding of various components of food, their composition and Biochemistry.
- The various flavors added to our daily dietary food is due to trifling in various components of food besides it maintaining the natural nutrition of various low shelf-life foods.
- Minimal processing of food and manufacture of fruit juices, jams etc. is the main component of food industry, providing job opportunities.
- A practical hand on adds to the better understanding and exposure level of the students

### UNIT I

- I. Introduction to various branches of Food Science and Technology, Basic concept of Food: Nutrient, Nutrition, Classification of Nutrients, Balanced diet.
- II. Classification and biochemistry of food and its components, Enzymes and their properties, Role of different enzymes in food processing.

### UNIT II

- I. Methods for food preservation. Application of sugar, salt, antimicrobial and biological agents in preservation of foods. Minimal processing of foods and its Safety criteria.
- II. Definition, quality concepts, Quality testing and analysis parameters: GMP/GLP. Food additives and contaminants effecting Food Safety and Standard Rules.

### **Books recommended**

1. Lehninger, Nelson & Cox. (2013). Principle of Biochemistry, 6th ed., CBS Publication
2. Swaminathan, M., (2014). Handbook of Food and Nutrition, 1st ed., bappco publishers.
3. Rekhi, T., and Yadav, H. (2014). Fundamentals of Food and Nutrition. 1st ed., Elite Publishing House.
4. Desrosier, N.W. & James, N. (2007). Technology of food preservation. AVI Publishers Fellows, P.J

### Practicals

1. Nutritional labelling of Food Products.
2. To perform the clarification of fruit juices using the filtration technique.

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3. To preserve the food using the Refrigeration and freezing techniques.
4. Performing the pasteurization of milk for enhancing its shelflife.
5. Minimal processing of milk for production of dairy products.
6. Study non enzymatic type of browning reaction in Perishable food items.
7. Identification of pigments in fruits and vegetables and influence of pH on them.
8. To study the germination of pulses as minimal processed food with biofortification.
9. Estimation of reducing sugar by Fehling's procedure.
10. Determination of pH of different foods using pH meter.

### **Books recommended**

1. Bamji, M.S., Krishnaswamy, K., Brahmam, G. N. V. (2019). Textbook of Human Nutrition, 4<sup>th</sup> edition. Oxford and IBH Publishing Co. Pvt.Ltd.
2. Srivastava, R.P. and Kumar, S. (2019). Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.
3. De Sukumar. (2007). Outlines of Dairy Technology, Oxford University Press, Oxford.

*Maharaj Tyagi*