SRI VENKATESWARA UNIVERSITY

S.V.U COLLEGE OF SCIENCES

TIRUPATI - 517 502

DEPARTMENT OF BIOCHEMISTRY

Re-Structured P.G. Programme (CBCS) as per NEP 2020, NHEQF and Guidelines of APSCHE

(With effect from the batch of Students admitted from the academic year 2024-25)

M.Sc Biochemistry (Immunology)

SRI VENKATESWARA UNIVERSITY:: TIRUPATI
SVU COLLEGE OF SCIENCES, Department of BIOCHEMISTRY
Re-Structured P.G. Programme (CBCS) as per NEP 2020, National Higher Education Qualification Frame Work (NHEQF) and Guidelines of APSCHE
(With effect from the batch of Students admitted from the academic year 2024-25)
M.Sc Branch II (B) : M.Sc Biochemistry (Immunology)

SEMESTER - I								
S. No	**Course**	**IMT Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	101	Core Course-1: Intermediary Metabolism I	4	4	70	30	100
2		102	CC – 2(A): Biochemical and Biophysical Techniques CC – 2(B): Food safety and quality management	4	3	50	25	75
3		103	CC – 3(A): Biomolecular Chemistry CC – 3(B): Plant Biochemistry	4	3	50	25	75
4	*P	104	Practical I (related to CC 2 & 3)	6	2	35	15	50
5	SOC	105	Skill Oriented Course – 1(A): Microbiology Skill Oriented Course – 1(B): Inheritance Biology	4	3	50	25	75
6		106	Skill Oriented Course – 2(A): Molecular Biology SOC – 2(B) : Biotechnology and Nanotechnology	4	3	50	25	75
7	*P	107	Practical II (related to SOC 1 & 2)	6	2	35	15	50
		108	108 Open Online Trans disciplinary Course-1		2			
			Total	**36**	**22**	**340**	**160**	**500**
8	Audit Course	109	Indian Knowledge Systems – 1 (Indian Health Sciences)	4	0	0	100	0

- **CC (Core Courses) - 1st Core Course is mandatory and 2nd& 3rd Core Courses Student can choose one from each code**
- ***SOC (Skill Oriented Courses) – Student can choose one from each code**
- ***Practical – I relating to 2nd& 3rd Core Courses and Practical - II relating to 1st& 2nd Skill Oriented Courses (SOC)**
- Audit Course – Zero Credits but mandatory with only a Pass.

SEMESTER - II								
S. No	**Course**	**IMT Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	201	Core Course-4: Intermediary Metabolism II	4	4	70	30	100
2		202	CC– 5(A): Molecular Physiology CC–5(B): Molecular Signaling & Immuno-Technology	4	3	50	25	75
3		203	CC – 6(A: Enzymology CC – 6(B): Ecological Principles	4	3	50	25	75
4	P	204	Practical III (related to CC 5 & 6)	6	2	35	15	50
5	SOC	205	Skill Oriented Course–3(A): Nutritional Biochemistry Skill Oriented Course – 3(B) : Nutraceuticals	4	3	50	25	75
6		206	Skill Oriented Course –4(A) : Genetic Engineering Skill Oriented Course – 4(B) : Metabolomics	4	3	50	25	75
7	P	207	Practical IV (related to SOC3 & 4)	6	2	35	15	50
8	OOTC	208	Open Online Trans disciplinary Course-1	-	2	-	100	100
			Total	**36**	**22**	**340**	**260**	**600**
9	Audit Course	209	Indian Knowledge Systems – 2 (Human Ethics)	4	0	0	100	0

- **CC (Core Courses) – 4th Core Course is mandatory and 5th& 6th Core Courses Student can choose one from each code**
- ***SOC (Skill Oriented Courses) – Student can choose one from each code**
- ***Practical - III relating to 5th& 6th Core Courses and Practical - IV relating to 3rd& 4th Skill Oriented Courses (SOC)**
- ***Open Online Trans disciplinary Course (OOTC) - Students can choose any relevant course of his / her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL, etc.,**
- **Audit Course – Zero Credits but mandatory with only a Pass**

SEMESTER - III								
S. No	**Course**	**IMT Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	301	Core course-7: Endocrine Biochemistry	4	4	70	30	100
2		302	Core Course – 8(A) : Immunology Core Course – 8(B) : Computational Biology	4	3	50	25	75
3		303	Core Course – 9(A) : Applied and Molecular Immunology Core Course – 9(B) : Cancer Biology	4	3	50	25	75
4	P	304	Practical V (related to CC 8 & 9)	6	2	35	15	50
5	SOC	305	Skill Oriented Course – 5(A) : Technical Writing, Biostatistics, Bioinformatics and Omics SOC– 5(B): Research Methodology Tools Techniques, Research Publication and Ethics	4	3	50	25	75
6		306	Skill Oriented Course –6(A): Clinical Immunology SOC –6(B): In Silico Drug Design and Discovery	4	3	50	25	75
7	P	307	Practical VI (related to SOC 5 & 6)	6	2	35	15	50
8	OOTC	308	Open Online Trans disciplinary Course-2	-	2	-	100	100
			Open Elective (Offered by other Dept.) **IMT 308 Open Elective: Endocrine Biochemistry**		2	70	30	100
*	Seminar / tutorials / remedial classes and Quiz as part of internal assessment			4				
			Total	**36**	**20**	**340**	**260**	**600**

- **CC (Core Courses) – 7th Core Course is mandatory and 8th& 9th Core Courses Student can choose one from each code**
- ***SOC (Skill Oriented Courses) – Student can choose one from each code**
- ***Open Online Trans disciplinary Course (OOTC) - Students can choose any relevant course of his / her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL, etc.,**
- ***Practical - V relating to 5th& 6th Core Courses and Practical - VI relating to 5th& 6th** Skill Oriented Courses (SOC)'

SEMESTER - IV								
S. No	**Course**	**IMT Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	OOSD C/SDC	401	Open Online Skill Development Courses/Two Skill Development Courses (Select Any Two out of Three Courses)	-	8			200
			401 a) Immunotechniques	06	4	70	30	100
			401b) **Immunological Diseases and Therapeutics**	06	4	70	30	100
			401 c) Immunopharmacology (E)	06	4	70	30	100
2	PW	402	Project Work – Orientation classes	12	12	300	0	300
*	Conducting classes for competitive exams, communication skills, UGC / CSIR and NET / SLET examinations			12	-	-	-	-
			Total	**36**	**20**	**440**	**60**	**500**
Total Semesters				**144**	**84**	**1320**	**880**	**2200**

- Open Online Skill Development Course (OOSDC) - Students can choose any **Two** relevant courses of his / her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL, etc., **to get 8 credits (with 4 credits from each course)**

SEMESTER III

IMT 301 Core Course 7: Endocrine Biochemistry (Credits 4)

Course Objectives: The main objectives of this course are to:

1. This course presents an introduction and provides a comprehensive, balanced introduction to Endocrine glands, their secretions and functions.
2. To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various hormones.

Unit I

Endocrine system – organization of the endocrine system. General features and classification of hormones, mechanism of action of hormones, hypothalamic hormones, chemistry, biosynthesis, Secretion, physiological functions, regulation and disorders of anterior and posterior pituitary hormones, LH, FSH, Growth hormone, prolactin, oxytocin, Vasopressin. Hormones of the pineal gland – Serotonin and melatonin.

Unit II

Thyroid hormones – chemistry, biosynthesis, secretion, physiological function, regulation and disorders, hypo and hyperthyroidism, tests for thyroid function. Antithyroid drugs and calcitonin.

Parathyroid gland – Parathormone and disorders of Parathormone. Role of calcitonin in calcium and phosphate homeostasis in blood.

Unit III

Pancreatic and gastrointestinal hormones – Biosynthesis, secretion, physiological functions and regulation of insulin and glucagon. Role of insulin and glucagon in carbohydrate, lipid and protein metabolism. Disorders of pancreas. Gastrin, secretin, Cholecystokinin.

Unit IV

Adrenal hormones – Chemistry, biosynthesis and functions of adrenal medullary and adrenal cortical hormones. Cortisol, corticosterone, aldosterone, adrenaline, nor-adrenaline, Disorders of adrenal hormones.

Hormones of reproduction – Gonadal hormones (testosterone), chemistry, biosynthesis and physiological functions of androgens, estrogens and progesterone, inhibin.

Hormonal regulation of menstrual cycle, placental hormones, contraception, reproductive disorders.

Recommended Books:

1. Text book of Biochemistry and Human Biology by Talwar G.P., Prentice Hall India.
2. Human Physiology and Mechanism of distance. Guyton 3rd Ed. Igkushoen/Seunders.
3. Clinical Biochemistry, Vol. 1 and 2, Williams *et al*., Heinemann Medical, 1978.
4. Lynchs Medical Laboratory Technology by Raphael, S. S., 4th Ed. Igkushoen/Seunders.
5. Text Book of Endocrinology, William.
6. General Endocrinology – Turner.
7. Biochemical Endocrinology of the Vertebrates – E. Fruden and H. Lines.
8. Foundation of Modern Biochemical Series, Prentice Hall Inc., 1971.
9. Metabolic and Endocrine Physiology – Jay Teppermann.
10. Metabolic Pathways – Green Berg.
11. Intermediary Metabolism and its regulation – Larner
12. Principles of Biochemistry – White A., Handler P and Smith.
13. Receptors and Hormone action. Receptors and Recognition series. Medical physiology by A.C. Guytom.

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

Obtain a deep knowledge regarding Endocrine glands and their secretions (K1 & K2).

Gives an idea about structure and functions of endocrine glands (K1 & K2)

Provides knowledge about Hormone and its regulation (K2, K3 & K4)

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

IMT 302 Core Course 8(A): Immunology (Credits 3)

Course Objectives: The main objectives of this course are to:

1. The study of immunology helps the students in understanding the immune system in all organisms, especially the physiological functioning of the immune system in states of both health and disease.
2. To understand the malfunctions of the immune system in immunological disorders such as autoimmune disease, hypersensitive, immune deficiency and transplant rejection.
3. To understand the physical, chemical and physiological characteristics of the components of the immune system in *in vitro*, *in situ* and *in vivo*.

Unit I

Lymphoid organs (primary and secondary), organization of the immune system, Types of immunity – Natural and acquired, specific and non-specific immune response. Cells and organs of the immune system, antigenic determinants/Epitopes.

Haptens, adjuvants, classification, structure and biological functions of immunoglobulins, Isotypes, allotypes and idiotypes. Theories of antibody formation.

Unit II

Active and passive immunity, Humoral and cell mediated immune response, T-Cell and B-Cell activation. Antigen processing and presentation.

T-Cell and B-Cell receptors, Complement system, Alternate and classical pathways of complement activation. Complement fixation tests. Types of Interferons and Cytokines. Major Histocompatability Complex: MHC in mice and HLA in man-fine structure and functions.

Unit III

Transplantation: Terminology, Auto graft, Isograft, Allograft, Xenograft, Immunological basis of transplantation reactions, GVH reaction, Immuno suppression, General mechanisms of Immune suppression, Immune suppression, drugs (azothioprine, methotrexate, cyclophosphamide, cycosporin-A, Steroids). Blood groups: AB, Rh system, Lewis-Luthern systems, significance, practical application of immuno methodology in blood transfusions, Erythoblastosis faetalis.

Disorders of immune response – Autoimmune diseases – Hashimoto's thyroiditis, Rheumatoid arthritis (RA), Systemic lupus erythomatosis (SLE). Immuno deficiencies – Introduction, primary and secondary deficiencies. T-cell, B-cell and combined immune deficiencies, Compliment system deficiency. SCID, AIDS. Cancer immune therapy.

Unit IV

Hypersensitivity reactions: Antibody mediated type II, anaphylactic reactions, Antibody mediated, type II cytotoxic reactions, Immune complex reactions Type – III, T-cell mediated delayed type hypersensitivity Type-IV**.** Immunological tolerance and tolerance induction.

Antigen-antibody interactions, precipitation reactions – immune diffusion, radial immuno diffusion, immuno electrophoresis, immunofluorescence, Western blotting, Radioimmunoassay (RIA) and ELISA – Principle, Methodology and applications. Hybridoma Technology, Production of polyclonal and monoclonal antibodies and their application,

Recommended Books:

1) Essential immunology – Ivan M. Roitt.
2) Immunology – a short course elibezamini and Sidney Leskowitz, Alan R. Lisi Inc. New York, 1988.
3) Immunology III, Joseph A. Bellanti Igaku – Shein Saunders International Ed. 1985.
4) Immunology at a glance J.H. L. Playfeir 4^{th} Ed. Blackwell Scientific Publication 1987.
5) Acids to Immunology D.M. Wier Churchill, Livingtons 1986.
6) Fundamentals of Immunology, Myrvik and Weiser, 1984.
7) Fundamentals of Immunology, Bier *et al*, Springer 1986
8) Textbook of Biochemistry and Human Biology, Talwar G.P. Prentice Hall, 1980.
9) Basic and Clinical Immunology – Stites et al., 4^{th} Ed. Lange 1982.
10) The Immuno-system, Mc Connell et al., Blackwell Scientific 1981.
11) Fundamentals of Immunology – William C. Boyed (Wiley Toppan)
12) Introduction to Immunology – John W. Kinball.
13) Fundamentals of Immunology – Otto S. View and others.
14) Immunology – D.M. Weir.
15) Immunology – Janis Kuby,

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Obtain the knowledge about the immune system, as a host defense system comprising many biological structures and processes within an organism that protects against disease (K1 & K2).
2. Concentrate on the antigen and antibody reactions and immunological techniques (K1 & K2).
3. Understanding about the two branches of the immune system such as humoral immunity and cellular immunity, cytokines and complement system (K1 & K2).
4. Clear about the hypersensitivity reaction or intolerance undesirable reactions produced by the normal immune system, including allergies and autoimmunity (K1 & K2).
5. Obtain the knowledge about the hybridoma technology is to produce large numbers of identical antibodies (monoclonal antibodies) and a recombinant DNA technology that involves inserting the DNA encoding an antigen that stimulates an immune response (K1, K3 & K4).

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Practicals: Immunology (Credit 1)

1. Separation of serum and plasma
2. Lymphocyte separation and identification of viable lymphocytes.
3. Fluorescent antibody technique
4. Raising of antibodies to soluble antigen in rabbits.
5. Single Radial Immunodiffusion.
6. Ouchterlony Double Immunodiffusion.
7. Rocket immunoelectrophoroesis.
8. Cross over Immunoelectrophoresis.
9. Graber and Williams Immunoelectrophoresis.
10. Haemeagglutination tests for identification of human blood groups.

IMT 302 Core Course 8(B): Computational Biology

Course Objectives: The main objectives of this course are to:

1. Know the various disciplines of Bioinformatics and biological databases.
2. Understand the molecular modeling, drug design and Molecular visualization.
3. Know the aspects Proteomics, its significance and applications.
4. Assimilate the concepts of System Biology tools and Metabolomics.
5. Acquire knowledge on Genomics, HGP, and ELSI.

Unit-I

Introduction to Bioinformatics: Various disciplines and applications of Bioinformatics- Databases, Genome analysis, fundamentals of genomics, proteomics, metabolomics, phylogenetics, structure prediction, drug design, pharmacogenomics.

Biological Databases: General introduction, need of DB, database searching options- sequence alignment, An overview of Public molecular DATABASES (EMBL, GenBank, DDBJ, GSDB) - SWISS-PROT database, PDB, Database querying NCBI.

Unit-II

Molecular Modeling & Drug Design: Homology modelling, Model building tools- Preparation of alignment and template files. Building protein 3-D model with Swiss PDB viewer, energy minimization. Molecular Visualization Packages: Rasmol - basic utilities and commands for protein visualization in 3-D. study of protein-DNA interactions, stereo mode, visualization of hetero atoms, HOH, metals, electron density maps, N and C terminals, disulfide bonds. Phases of drug development and drug design in genomic era.

Unit-III

Proteomics: Introduction, principle, technique, 2-D database. Gel analysis software, post gel analysis, MALDI-TOF, MS analysis. Significance and applications of proteomics in biology. Protein – Protein Interaction Network, Signalling Pathways, key metabolic pathways; network motifs, Systems Biology tools and standards. Study of Metabolomics.

Unit-IV

Genomics: Micro RNAs, NGS, Genome Projects: General introduction to genome projects. Human Genome Project (HGP) - Science behind HGP, facts at genome, chromosome and gene level. Benefits of HGP in medicine, agriculture, evolution, forensic science. Ethical Legal Social Implications (ELSI) of HGP- fairness in the use of genetic information, privacy and confidentiality, psychological impact and stigmatization. Genetic testing-standards, quality control and commercialization.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Gives an idea about Bioinformatics and its various disciplines (K1& K2).
2. Gives a clear understanding about Biological Data bases and sequence alignments. (K2 & K3).
3. Gives a clear Knowledge on Molecular modeling and drug designing. (K2 & K3).
4. A Clear Knowledge of proteomics and tools and techniques related to it. (K2 & K3).
5. Provides knowledge on metabolomics. (K2 & K3).
6. Acquires knowledge on genomics, HGP and its impact in different modes. (K2, K3 & K4).

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Practicals: Computational biology (Credit 1)

1. Extraction of DNA and Protein from various tissues
2. Isolation of Plasmid DNA
3. Quantification of DNA – Spectrophotometry.
4. Quantification of protein – Spectrophotometry.
5. Chromatography: Paper, Thin layer
6. Electrophoresis: AGE, PAGE, SDS-PAGE
7. Amplification of DNA - Polymerase Chain Reaction.
8. *In silico* Experiments: Genomics- orf finder, Gene finder,
9. Sequence alignment- pair-wise –Blast, Dot plot analysis
10. Multiple sequence alignment

Recommended books

1. Benson, G. (2003). Algorithms in Bioinformatics. Springer Berlin Heidelberg.
2. Rastogi, S. C., Mendiratta, N., & Rastogi, P. (2013). Bioinformatics: Methods and Applications-(Genomics, Proteomics and Drug Discovery). PHI Learning Pvt. Ltd.
3. Primrose SB. Principles of Genome Analysis: a guide to mapping and sequencing DNA from different organisms. 2nd Ed.
4. Genome Mapping: A practical approach. Dear P (Editor). 1st Ed. 1997. Oxford University Press: Oxford, New York.
5. Developing Bioinformatics Skills. Alfonso Valencia and Blaschke. L (2002) Oreille's Publication.
6. Bioinformatics sequence, structure and data banks ed. By Des Higgins Willie Taylor.

References on WEB

1. European Molecular Biology Laboratory (EMBL) http://www2.ebi.ac.uk/Help/General/general.html
2. UK Human Genome Mapping Project - Resource Center (HGMP-RC) http://www.hgmp.mrc.ac.uk/
3. SeqNet: UK Node of European Molecular Biology Network (EMBNet) http://www.seqnet.dl.ac.uk/About/SEQNET/
4. GenBank http://www.ncbi.nlm.nih.gov/Genbank/
5. DNA Databank of Japan (DDBJ) http://www.ddbj.nig.ac.jp

IMT 303 Core Course 9(A): Applied and Molecular Immunology (Credits-3)

Course Objectives:

1. To acquaint them with the hybridoma technique and its clinical applications.
2. To impart knowledge on Immobilization of enzymes.
3. To make them understand the concept of Vaccines and Subunit vaccines.
4. To impart knowledge about intellectual property rights.

Unit I

Immunodiagnostics and preparation of tools: Hybridoma technique, monoclonal antibodies production, myeloma cell lines, fusion of myeloma cells, selection of hybridomas, Screening, purification and application (biochemical research, clinical diagnosis and treatment) of monoclonal antibodies

Unit II

Immobilization of enzymes, Examples and their industrial and clinical applications. Production of DNA antigens. Transgenic organisms and their uses, Patenting, General Agreement on Trade and Tariff {GATT} and Intellectual Property Rights

Unit III

Histamines, Serotonins, vasoactive peptides and ergot alkaloids, Immunomodulation therapy, infiltration of cells and their diseases, Immunosuppressive drugs and antibodies, glucocorticoid drugs, malignancy therapy, role of TNFa, Immunoglobulin genes.

Unit IV

Vaccines and Subunit vaccines-against Herpes Simplex virus, Foot and Mouth disease, live recombinant vaccines-attenuated (Cholera, Salmonella), Vector vaccines directed against viruses and bacteria. Purified vaccines. DNA vaccines. Antifertility vaccines.

Recommended Books:

1. Harper's Review of Biochemistry.
2. Leninger's principles of Biochemistry
3. Biochemistry – Lubert Stryer.
4. Fermentation Technology (2nd Ed.) Standury (Pergman press)
5. Biotechnology: Textbook of Industrial microbiology 2nd Edit. By Wulf Crueger and Anneliese Crueger (2000).
6. Molecular biotechnology: Principles and Applications of Recombination DNA. (1996) Bernard R. Glick and Jack. J. Pasternak (Panima Publishing Corporation)
7. Principles of Gene manipulation: An Introduction to genetic Engineering (5th) R.V. Old and S. B. Primrose (Blackwell Scientific Publications).
8. Principles of Biotechnology (1985) Alen Weisman (Surrey University Press).
9. Concepts in Biotechnology (1996) Ed., D.Balasubramaian, K.Dharmalingam, J.Green and K. Jayaraman (University Press).
10. Industrial Microbiology, Miller and Litsowky, Mc Graw- Hill, 1976.
11. Industrial Microbiology, L.E.Casida, JR. New Age International. (1995).
12. Industrial Microbiology (Prescott & Dunn), Ed by G.Reed, CBS Publishers.
13. Immobilized enzymes (1978) by Ichiro Chibata, Halsted Press Book.
14. Basic and Clinical pharmacology by BT Katzung, 10th Edn, McGraw Hill Edn, Oxford, 2008

Course Outcomes:

1. Develop skill in production of monoclonal antibodies.
2. How better enzyme immobilization enhances its activity and their industrial and clinical applications.
3. Familiar with different types of vaccines and how they help in prevention of diseases.
4. Acquire the knowledge on IPR and procedures for patent filing.

Practicals: Applied and Molecular Immunology (Credit-1)

1. Raising of antibodies to soluble antigen in rabbits.
2. Single Radial Immunodiffusion.
3. Ouchterlony Double Immunodiffusion.
4. Rocket immune electrophoroesis.
5. Cross over Immuno electrophoresis.
6. Graber and Williams Immuno electrophoresis.
7. Haemeagglutination tests for identification of human blood groups.

IMT 303 Core Course 9(B): Cancer Biology (Credits-3)

Course Objectives:

The objective of this course is:

1. To learn the principles of cancer biology and identify the main cellular and molecular mechanisms underlying the initiation and progression of neoplastic growth.
2. The focus of this course is on the difference between malignant cells and normal cells.
3. It explores the animal models of cancer study and the multi-step process of tumor progression leading to invasive metastatic growth.
4. The course will also examine the role of stem cells and their potential for differentiation in different types of malignancies and it includes recent advances in molecular diagnostics and therapy of cancer.

Unit-I

Introduction to Cancer Biology: Definition and classification; evolution of cancer cells; cellular oncogenes; oncogene, viral-oncogene, tumorigenicity, tumor suppressor genes; p53, Rb and PTEN. Cancer metastasis, migration & invasion, metastasis steps, epithelial to mesenchymal transition, angiogenesis.

Unit-II

Microenvironment of Tumor cells: Stroma interaction, adipose stromal cells, cancer associated fibroblast, tumor associated macrophages, mesenchymal stem cells, impact of tumor-stroma interaction on tumor development, tumor immunology; interferons, T cells, cancer stem cells; origin, isolation and culture of cancer stem cells, animal models of cancer study; xenograft and metastasis models.

Unit-III.
The difference between Normal cell versus Cancer cell. Cell immortalization and tumorigenesis, Oncogenes and tumor suppressor genes, Maintenance of Genomic integrity and development of cancer, Invasion and metastasis- Epithelial to Mesenchymal transition, Cancer stem cells-Basics and how to targeting cancer stem cells, Rationale treatment of cancer and Special emphasis on few imp cancers which are prevalent in India- Breast cancer, Oral cancer, etc
Unit-IV
Cancer growth and metastasis: Growth factor, receptors and cancer; in vitro testing of stemness property of cancer stem cells; detection and monitoring of metastasis process in animal models; osteoblastic & osteolytic metastasis.
Success and failure of chemotherapy, targeted specific therapy, monoclonal antibody for cancer treatment, micro-RNA mediated cancer treatment and targeted drug delivery, drug resistance, molecular diagnosis and stem cell therapy.

Expected Course Outcomes:
Upon successful completion of this course students should be able to:

1. Identify the main cellular mechanisms leading to initiation and progression of cancer growth. Describe the characteristics of cancer cells that explain high mortality rate.
2. Define the role of oncogenes and mutations in cancer and explain why several types of cancer have heritable traits and family history.
3. Define the main factors contributing to metastatic growth. Identify the role of stem-like cells, their properties and contribution to tumor progression. List and describe the main factors controlling the evolution of cancer cell populations.
4. Develop a solid understanding of the main methods used in the modern studies of cellular and molecular mechanisms of cancer.
5. Demonstrate core knowledge of the cellular targets and molecular mechanisms of traditional and novel cancer therapies.

Practicals: Cancer biology (Credit-1)

1. Preparation of culture media.
2. Establishment of primary cell culture: mouse splenocyte culture.
3. Handling mammalian cell lines: thawing, culture maintenance and cryopreservation.
4. Cell counting using hemocytometer.
5. Cell viability and proliferation assays: i. Trypan blue exclusion test, ii. MTT assay, iii. Propidium Iodide staining, iv. CFSC labeling.
6. Mammalian cell transfection (transient).
7. Immuno fluorescence detection to check transfection efficiency (using fluorescence and confocal microscopes).

Recommended books:

1. Biology of Cancer by Robert Weinberg 2.Principles Of Cancer Biology - Lewis J Kleinsmith
2. Oxford Textbook of Cancer Biology. Edited by Francesco Pezzella, Mahvash Tavassoli and David Kerr.
3. Cancer Biology by Raymond Ruddon.

IMT 305 Skill Oriented Course 5(A): Technical writing, Biostatistics, Bioinformatics and Omics

Course Objectives: The main objectives of this course are to:
1. Know the nuances of technical writing of scientific documents like thesis, project proposals and journal articles.
2. Understand the statistical tools commonly used in biological research.
3. Know the aspects fundamental to research and to understand the methods of research
4. Assimilate the concepts of hypothesis testing and its importance in research
5. Improve computer based skills for analyzing biological data.

Unit I
Technical Writing: Sentence writing, paragraph writing, story writing, review writing, various types of letters writing.
Preparation of a research project proposal: Selection of appropriate funding agency, Informal proposal, formal proposal, submission of technical report (format: title page, introduction, aims of the proposal/research, methodology, results, interpretation of results, references, acknowledgments, budgetary allocations), execution of results, submission of progress report (year wise), scientific communications (Articles, papers, reviews etc.,) and critical comments writing.
Unit II
Scope of statistical methods in life sciences. Variables, Measure of central tendency: Mean, median and mode, Measuring Dispersion: Standard deviation, co-efficient of variation, probability, probability distributions, test of significance and estimation, Linear regression and correlation, the chi-square test, ANOVA, t-Test and F-Test.

Unit III

Bioinformatics: Branches of Bioinformatics, scope of bioinformatics, useful sites on the internet: Data bases and search tools: NCBI (http://www.ncbi.nlm.nih.gov/), EMBL serve: (http://www2.ebi.ac.uk/services.html), sequence alignment: gene bee multiple sequence alignment (http://www.genebee.msu.su.), Tree view (http://taxnomy.zoology.gla.ac.uk/rod/treeview.html), Gene doc (http://www.cris.com/ketchup/genedoc.shtml). Sequence analysis, repetitive elements, Image analysis, office applications, logic development. Introduction to Proteomics and genomics.

Unit IV

Genomics, Transcriptomics, proteomics, metabolomics and omic data bases. Sequencing by conventional, automated and next generation sequencing approaches-advantages and limitations. ARDRA, RISA, DGGE/TGGE, Multiple Displacement Amplification (MDA). Whole genome analysis. Advantages and limitation of Metagenomics approach. Culturomics. Proteome, Functional proteomics, metaproteome. Proteome tools – 2-DE Mass spectrometry analysis. Identification of post-translational modifications: Phosphorylation, Glycosylation, Acetylation. Sequence based protein prediction: Homology or comparative modeling, Remote homology (Threading), Protein function prediction. Application of omic technologies in Bioprospecting. Integration of omic platforms, interactomics, Systems biology.

Recommended Books:

1) Bio-statistics, A foundation for analysis in the Health (7th Ed. 1999) by WWW Daniel and Sons Inc., New York.
2) Introduction to Bio-statistics and Research Methods by P.S.S. Sundar Rao and Richard.
3) Bio-statistics by Sokal and Rolf.
4) Bioinformatics, Sequence, Structure and Databanks by Des Higgins Willie Taylor (2000).
5) Introduction to Bioinformatics by T.K. Altwood and D.J Parry- Smith (Oearson Education Asia 1999).
6) UGC-MRP guidelines and format, DST and DBT guidelines and formats for project praposals.
7) Authour guidelines of any UGC recognized journals.
8) English grammar books for formal and informal letter writing.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

7. Gives an idea about thesis writing, funding agencies and patenting (K3 & K4).
8. Helps to collect data and organize the data (K1 & K2).
9. Gives a clear understanding about the basic statistical analysis (K1 & K2).
10. A Clear Knowledge of probability and its application (K2 & K3).
11. Provides the sampling distribution techniques and its analysis (K2 & K3).
12. Expertise in computer based analysis of biological data (bioinformatics) (K4, K5 & K6).

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Practicals: Technical writing, Biostatistics, Bioinformatics and Omics (Credits 1)

1. Article writing
2. Standard Deviation
3. Mean, Median and Mode
4. ANOVA
5. Survey of some genome, metagenome, proteome data bases.
6. nBLAST, pBLAST, Multiple Sequence Analysis
7. Gene Annotation of genome sequences (ORF finding)
8. Amplification of 16S DNA
9. Phylogenetic analysis using 16S rDNA typing
10. Native gel, SDS PAGE and 2D gel Electrophoresis.

IMT 305 Skill Oriented Course 5(B): Research methodology tools techniques, Research Publication and Ethics

Course Objectives:

1. The primary objective of this course is to enable the students, irrespective of their disciplines, in developing the most appropriate methodology for their research studies; and
2. To make them familiar with the art of exploiting different research methods and techniques.
3. Students should obtain a guideline on how to write, publish, present, and review scientific papers.
4. The course aims to guide the students regarding the publication ethics and misconducts. It is expected that the course will assist in the accomplishment of exploratory as well as result-oriented research studies.

Unit I

Research Methodology- Definition and significance- Types of research - Exploratory research, Conclusive research, Modeling research, Algorithmic research, Casual research, Theoretical and Empirical research, Cross-Sectional research and Time Series research, Research process-, Research problem- Objectives, Characteristics, Hypothesis and research in evolutionary perspective. Research Design- Definition, Types- Descriptive and Experimental Questionnaire preparation- prerequisites of a good questionnaire, Data Collection methods in research -Primary data and Secondary data.

An overview and implications of translational research. Rationale and implications of Intellectual property rights (IPR) and Patenting. Fundamentals of IPR; Basics understanding about Patentability. Innovation & Knowledge management; Translating Ideas to Entrepreneurship and Startups

Unit II

Validity and Reliability-Definition, importance, types of validity, types of reliability-- Construction and Validation of questionnaire, Cronbach alpha test, Measurement – definition- significance – types Nominal, Ordinal, Interval and Ratio ,Scaling- Importance, Scaling techniques. Sampling methods- Probability sampling methods and Non - Probability sampling methods, Report writing – importance , guideline to write an academic report, Basics of report presentation- Content of an Academic Research report, Content on a Research Article, Steps to publish an article, Research Metrics: Significance of Journal Impact Factor, SNIP, SJR, IPP, Cite Score, Metrics: h-index, g index, i10 index.

Unit III

Non parametric tests- One sample tests- one sample sign test. Kolmogorov- Smirnov test, Run test for randomness, two sample tests- tow sample sign test, Mann-Whitney U test, K sample test- Kruskal Wallis test (H- test). Hypothesis testing – Testing of hypothesis concerning means (one mean and difference between two means – one tailed and two tailed tests), Concerning Variance – One tailed Chi square test, Analysis of Variance (anova). Introduction to Discriminant.

Unit IV

Introduction to philosophy: definition, nature and scope, concept, branches, Ethics: definition, moral philosophy, nature of moral judgments and reactions', Ethics with respect to science and research, Intellectual honest and research integrity, Scientific misconduct: falsification, fabrication, and plagiarism, Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

Publication ethics: definition, introduction and importance, Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behavior and vice verse, types, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Learn about research methodology, statistical methods, research plan and implementation.
2. The knowledge will be utilized for improving the quality of research practice and education.

Practicals: Research methodology tools techniques, Research Publication and Ethics

1. Open access publishing and initiatives, SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies.
2. Software tool to identify predatory publications developed by SPPU, Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.,
3. Publication misconduct (Group Discussion): Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad.
4. Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools.
5. Databases: Indexing databases, Citation databases: Web of Science, Scopus, etc.
6. Research Metrics: Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score, Metrics: h-index, g index, i10 index, altmetrics.

Recommended Books:

1. Ana smith Iltis," Research Ethics", Publisher: Routledge, ISBN: 0415701589, 2016 by HAN LUO - 2012 2. Dr.Tripathi, P.C, Research Methodology, 1st Edition, Prentice Hall Inc., 2009.
3. Garg, B.L.Karadia, R.Agarwal, &F.Agarwal, U.K 2002. An introduction to research methodology, RBSA Publishers
4. Introducing Research Methodology: A Beginner's Guide to Doing a Research Project by FLICK, UWE. HAN LUO. Northwestern University.
5. Kothari, K.C. and Gaurav Garg Research Methodology: Methods and Techniques (Multi Colour Edition, 6. Mr.Suber Peter, Open Access (MIT Press Essential Knowledge series), New age international publishers, 2019
7. Oliver Paul, "The Student's guide to research ethics", McGraw-Hill Education (UK), Second edition 2010
8. The Ethics of Online Research (Advances in Research Ethics and Integrity Book 2) Kindle Edition by Kandy Woodfield (Editor), 2017.
9. William G.Zikmund, Business Research Methods, 7th Edition, Tata Mc Graw Hill, 2009.

IMT 306 Skill Oriented Course 6(A): Clinical Immunology (Credits 3)

Course Objectives: The main objectives of this course are to:

1. To inculcate the etiquette to be maintained in Immunology lab.
2. To impart knowledge about different types of immuno deficiencies and autoimmune diseases.
3. To equip with the knowledge on transplantation and immunosuppression.
4. To understand the fundamentals of cancer biology, the Principles of carcinogenesis and immunotherapy.

Unit I

Introduction to Clinical Immunology: Introduction and maintenance of clinical Immunology/ biochemistry laboratory; hazards in clinical laboratory; units; 'normal range', reference values. Factors affecting reference values quality control in laboratory – use of external and internal standards; use of WHO standards. Selection of analytical methods. Automation in clinical laboratory. Collection and preservation of specimens.

Natural Immunity a. First Line of Defense innate / nonspecific immunity b. Adaptive / specific immunity, c. Factors associated with immunologic disease, Components of the Immune System. Immune response to various infectious diseases

Unit II

Primary immune deficiencies, AIDS and other acquired or Secondary immune deficiencies, Auto immune diseases,

Animal model for autoimmune diseases. Proposed mechanism for induction of autoimmunity. Treatment of autoimmune diseases.

Unit III

Transplantation, Types of grafts, Graft acceptance and rejection, Clinical manifestation of graft rejection.

General immunosuppressive therapy, immune tolerance to allografts, clinical transplantation.

Unit IV

Cancer origin and terminology, malignant transformation of cells, oncogenes and cancer induction, tumors of the immune systems, tumor antigens, tumor evasion of the immune system and cancer immunotherapy. Psycho immunology: Psychoneuroimmunology, Immuno mediators, Immune system neuro anatomy, Neuroimmuno modulation.

Recommended books

1. Turgons "Immunology and serology" by Mosby Latest Edition 2007
2. Immunology by Irwin Roitt Latest edition.
3. Immunology by Kubay.
4. Varley's Practical clinical Biochemistry – Ed. Alan W.Gowenlock (Heinemann medical).
5. Clinical diagnosis and management by Laboratory methods (John Bernard Henry, W.B. Salunders Company, 1984).
6. Hand Book of Human stress and immunity by Glaser R and Glaser K (1994)
7. Psychoimmunology by Schedlowski M (2000).

Expected Course Outcomes: On the successful completion of the course, students will be able to:

Maintain the Clinical Immunology lab with all required standards.

Gain knowledge on different types of immunodeficiencies, their treatment and about autoimmune disorders.

Familiar with Clinical manifestation in graft acceptance or rejection and how immunosuppressive therapy is useful.

To understand cancers, the mechanisms involved from theory concept, experimental, research, cancer immunotherapy and human health-care perspectives and Psycho immunology.

Practical: Clinical Immunology (Credits 1)

1. Estimation of C-Reactive protein
2. Diagnosis of SLE
3. Diagnosis of Rheumatoid Arthritis
4. Widal test
5. VDRL test
6. *Detection of HCG by latex agglutination inhibition test*

IMT 306 Skill Oriented Course 6(B): *In Silico* Drug Design and Discovery

Course Objectives: The main objectives of this course are to:

1. Provide basic principle of pharmacology and Molecular interactions with drugs
2. Theories of receptors and enzyme inhibition
3. Biotransformation of drugs

Unit-I

Introduction to Pharmacology: Basic principles of pharmacology, including receptor mechanisms, drug distribution and metabolism, and pharmacokinetics. Interactions Inter- and intramolecular interactions. Weak interactions in drug molecules. Chirality and drug action. Covalent, ion-ion, ion-dipole, Hydrogen bonding, C-H hydrogen bonding, dihydrogen bonding, Van der Waals interactions and the associated energies.

Unit-II

Receptorology Drug-receptor interactions, Receptor theories and drug action: Occupancy Theory, Rate Theory, Induced Fit Theory, Macromolecular perturbation theory, Activation-Aggregation theory. Topological and stereochemical consideration.

Unit-III

Enzyme Inhibition Drug action through enzyme inhibition. Examples based on PDE4, GSK3, etc. Theories of enzyme inhibition and inactivation. Enzyme activation of drugs prodrugs.

Unit-IV

Drug likeness Drug like molecules and theories associated with the recognition of drug like properties. Physical organic chemistry of Drug metabolism, drug deactivation and elimination.

Drug action after Metabolism: Phase I and Phase II transformations. Concept of hard and soft drugs. Chemistry of ADME and Toxicity properties of drugs.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Gain knowledge about principles of pharmacology and interaction of drug and receptor.
2. Develop skills relevant for the medical and pharmaceutical industries.

Practical: *In Silico* Drug Design and Discovery (Credits 1)

In silico prediction: signal peptide, transmembrane domains.

Recommended Books

1) The Organic Chemistry of Drug Design and Drug Action by R.B. Silverman
2) C.J. Coulson, Molecular Mechanism of Drug Action by C.J. Coulson
3) A primer of Drug Action by R.M. Julien
4) Drug-Receptor Thermodynamics by R.B. Raffa
5) Principles of Drug Action by W.B. Pratt, P. Taylor
6) Medicinal Chemistry How Drugs Act and Why by A. Gringauz
7) Principles of Molecular recognition by A.D. Buckingham
8) Quantitative molecular pharmacology and Informatics by M. Lutz
9) Physical Biochemistry by K.E.V. Holde
10) Free energy calculations in rational drug design by M. Rami Reddy.

IMT 308 OPEN ONLINE TRANS DISCIPLINARY COURSE – 2 (Or)

BCH 308 Open Elective: Endocrine Biochemistry (Offered to other Departments)

Course Objectives: The main objectives of this course are to:

1. This course presents an introduction and provides a comprehensive, balanced introduction to Endocrine glands, their secretions and functions.
2. To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various hormones.

Unit I

Endocrine system – organization of the endocrine system. General features and classification of hormones, mechanism of action of hormones, hypothalamic hormones, chemistry, biosynthesis, Secretion, physiological functions, regulation and disorders of anterior and posterior pituitary hormones, LH, FSH, Growth hormone, prolactin, oxytocin, Vasopressin. Hormones of the pineal gland – Serotonin and melatonin.

Unit II

Thyroid hormones – chemistry, biosynthesis, secretion, physiological function, regulation and disorders, hypo and hyperthyroidism, tests for thyroid function. Antithyroid drugs and calcitonin.

Parathyroid gland – Parathormone and disorders of Parathormone. Role of calcitonin in calcium and phosphate homeostasis in blood.

Unit III

Pancreatic and gastrointestinal hormones – Biosynthesis, secretion, physiological functions and regulation of insulin and glucagon. Role of insulin and glucagon in carbohydrate, lipid and protein metabolism. Disorders of pancreas gastrointestinal hormones-. Gastrin, secretin, Cholecystokinin.

Unit IV

Adrenal hormones – Chemistry, biosynthesis and functions of adrenal medullary and adrenal cortical hormones. Cortisol,corticosterone, aldosterone, adrenaline, nor-adrenaline, Disorders of adrenal hormones.

Hormones of reproduction – Gonadal hormones (testosterone), chemistry, biosynthesis andphysiological functions of androgens, estrogens and progesterone, inhibin.

Hormonal regulation of menstrual cycle, placental hormones, contraception, reproductive disorders.

Recommended Books:

1. Text book of Biochemistry and Human Biology by Talwar G.P., Prentice Hall India.
2. Human Physiology and Mechanism of distance. Guyton 3rd Ed. Igkushoen/Seunders.
3. Clinical Biochemistry, Vol. 1 and 2, Williams *et al*., Heinemann Medical, 1978.
4. Lynchs Medical Laboratory Technology by Raphael, S. S., 4th Ed. Igkushoen/Seunders.
5. Text Book of Endocrinology, William.
6. General Endocrinology – Turner.
7. Biochemical Endocrinology of the Vertebrates – E. Fruden and H. Lines.
8. Metabolic and Endocrine Physiology – Jay Teppermann.
9. Metabolic Pathways – Green Berg.
10. Intermediary Metabolism and its regulation – Larner
11. Principles of Biochemistry – White A., Handler P and Smith.
12. Receptors and Hormone action. Receptors and Recognition series. Medical physiology by A.C. Guytom.

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

Obtain a deep knowledge regarding Endocrine glands and their secretions (K1 & K2).

Gives an idea about structure and functions of endocrine glands (K1 & K2)

Provides knowledge about Hormone and its regulation (K2, K3 & K4)

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

SEMESTER: IV

- Type of Course: Open Online Skill Development Course's MOOCS / SWAYAM; Course No: **OOSDC IMT401**

IMT (CORE)401(A): Immunotechniques

Unit I

Methods used in immunology: Preparation of antigens and antibodies, purification of antibodies, analysis of antibodies and antigens, preparation and uses of various types of vaccines.

Unit II:

Techniques used in immunology: Types of immunodiffusion methods, ELISA, RIA, Westernblot analysis, Electrophoresis and Hybridization techniques, immunohistochemistry, Immunoflowcytometry, Immunofluoroscence.

Unit III:

Applications of antisera in the detection of various diseases. Examples: syphilis and lyme, typhoid, streptococci infections, HIV, various types of Hepatitis

Unit IV:

Antibody engineering, Catalytic antibodies, antibody immunotherapy, productions of drugs to allergies.

Recommended Books:

1. Harper's Biochemistry (Latest edition)
2. Immunology by Carpenter (Latest edition)
3. Kubay's Immunology (Latest edition)
4. Biotechnology by RC Dubay (2001) S Chand and Company, New Delhi.

IMT 401(b): Immunological Diseases and Therapeutics

Unit I

Introduction to Clinical Immunology: Introduction and maintenance of clinical Immunology laboratory; hazards in clinical laboratory; units; 'normal range', reference values. Factors affecting reference values quality control in laboratory – use of external and internal standards; use of WHO standards. Collection and preservation of biological samples.

Unit II Natural Immunity (a) First Line of Defense innate / nonspecific immunity (b) Adaptive / specific immunity, (c) Factors associated with immunologic disease, Components of the Immune System. Immune response to various infectious diseases

Unit III Primary immunodeficiencies, AIDS and other acquired or Secondary immunodeficiencies, Auto immune diseases, Animal model for autoimmune diseases. Proposed mechanism for induction of autoimmunity. Rheumatoid Arthritis, Scleroderma, Vitiligo, Systemic Lupus Erythematosus, Graves' disease, Myasthenia gravis, Multiple sclerosis, Diabetes (type 1) Psoriasis, Treatment of autoimmune diseases.

Unit IV Transplantation, Types of grafts, Graft acceptance and rejection, Clinical manifestation of graft rejection, general immunosuppressive therapy, immune tolerance to allografts, clinical transplantation. Tumors of the immune systems, tumor antigens, tumor evasion of the immune system and cancer immunotherapy.

Recommended Books:

1. Varley's Practical clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books).
2. Clinical diagnosis and management by Lab methods (John Bernard Henry, W.B. Salunders Company).
3. Clinical Biochemistry – S.Ramakrishnan and Rajiswami.
4. Chemical Biochemistry (Metabolic and clinical aspects) by W.J.Marshall & S.K.Bangert.
5. Text book of clinical Biochemistry by Tietz et al.
6. Turgons "Immunology and serology" by Mosby Latest Edition 2007 Immunology by Irwin Roitt Latest
7. Immunology by Kubay.
8. Hand Book of Human stress and immunity by Glaser R and Glaser K (1994)

IMT 401(C): Immunopharmacology

Unit I

Drugs, Drug receptors, pharmacodynamics, pharmacokinetics, drug biotransformation, development and regulation of drug, Cholino and adreno receptor drugs.

Unit II

Histamines, Serotonins, vasoactive peptides and ergot alkaloids, Immunomodulation therapy, infiltration of cells and their diseases, Immunosuppressive drugs and antibodies, glucocorticoid drugs, malignancy therapy, role of TNFa, Immunoglobulin genes.

Unit III

The Eicosanoids, Prostaglandins, thromboxanes, leukotrienes and related compounds, and inhibitors of these molecules formation.

Unit IV

Nitric oxide and its immunological effects, Drugs used in asthma.

Reference Books:

Basic and Clinical pharmacology by BT Katzung, 10th Edn, McGraw Hill Edn, Oxford, 2008

- M.Sc. Biochemistry(Immunology) Project: Multi-Disciplinary Project Course No.: **IMT PW402**.
- Project work under the supervision of respective faculty.
- Dissertation – Thesis Submission, Project Evaluation and *Viva-voce*
- Project work carries **300 Marks** (Dissertation -200 marks, Seminar- 50 marks, *Viva voice* – 50 marks).

*Conducting classes for competitive exams, communication skills, UGC/ CSIR/ NET/ SLET examinations.

S.V.U .College of Sciences, M.Sc Biochemistry

M.Sc Biochemistry (Immunology): Model Question papers

Semester- III

CORE IMT 301 and IMTOE 308 Papers

Time 3 Hrs **Max marks 70**

PART A (5 X 4 = 20 marks) Answer any Five (05) of the following questions?

1. Unit 1
2. Unit 1
3. Unit 2
4. Unit 2
5. Unit 3
6. Unit 3
7. Unit 4
8. Unit 4

PART B (4 X 12.5 = 50 marks) Answer any ALL of the following questions?

9. Unit 1 A or B
10. Unit 2 A or B
11. Unit 3 A or B
12. Unit 4 A or B

S.V.U. College of Sciences M.Sc Biochemistry (Immunology):

Model Question paper; Semester- IV

CORE IMT 401 paper

Time 3 Hrs **Max marks 70**

PART A (5 X 4 = 20 marks) Answer any Five (05) of the following questions?

1. Unit 1
2. Unit 1
3. Unit 2
4. Unit 2
5. Unit 3
6. Unit 3
7. Unit 4
8. Unit 4

PART B (4 X 12.5 = 50 marks) Answer any ALL of the following questions?

9. Unit 1 A or B
10. Unit 2 A or B
11. Unit 3 A or B
12. Unit 4 A or B

SRI VENKATESWARA UNIVERSITY
S.V.U. College of Sciences
TIRUPATI-517 502, (A.P.), INDIA

Dr. O. Vijaya Sarathi Reddy
Professor & Head
Chairman BOS
Department of Biochemistry

Email: ovsreddy@yahoo.com
ovsreddy@gmail.com
Office: +91-877-2289495
Mobile: +91-9440046293

Dt: 25-08-2025

To
The Registrar
Sri Venkateswara University,
Tirupati – 517 502

Respected Sir

Sub: M. Sc. Biochemistry (Immunology) Programme- Meeting of the Board of Studies (combined) - Submission of Syllabus, Model Question Papers and Reference Books of Re-Structured M.Sc. Biochemistry (Immunology) Programme in consonance with NEP – 2020, as per the levels prescribed by NHEQF - Reg.

Ref: 1. No.CII(A&F)–Restructuring/P.G./Arts/Sciences/Commerce/2024 Dated: 14-08-2024.
2. No.CII(A&F)–/3rd&4th sem. Amed/2025 Dated: 25-07-2025

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I am to inform you that Minutes of the meeting of Board of Studies in Biochemistry (combined) held on 11-08-2025 at3.30 P.M. The resolutions of the meeting are enclosed for your kind reference and record. Therefore, I request you to kindly accord necessary approval for implementation of the syllabi for the M.Sc. Biochemistry(Immunology) Branch II (B) Programme from the academic year 2024-25.

Further, the Syllabi, Reference Books, Scheme of Examinations, Eligibility and Credit Requirement for admission in M.Sc. Biochemistry Branch II (B) Multiple Entry and Exit Options duly recommended by the Board of Studies in Biochemistry (combined) are enclosed here with, for your kind reference and record. The receipt of this letter together with its enclosures may kindly be acknowledged.

Yours faithfully

Chairman BOS

SRI VENKATESWARA UNIVERSITY
Department of Biochemistry
Tirupati-517 502, Andhra Pradesh, India

Minutes of the meeting of Board of Studies in Biochemistry (combined) held on 11-08-2025 at3.30 P.M.

MEMBERS PRESENT

S. No.	Name of the Faculty, Department, College	Chairman/ Members	SIGNATURE
1	Prof. Vijaya Sarathi Reddy Dept. of Biochemistry SVU College of Sciences, Tirupati Mobile: 9440046293 Email: ovsreddy@gmail.com	Chairman	
2	The Head Dept. of Biochemistry SVU College of Sciences, Tirupati	Ex-Officio Member	
3	Prof. M.Balaji Department of Biochemistry SVU College of Sciences, Tirupati Mobile: 9849086856 Email: balaji.meriga@gmail.com	Member	
4	Dr. Y. Sireesha, Dept. of Biochemistry S.P.W Degree & P.G. College, Tirupati Mobile: 9246997116 Email: drsireeshay@gmail.com	Member	
5	Prof. Rayala Suresh Kumar, Department of Biotechnology, Indian Institute of Technology Madras (IITM), Chennai - 600 036, Mobile: 9840885870 Email: sureshkumarrayala@gmail.com	External Member	
6	Prof.Chandrakant S. Karigar Dept. of Biochemistry Bangalore University, Bangalore Mobile: 9480617964 Email: cskarigar@gmail.com	External Member	