VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Biotechnology
[Academic Year of Implementation: 2019-2020]

Course Outline: Semester-X

For fulfilment of M. Sc. Biotechnology Degree, Student shall get two options in Semester-X (A) Research Based and (B) Skill Based. He / She have to select any one option immediately after end of Semester-VIII or before start of Semester-IX.

[NOTE: Affiliated colleges running M. Sc. Biotechnology Course shall conduct orientation programme for registered students after Semester-VIII to create awareness regarding options available for Semester-X]

A. Research Based:

BT: R-4001	Seminar Presentation
BT: R-4002	Review of Research Publications
BT: R-4003	Research Poster Presentation
BT: R-4004	Dissertation (Plant/Animal/Microbial Biotechnology)

B. Skill Based:

BT: S-4001	Essential Skills for Biopharmaceutical Industry
BT: S-4002	Essential Skills for Bio-services and Bio-Agri Industries
BT: S-4003	Essential Skills for Clinical Laboratories
BT: S-4004	Skill Enhancement Laboratory Work

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M. Sc. Biotechnology Semester–X

A: Research Based

BT: R-4001: Seminar Presentation: A seminar presentation will be made during the external examination by the candidates before the examiners based on the theme area or recent developments in Animal/Microbial/Plant Biotechnology. Power point presentation should be done using 25-30 slides and total time period allotted to candidate shall be 15 minutes which will include time for viva-voce.

BT: R-4002: Review of Published Research Paper/Article: Oral presentation will have to be made on a selected research paper from the reputed Journal by the candidate before external examiners. List of 10 research articles shall be recommended by Board of Studies in Biotechnology every year and to be provided to all affiliated colleges running M. Sc. Biotechnology course.

BT: R-4003: Poster Presentation: One poster related to research work done by the students is to be presented before external examiners. Size of the research poster prepared for external evaluation shall be 2 ft X 3 ft (portrait or landscape) and screen/digital/flex printing is allowed. Poster already prepared for participation in any seminar/conference/symposium during Semester-X can also be considered for evaluation in external examination. Student is required to produce certificate of participation as a proof that he/she has participated during Semester-X and work presented is his/her own work.

BT: R-4004: Dissertation on Biotechnology (Duration for work: Minimum 3 Months)

A project work should be done individually on topic related to any one of the following area justifying Animal, Microbial or Plant Biotechnology. The candidate may be allowed to work at some outside institutions as specified in rules and guidelines. Thesis will be sent for evaluation by college as per directions given by Chairman/Chairperson appointed for BT: R-4004 to external examiner for assessment. Candidate has to present his/her work in the form of presentation in external examination.

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M. Sc. Biotechnology Semester–X

BT: S-4001

ESSENTIAL SKILLS FOR BIOPHARMACEUTICAL INDUSTRY

UNIT-1: BIOPHARMACEUTICALS

1.1 Introduction and classes of biopharmaceuticals
1.2 Gene Therapy
1.3 Manufacture of Biopharmaceuticals
1.4 Pharmacokinetic, toxicological and drug delivery issues
1.5 Case Study of Biopharmaceuticals: Insulin Lispro (Humalog) and Monoclonal Antibodies

UNIT-2: PRODUCTION OF BIOPHARMACEUTICALS

2.1 **Sources of biopharmaceuticals:**
- 2.1.1 *Escherichia coli*
- 2.1.2 Animal cell culture systems
- 2.1.3 Additional systems

2.2 **Upstream Processing for biopharmaceutical production:**
- 2.2.1 Cell banking system
- 2.2.2 Microbial cell fermentation
- 2.2.3 Mammalian cell culture system

UNIT-3: DOWNSTREAM PROCESSING OF BIOPHARMACEUTICALS

3.1 Cell disruption and Initial recovery
3.2 Product concentration
3.3 Chromatographic Purification
3.4 HPLC of proteins and recombinant proteins
3.5 Final product formulation

UNIT-4: PRODUCT ANALYSIS

4.1 Protein based contaminants
4.2 Removal of altered forms of proteins
4.3 Detection of protein based impurities
4.4 Immunological approaches of detection
4.5 Endotoxins and other pyrogenic contaminants

REFERENCES:

1. Rang, H. P., Drug Discovery and development. Churchill Livingstone Elsevier, 2006.
2. Crommelin, D.J.A., Sindelar, R.D. and Meibohm. B., Pharmaceutical Biotechnology: fundamentals and applications. Informa Helthcare, 2008.
3. Walsh, G., Pharmaceutical Biotechnology: Concepts and Applications. John Wiley & Sons, 2007.
4. Walsh, Gary, and Brendan Murphy, eds. Biopharmaceuticals, an Industrial Perspective. Springer Science & Business Media, 1999.

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M. Sc. Biotechnology Semester–X

BT: S-4002

ESSENTIAL SKILLS FOR BIO-SERVICES AND BIO-AGRI INDUSTRIES

UNIT-1: INTRODUCTION OF IN VITRO FERTILIZATION

1.1 Biological basis of fertilization
1.2 Indications for IVF treatment
1.3 Initial investigation of the infertile couple
1.4 Fertilization in assisted reproduction
1.5 Role of Assistant reproduction technology nurse

UNIT-2: OOCYTE AND EMBRYO HANDLING IN A. R. T.

2.1 *In vitro* Maturation in treatment
2.2 Outline of IVM treatment cycle
2.3 Types of media for embryo culture
2.4 Composition of embryo culture media
2.5 Gamete micromanipulation

UNIT-3: SPERM PROCESSING IN A. R. T.

3.1 Sperm collection
3.2 Sperm preparation methods
3.3 Post-separation treatment of spermatozoa
3.4 Intracytoplasmic sperm injection
3.5 Protocols of cryopreservation

UNIT-4: PRACTICAL SEED TECHNOLOGY

4.1 Types of seeds: Nucleus seed, Breeder seed, Foundation seed, Registered seed and certified seed
4.2 Role of male sterility in hybrid production
4.3 Assessment of genetic purity of lines and hybrids
4.4 Characterization of Lines and Hybrids for Intellectual Property Rights Protection
4.5 Recent advancement in crop improvement via genome editing: a case study for application of CRISPR- Cas9/Cpf1 in crop improvement

REFERENCES:

1. Gardner DK, Weissman A, Howles CM, Shoham Z, editors. Textbook of assisted reproductive techniques 5th Ed: Volume 2: Clinical perspectives. CRC press; 2018.
2. Gardner DK, editor. *In vitro* fertilization: a practical approach. CRC Press; 2006 Sep 29.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Biotechnology Semester–X

BT: S-4003

ESSENTIAL SKILLS FOR CLINICAL LABORATORIES

UNIT-1: CLINICAL MICROBIOLOGY

1.1 Culture media: Composition, types and forms
1.2 Study of *Escherichia*, *Salmonella*, *Leptospira* and *Mycobacterium*
1.3 Routine urine examination
1.4 Routine examination of faeces
1.5 Routine examination of semen and semen washing
1.6 Routine examination of sputum

UNIT-2: CLINICAL BIOCHEMISTRY

2.1 Cardiac profile tests
2.2 Kidney function tests
2.3 Liver function tests
2.4 Laboratory determination of lipids in serum
2.5 Determination of hormones
2.6 Determination of glucose and glycosylated haemoglobin

UNIT-3: DIAGNOSTIC SEROLOGY

3.1 Widal test and Immunological pregnancy test
3.2 Detection of rheumatoid factor and CRP
3.3 Detection of HBsAg
3.4 Detection of Dengue Fever and *Leptospira* IgM
3.5 Detection of malarial parasite by strip test and microscopy
3.6 Detection of allergens and antinuclear antibodies

UNIT-4: CYTOGENETICS AND AUTOMATION IN CLINICAL LABORATORIES

4.1 Cell culture, Karyotyping and FISH
4.2 Prenatal chromosomal diagnosis
4.3 Molecular diagnosis of genetic diseases
4.4 Automation in bacteriology
4.5 Discrete autoanalyzers
4.6 Introduction to working of semi-autoanalyzer

REFERENCES:

1. Godkar P, Godkar D. Textbook of Medical Laboratory Technology. 3rd Ed. Mumbai: Bhalani Publishing House; 2014.
2. Murray P. Manual of Clinical Microbiology. Washington, DC: ASM Press; 2011.

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M. Sc. Biotechnology Semester–X

BT: S-4004

SKILL ENHANCEMENT LABORATORY WORK

1. Purification his-tagged recombinant proteins from bacterial hosts.
2. Detection of Endotoxins in pharmaceutical products by LAL test.
3. Routine chemical and microscopic examination of urine.
4. Microbiological diagnosis of suspected infection of *Salmonella*.
5. Microbiological diagnosis of Urinary Tract Infection.
6. Estimation of blood sugar by GOD method.
7. Estimation of blood urea by DAM method.
8. PCR based diagnosis of tuberculosis.
9. Identification and differentiation of Bt-cotton and Non Bt-cotton.
10. Microscopic examination of semen to study spermatozoa abnormalities (Demonstration).
11. Dilution and washing of spermatozoa (Demonstration).
12. Study of Intracytoplasmic sperm injection process (Demonstration).
13. Study of the Cryopreservation, Thawing and Vitrification of embryo (Demonstration).
14. Visit to the Assisted Reproduction Treatment (ART) centre / Clinical diagnostic laboratory / Seed research facility or Agriculture biotechnology research laboratory.

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Guidelines & Rules for Dissertation:

-Identification and confirmation of institute for dissertation shall be done during Semester-IX. Problem identification (Aim and Objectives) and literature survey in consultation of internal guide/co-guide shall also be done during Semester-IX.

-Those that opt for pursuing dissertation at other place will get 50% of their fees collected by other institute with maximum limit of Rs. 10,000/- from mother institute from the fees he/she has paid of respective semester.

-Place of dissertation other than his/her institute shall be a one of the following:

1. All UGC recognized University Post Graduate Departments.

2. All Agricultural Universities.

3. All National and State Level Research Institutes having DSIR/NABL certification.

4. Reputed Biotechnology/Pharmaceutical Industries having R & D and Q. C. facilities.

-In external evaluation of dissertation, 100 marks shall be for thesis assessment and 100 marks shall be for power point presentation and viva-voce examination.

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