SKILL ENHANCEMENT COURSES

SYLLABUS FOR THE

SUBJECT: BIOTECHNOLOGY (VOCATIONAL)

for the award of the Degree in

BACHELOR OF ARTS/ BACHELOR OF SCIENCE/ HONOURS

(Offered under 4-year UG Degree Programme)

(Credit Based Grading System)
under NEP 2020

Batch: 2025–29

GURU NANAK DEV UNIVERSITY AMRITSAR

Skill Enhancement Courses in Biotechnology (Vocational)
(CBGS) (under NEP 2020) (Batch 2025-29)

SCHEME

BIOTECHNOLOGY (VOCATIONAL)

SKILL ENHANCEMENT COURSES

SEC-I

Sr. No.	Course Code	Course Title	Credits L-T-P	Marks
1.		CELL BIOLOGY (THEORY)	2-0-0	50
2.		CELL BIOLOGY (PRACTICAL)	0-0-1	25

SEC-II

Sr. No.	Course Code	Course Title	Credits L-T-P	Marks
1.		SKILL DEVELOPMENT IN BIOTECHNOLOGY-I (THEORY)	2-0-0	50
2.		SKILL DEVELOPMENT IN BIOTECHNOLOGY-I (PRACTICAL)	0-0-1	25

SEC-III

Sr. No.	Course Code	Course Title	Credits L-T-P	Marks
1.		SKILL DEVELOPMENT IN BIOTECHNOLOGY-II (THEORY)	2-0-0	50
2.		SKILL DEVELOPMENT IN BIOTECHNOLOGY-II (PRACTICAL)	0-0-1	25

BIOTECHNOLOGY (VOCATIONAL)

SKILL ENHANCEMENT COURSES

(SEC-I)

CELL BIOLOGY

(THEORY)

Time: 3 Hrs. **L-T-P**

Credits : 2-0-0

Marks: 50

30 Hrs.

Instructions for the paper setters:
Eight questions of equal marks (specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

SECTION-A **(8 Hrs.)**

Cell as a basic unit of living systems. The cell theory Broad Classification of Cell Types: PPLO's, bacteria, plant and animal cells. A detailed classification of cell types within an organism. Cell, tissue, organ and organism as different levels of organizations of otherwise genetically similar cells.

SECTION-B **(8 Hrs.)**

Structure and function of cell organelles, cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.), Mitochondria, chloroplasts, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

SECTION-C **(7 Hrs.)**

Cell Division and Cell Cycle: mitosis, meiosis, stages of cell cycle, binary fission, amitosis and its regulation. Cell-cell interaction Cell locomotion (amoeboid, flagellar and ciliar).

SECTION-D **(7 Hrs.)**

Biological Membranes: ultrastructure of cell membrane, Supramolecular architecture of membranes; Solute transport across membranes; Model membranes and Liposomes.

Course Outcome:

1. The students will be acquainted with the basic concept of cell biology and its relevance in daily life.
2. Hands on Skill: The objectives of this course are to introduce field of cell biology with special emphasis on different types of cells and their studies.
3. Creation of New Knowledge Globally Recognized: Knowledge for utilization of different organisms by utilizing their cellular studies including structure and functions of cell organelles, cell divisions, biological membranes etc.
4. Entrepreneurship Skills to be Imparted: Students should be able to Identify different features of cellular components and further utilization in scientific studies

Books Recommended:

1. De-Robertis, F.D.P. and De-Robertis Jr. E.M.F. (1991) Cell and Molecular Biology, Saunders, Philadelphia.
2. Lodish, H., Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P. and Darnell, J. (1995)
3. Molecular Cell Biology 3rd Edition, Scientific American Books Inc.
4. Geoffrey, M. (2000). The Cell : A molecular approach 2nd Edition, ASM Press.

BIOTECHNOLOGY (VOCATIONAL)

SKILL ENHANCEMENT COURSES

(SEC-I)

CELL BIOLOGY

(PRACTICAL)

Time : 2 Hrs. **L-T-P**
Credits : 0-0-1
Marks: 25
30 Hrs.

Note. The question paper will be set by the examiner based on the syllabus.

1. Study of Cells:
   (a) Prokaryotic cells: Lactobacillus, E. coli. Blue green algae.
   (b) Eukaryotic cells: Testicular material (for studies of spermatogenesis)
2. Study of electron micrographs of various cell organelles-plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic Reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids, etc.
3. Preparation of Permanent Slides: Principles and procedures- Section cutting of tissues and staining of tissues with Haematoxylin/eosin method.
4. Study of permanent slides of various tissues (gut region, liver, lung, spleen, kidney, pancreas, testis, ovary, tongue, skin etc.).
5. Preparation of Buccal Smear for microscopic examination.
6. Barr body observation in human squamous epithelial cells.
7. Microtomy of Plant Tissue specimens (Stem & Root)

Course Outcome:

1. The students will be acquainted with the basic concept of cell biology and its relevance in daily life.
2. Hands on Skill: The objectives of this course are to introduce field of cell biology with special emphasis on different types of cells and their studies.
3. Creation of New Knowledge Globally Recognized: Knowledge for utilization of different organisms by utilizing their cellular studies including structure and functions of cell organelles, cell divisions, biological membranes etc.
4. Entrepreneurship Skills to be Imparted: Students should be able to Identify different features of cellular components and further utilization in scientific studies

Books Recommended:

1. Shah, V.C., Bhatavdekar, J., Chinoy, N.J. and Murthy, S.K. (1988). Essential techniques in Cell Biology. Anand Book Depot, Ahmedabad.
2. Celis, J.E. (1998) Cell Biology: A Laboratory handbook. Vol. 1-3. Academic Press, UK.

BIOTECHNOLOGY (VOCATIONAL)

SKILL ENHANCEMENT COURSES

(SEC-II)

SKILL DEVELOPMENT IN BIOTECHNOLOGY-I

(THEORY)

Time: 3 Hrs. **L-T-P**
Credits : 2-0-0
Marks: 50
30 Hrs.

Instructions for the paper setters:
Eight questions of equal marks (specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

SECTION-A **(8 Hrs.)**

Biofertilizers: Introduction and types and importance of biofertilizers, Microorganisms used in biofertilizers production, Biological Nitrogen fixation VIZ: Rhizobium: Process of nodule formation ,Role of Nif and Nod gene in, Enzyme nitrogenase and its component, Different methods of application of biofertilizers, Strategies of Mass production and packing, Registration of biofertilizers.

SECTION-B **(8 Hrs.)**

Herbal Biotechnology: Introduction to medicinal plants and their medicinal value, Phytochemicals, Essential oil:

definition, extraction and applications in domestic life, industry and other purposes (Eucalyptus, Levender, Rosa grass, Tulsi)

SECTION-C **(7 Hrs.)**

Nutraceuticals and Functional Foods: Introduction to Nutraceuticals as Science, Properties, structure and functions of various Nutraceuticals, Food as remedies, Anti-nutritional Factors present in Foods, Nutraceuticals and Functional, Functional Foods, Nutritional Genomics, Quality Control, Quality Assurance

SECTION-D **(7 Hrs.)**

Bio Entrepreneurship

Overview of bio industries, public/private funding opportunities; Innovation-focused thinking. Preparation of a business plan: socio-economic cost benefit analysis; Statutory and legal aspects. Business and market strategy: pricing, financing, market linkages, branding

Course Outcome:

Experimental or case study design, scientific data analysis, writing and communication, ethical practices, and effective team work. Students will be able to work safely and successfully in a biotechnology laboratory, both individually and as part of a team.

Books Recommended:

1. Fundamentals of Foods, Nutrition and Diet Therapy, (English, Mudambi Sumati R.), New Age International publication,
2. Clinical Dietetics and Nutrition, by Antia F P (Author), Oxford publication.
3. Alpers. D.H. , Stenson W.F. and Bier. D.M., (2002). Manual of Nutritional Therapeutics, 4th edition, Lippincott Williams & Wilkins, Philadelphia, USA.
4. Research pare and e-notes.
5. F. Bakkali, S. Averbeck , D. Averbeck, M. Idaomar. (2008). Biological effects of essential oils – A review. Food and Chemical Toxicology 46: 446–475.
6. R. Amorati, M. C. Foti, L. Valgimigli. (2013). Antioxidant Activity of Essential Oils. Journal of Agriculture and Food Chemistry. 61:10835−10847.
7. A Sharma, D.S. Cannoo. (2016). Comparative evaluation of extraction solvents/techniques for antioxidant potential and phytochemical composition from roots of Nepeta leucophylla and quantification of polyphenolic constituents by RP-HPLC-DAD. Food Measure. Doi10.1007/s11694-016-9349-5
8. Sharma and D. S. Cannoo. (2013). Phytochemical composition of essential oils isolated from different species of genus NEPETA of Labiatae family: a review. Pharmacophore, 4(6): 181-211.
9. Sarikurkcu, B. Tepe, D. Daferera, M. Polissiou, Mansur Harmandar. (2008). Studies on the antioxidant activity of the essential oil and methanol extract of Marrubium globosumsubsp. globosum (lamiaceae) by three different chemical assays. Bio resource Technology, 99: 4239–4246.

BIOTECHNOLOGY (VOCATIONAL)
SKILL ENHANCEMENT COURSES

(SEC-II)

SKILL DEVELOPMENT IN BIOTECHNOLOGY-I

(PRACTICAL)

Time : 2 Hrs. **L-T-P**
Credits : 0-0-1
Marks: 25
30 Hrs.

Note. The question paper will be set by the examiner based on the syllabus.

1. Isolation of Rhizobium from root nodules
2. Production of commercial biofertilizers using Rhizobium.
3. Extraction of essential oils through oil distillation apparatus.
4. To measure total polyphenolic content of the essential oil.
5. Total flavanoid content of the essential oil.
6. Investigating the antioxidant potential of the oils by DPPH assay.
7. Antimicrobial activity of essential oils.
8. Estimation of BMR
9. Estimation of lipid profile
10. Estimation of blood glucose

Course Outcome:

Experimental or case study design, scientific data analysis, writing and communication, ethical practices, and effective teamwork. Students will be able to work safely and successfully in a biotechnology laboratory, both individually and as part of a team.

Books Recommended:

1. Fundamentals of Foods, Nutrition and Diet Therapy, (English, Mudambi Sumati R.), New Age International publication,
2. Clinical Dietetics and Nutrition, by Antia F P (Author), Oxford publication.
3. Alpers. D.H. ,Stenson W.F. and Bier. D.M., (2002). Manual of Nutritional Therapeutics, 4th edition, Lippincott Williams & Wilkins, Philadelphia, USA.
4. Research pare and e-notes.
5. F. Bakkali, S. Averbeck , D. Averbeck, M. Idaomar. (2008). Biological effects of essential oils – A review. Food and Chemical Toxicology 46: 446–475.

BIOTECHNOLOGY (VOCATIONAL)
SKILL ENHANCEMENT COURSES

(SEC-III)

SKILL DEVELOPMENT IN BIOTECHNOLOGY-II

(THEORY)

Time: 3 Hrs. **L-T-P**
Credits : 2-0-0
Marks: 50
30 Hrs.

Instructions for the paper setters:
Eight questions of equal marks (specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

SECTION-A **(8 Hrs.)**

Phlebotomy: Collection of blood samples, preparation and use of different anticoagulants, estimation of CBC, TLC, DLC, bleeding count, clotting time, Platelet count, Reticulocyte count, Morphology of red cells, ESR, PCV

SECTION-B **(8 Hrs.)**

Diagnostic tests: Principles of X-ray, MRI, ultrasonography, CT scan, PET Scan, ECG, ECHO, Biopsy , colonoscopy, Gastroscopy, Eye test, Hearing test

SECTION-C **(7 Hrs.)**

Cancer, Tumor & Cancer Markers : Carcinogens, Oncogene, Clinical applications of tumor markers, Overview of vector borne diseases: Dengue, Chickengunia, PCR based diagnosis of Bacterial, viral & fungal diseases (covid-19, Swine flu, Tuberculosis, Candidiasis)

SECTION-D **(7 Hrs.)**

Bio-medical waste management: Causative methods, transmission methods, investigation, prevention and control of biomedical Infection**,** Non-infectious waste, infected sharp waste disposal, infected non-sharp waste disposal.

Course Outcome:

Experimental or case study design, scientific data analysis, writing and communication, ethical practices, and effective teamwork. Students will be able to work safely and successfully in a biotechnology laboratory, both individually and as part of a team.

Books Recommended:

1. Godkar, PB and Godkar, DP (2008) Text Book of Medical Laboratory Technology, 2nd edition Bhalani Publishing House, Mumbai, India.
2. Martin R. Howard & Peter J Hamilton (2013) Text Book of Hematology, 4th edition, Churchill Livingstone.
3. Robert A. Weinberg (2023). The Biology of Cancer, 3rd Edition. W W Norton & Co Inc:.
4. Lauren Pecorino (2012). Molecular Biology of Cancer, 3rd Edition, Oxford.
5. Singh A., Bachheti P. (2017). Hematology & Blood Banking, 2nd Edition, Vayu Edition of India

BIOTECHNOLOGY (VOCATIONAL)

SKILL ENHANCEMENT COURSES

(SEC-III)

SKILL DEVELOPMENT IN BIOTECHNOLOGY-II

(PRACTICAL)

Time : 2 Hrs. **L-T-P**
Credits : 0-0-1
Marks: 25
30 Hrs.

Note. The question paper will be set by the examiner based on the syllabus.

1. Isolation of Rhizobium from root nodules
2. Production of commercial biofertilizers using Rhizobium.
3. Extraction of essential oils through oil distillation apparatus.
4. To measure total polyphenolic content of the essential oil.
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6. Investigating the antioxidant potential of the oils by DPPH assay.
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