

# SYLLABUS (CBCS) M.Sc. MICROBIOLOGY

## SARGUJA UNIVERSITY, AMBIKAPUR, C.G.

WITH EFFECT FROM ACADEMIC YEAR : 2018 -19

M. Sc. in MICROBIOLOGY:

FACULTY OF LIFE SCIENCE

SECOND SEMESTER (EVEN SEMESTER)

Eligibility Criteria (Qualifying Exams)	Course Code	Course Type	COURSE (PAPER/SUBJECTS)	Credits	Maximum Marks		
					CCA	ESE	Total
After appearing in the first semester examination irrespective of any number of back/ arrear papers	MMB 201	CCC	Immunology	6	30	70	100
	MMB 202	CCC	Medical Microbiology	6	30	70	100
	MMB 203	CCC	Microbial Physiology and Metabolism	6	30	70	100
	MMB 221	PRJ/FST/EST	Social Outreach / Educational study tour	6	30	70	100
	MMB B01	ECC/CB	Plant and Animal Biotechnology	6	30	70	100
	MMB B02	ECC/CB	Plant Physiology				
	MMB B03	ECC/CB	Pharmaceutical Biotechnology				
	MMB 211	LAB	Lab Course-2	4	-	-	100
	Minimum credits in individual subject are 6 and in complete semester it would be 30				<b>Total: 34</b>		

<b>M.Sc. MICROBIOLOGY</b>		<b>II SEMESTER</b>	
<b>COURSE CODE: MMB 201</b>		<b>COURSE TYPE: CCC</b>	
<b>COURSE TITLE: CODE: IMMUNOLOGY</b>			
<b>CREDIT: 06</b>		<b>TEACHING HOURS: 90</b>	
<b>MARKS: 100</b>		<b>THEORY EXAM. : 70</b>	<b>CCA: 30</b>
<p><b>OBJECTIVE:</b> The main aim of this course is to cater the students the information regarding the body's defence mechanism, components of defence system, genetic control and the consequences arising due to failure of defence mechanism. The course also includes immunotechniques for providing modern insights regarding the subject.</p>			
<b>UNIT-1</b> <b>15 Hours</b>	Immune system. Innate & acquired, Passive & Active, Herd immunity. Clonal nature of immune response. Antigens – properties and types. Immunogenecity and antigenecity. Factors affecting immunogenecity. Antigenic epitopes: B and T cell epitopes, adjuvants, haptens, superantigens. Cells and organs of immune system: Hematopoiesis and differentiation		
<b>UNIT-2</b> <b>20 Hours</b>	Antibody structure and function isotype, allotype and idiotype. Immunoglobulin classes and sub classes, Generation of antibody diversity; Antigen and antibody interactions and Immuno-techniques - ELISA, RIA, Western Blot, Immuno-blot and Immuno-fluorescent techniques.		
<b>UNIT-3</b> <b>20 Hours</b>	Major histocompatibility complex (MHC), Complement system; Antigen processing and presentation, Activation and Differentiation of B and T cells, B and T cell receptors, primary and secondary immune modulation, Toll-like receptors		
<b>UNIT-4</b> <b>20 Hours</b>	Generation of humoral and cell mediated immune responses, cytokines and their role in immune regulation, T- cell regulation, MHC- regulation, Immunological tolerance, Hypersensitivity, Autoimmunity, Immonosenesence.		
<b>UNIT-5</b> <b>15 Hours</b>	Transplantation; immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections & Tumor Immunology, congenital and acquired immune-deficiencies. Vaccines; Hybridoma Technology and Monoclonal antibody and applications.		

**SUGGESTED  
READINGS**

- *Abdul, K., Abbas, Andrew K. L., Jordan, S. P. (1998). Cellular and Molecular Immunology. Sanders College Pub.*
- *Benjamin, E., Coccoi., Sunshine. (2000). Immunology 4 th edition- Wiley- Liss. Publ. NY.*
- *Male D., Champion B. Cooke A. and Owen M. (1991) Advanced Immunology*
- *Richard A. Goldsby, Thomas J. Kindt and Barbara A. (2005) Kuby Immunology Osborne 6 Ed. Edition*
- *Roitt, I.M. (1998). Essential Immunology, ELBS, Blackwell Scientific Publishers, London.*
- *Tizard I.R. (1995). Immunology, 4th edition, Saunder College Pub.*

<b>M.Sc. MICROBIOLOGY</b>		<b>II SEMESTER</b>	
<b>COURSE CODE: MMB 202</b>		<b>COURSE TYPE: CCC</b>	
<b>COURSE TITLE: CODE: MEDICAL MICROBIOLOGY</b>			
<b>CREDIT: 06</b>		<b>TEACHING HOURS: 90</b>	
<b>MARKS: 100</b>	<b>THEORY EXAM. : 70</b>	<b>CCA: 30</b>	
<p><b>OBJECTIVE:</b> The main objective of the paper is to inform students regarding different microorganisms and their relation to human health and disease, the emerging concepts of microbial pathology and mechanism of pathogenesis of different microbes, their prevention and treatment.</p>			
<b>UNIT I</b>			
<p>Infection: Definition, Types, sources of infections, Transmission of infectious disease. portals of entry of pathogens, invasion, spread and tissue damage. virulent factors. normal flora of humans and its importance.</p>			
<b>UNIT-II</b>			
<p>Respiratory tract infections: upper respiratory tract infection, lower respiratory tract infections, including lungs. urinary tract infections: pathogenesis, laboratory diagnosis. Sexually transmitted diseases. Meningitis: Types, pathogenesis, laboratory diagnosis. Antibacterial drugs.</p>			
<b>UNIT-III</b>			
<p>Mycoses: Definition, Types: cutaneous mycoses (superficial mycoses, Dermatophytoses, Candidiasis), subcutaneous mycoses (Mycetoma, zygomycosis, mucormycosis). Systemic mycoses- Blastomycosis, opportunistic mycoses. Antifungal agents.</p>			
<b>UNIT -IV</b>			
<p>Classification of pathogenic Viruses. Virus host interaction. Pox virus, Herpes Virus (HHV-type 3, HHV type 5), picorna Virus (Polio virus), Rhabdo virus (Rabies virus), Hepatitis Virus, Human Immune Deficiency Virus. Viral Assays and Antiviral therapy.</p>			

## UNIT-V

Hospital acquired Infections. Emerging Infectious disease. Protozoan diseases: Malaria, Amoebiasis, Giardiasis, Leishmaniasis; General account of parasitic infections (Helminthes).

### SUGGESTED READINGS

1. *Medical Microbiology*. By: G.F. Brooks, J.S. Butel, S.A. Morse.
1. *Text book of Microbiology*. By: Ananthanarayan and Panikar.
2. *Medical Microbiology*. By: B.S. Nagoba and A. Pichare.
3. *Clinical Microbiology and Infection control*. By: Elaine Larson.
4. *Bacterial Pathogenesis; Molecular and cellular mechanism*. By: Camila Loch and Michel Simonet.
5. *Medical Microbiology*. By: David Greenwood.
6. *Medical Microbiology*. By: J.P. Duguid.
7. *Small DNA tumor viruses*. By: Kevin Gaston.
8. *Viruses and Interferon; current research*. By: Karen Mossam

<b>M.Sc. MICROBIOLOGY</b>		<b>II SEMESTER</b>	
<b>COURSE CODE: MMB 203</b>		<b>COURSE TYPE: CCC</b>	
<b>COURSE TITLE: CODE: MICROBIAL PHYSIOLOGY AND METABOLISM</b>			
<b>CREDIT: 06</b>		<b>TEACHING HOURS: 90</b>	
<b>MARKS: 100</b>	<b>THEORY EXAM. : 70</b>		<b>CCA: 30</b>
<p><b>OBJECTIVE:</b> The aim of this paper is to equip the students with basic knowledge of physiology of microorganism and impact of various environmental factors on the growth and survival of microorganisms.</p>			
<b>UNIT I</b>			
<p><b>Growth and cell division:</b> Measurement of growth, growth physiology, cell division, growth yields, growth kinetics, steady state growth and continuous growth. <b>Solute Transport:</b> Primary and Secondary transport: Introduction, Kinetics, ABC transporters, Phospho-transferase system, Drug export systems, amino acid transport.</p>			
<b>UNIT-II</b>			
<p><b>Central Metabolic Pathways and Regulation:</b> Glycolysis, PPP, ED pathway, Citric acid cycle: Branched TCA and Reverse TCA, glyoxylate cycle. <b>Nitrogen metabolism:</b> Metabolism of amino acids: Amino acid biosynthesis and utilisation, stringent response, polyamine biosynthesis and regulation.</p>			
<b>UNIT-III</b>			
<p><b>Metabolism of nucleotides:</b> Purine and pyrimidine biosynthesis, regulation of purine and pyrimidine biosynthesis, inhibitors of nucleotide synthesis.</p>			

#### UNIT –IV

**Metabolism of lipids and hydrocarbons:** Lipid composition of microorganisms, biosynthesis and degradation of lipids, lipid accumulation in yeasts, hydrocarbon utilization, PHA synthesis and degradation

#### UNIT-V

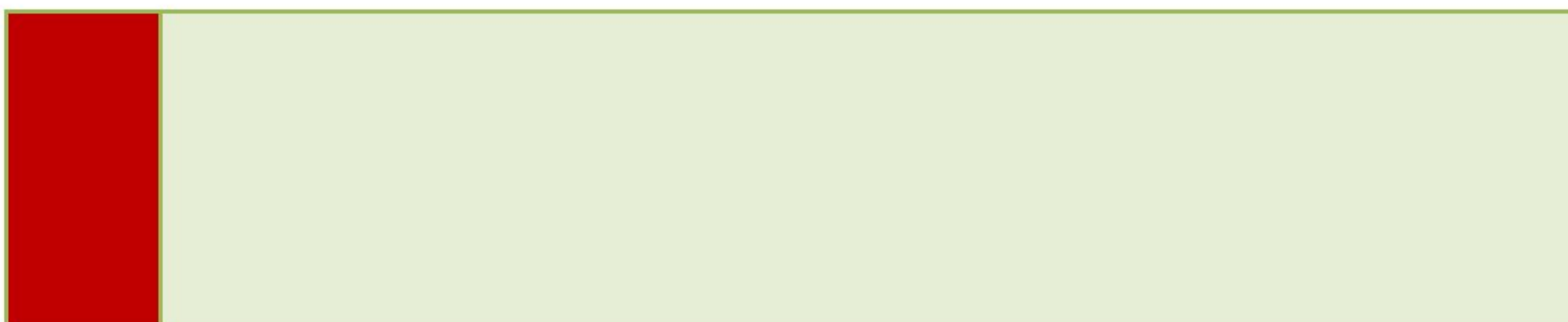
**Physiological Adaptations and Intercellular signalling:** Introduction to two component system, regulatory systems during aerobic- anaerobic shifts: Arc, Fnr, Nar, regulon, response to phosphate supply: Quorum sensing: A and C signaling system, sporulation in *Bacillus subtilis*, control of competence in *Bacillus subtilis*. Heat-Shock responses, osmotic homeostasis.

<b>M.Sc. MICROBIOLOGY</b>		<b>II SEMESTER</b>	
<b>COURSE CODE: MMB S02</b>		<b>COURSE TYPE: PRJ/FST/EST</b>	
<b>COURSE TITLE: SOCIAL OUTREACH AND EDUCATIONAL STUDY TOUR</b>			
<b>CREDIT: 06</b>			
<b>MARKS: 100</b>	<b>REPORT WRITING : 70</b>	<b>VIVA VOCE: 30</b>	
<b><u>Note for Students:</u></b>			
<ol style="list-style-type: none"> <li>1. During the 2<sup>nd</sup> semester, all students will have to go for Educational Study Tour/Field Study Tour (EST/FST) under the supervision of Professor/ Associate Professor/ Assistant Professor of Dept. of Microbiology, and finally will have to submit report not more than 25 pages on his/her assignment to the Department.</li> <li>2. Report of Educational Study Tour/Field Study Tour (EST/FST) will be evaluated by the board/committee constituted by the Head of the Department of the respective Department of the college.</li> </ol>			



<b>M.Sc. MICROBIOLOGY</b>		<b>II SEMESTER</b>	
<b>COURSE CODE: MMB B01</b>		<b>COURSE TYPE: ECC</b>	
<b>COURSE TITLE: PLANT AND ANIMAL BIOTECHNOLOGY</b>			
<b>CREDIT: 06</b>		<b>TEACHING HOURS: 90</b>	
<b>MARKS: 100</b>		<b>THEORY EXAM. : 70</b>	<b>CCA: 30</b>
<p><b>Plant and Animal biotechnology is essentially a genetic engineering related to Molecular biology Techniques used to genetically engineer them . Researchers in this field identify, isolate and transfer genes from one plant organism to another. It deals with the various cell and tissue culture systems and their applications, plant and animal transformation vectors and methods, and potential applications of transgenic technology in agriculture and health care.</b></p> <p><b>The Objectives of this course are:</b></p> <ul style="list-style-type: none"> <li>• <b>To enable the students gain information on culturing techniques and genetic manipulation of plants and animals to get newer and high quality agricultural and animal products and new breeds.</b></li> <li>• <b>To expose students to issues and challenges encountered in the area of plant and animal biotechnology.</b></li> </ul>			
<b>UNIT-1 18 Hours</b>	<p>Plant Tissue Culture: Laboratory organization, Nutrition medium, Sterilization techniques Micro-propagation; Concept of cellular totipotency and Cytodifferentiation, Organogenesis; Callus Culture, Suspension Culture, Single Cell culture. Somatic embryogenesis and Artificial seeds.</p>		
<b>UNIT-2 18 Hours</b>	<p>Somaclonal variation. Productions of virus free plants using Meristem Culture. Haploid and double haploid production: Anther, Pollen, Ovary culture and their applications in crop improvement. Protoplast isolation, fusion and somatic hybridization; cybrids. Cryopreservation and DNA banking for germplasm conservation.</p>		

UNIT-3 18 Hours	Enzymes in plant genetic engineering; restriction nucleases and modification enzymes, Nucleic acid amplification and hybridization, Probe and target sequences, Construction of cDNA and genomic libraries, Screening and preservation of DNA libraries. DNA sequencing and cloning strategies.
UNIT-4 18 Hours	Gene transfer techniques/mode of gene delivery in plant, Ti & Ri plasmids and <i>Agrobacterium</i> mediated gene transformation. Chloroplast transformation and its advantages. CRISPR-Cas9 mediated targeted genome editing. siRNA, miRNA technology. Selection and screening of transformations; Gene silencing.
UNIT-5 18 Hours	Plant Genetic Engineering for Biotic and Abiotic stress tolerance; Herbicide resistance, Disease resistance. Drought and Heat tolerance. Plant secondary metabolites, Metabolic engineering of alkaloids and industrial enzymes (Shikimate and PHA pathway), therapeutic proteins, Biopharming-Plants as Bioreactor and Edible vaccines.
SUGGESTED READINGS	<ul style="list-style-type: none"> <li>• Altman A, Hasegawa PM (Ed) (2012) – <i>Plant Biotechnology and agriculture. Prospects for the 21st century (Academic press).</i></li> <li>• Bhojwani SS. &amp; Razdan MK (1996). - <i>Plant Tissue Culture : Theory &amp; Practice</i></li> <li>• Chawla HC (2004) – <i>Introduction to plant biotechnology (Science Publ)</i></li> <li>• Slater A, Scott NW, Fowler MR (2008) – <i>Plant Biotechnology: the genetic manipulation of plants (Oxford Press)</i></li> <li>• Vasil IK, Thorpe TA (1994) – <i>Plant cell and tissue culture (Springer).</i> B Singh, S K Gautam, &amp; M S Chauhan (2013) <i>Textbook of Animal Biotechnology</i></li> <li>• B.D. Singh, (2004) <i>Biotechnology. Expanding Horizons. First Edition. Kalyani Publishers, Ludhiana.</i></li> <li>• Freshney, (2005) <i>Culture of Animal Cells, 5th Edition, Wiley-Liss,</i></li> <li>• Louis-Marie Houdebine, (1997) <i>Transgenic Animals: Generation and Use, 1st Edition, CRC Press,</i></li> <li>• M.M. Ranga, 2003. <i>Animal biotechnology, Agrobios, Jodhpur, India</i></li> <li>• M.M. Ranga, <i>Transgenic Animals, Agrobios, Jodhpur, India</i></li> <li>• Ralf Pörtner (2007) <i>Animal cell biotechnology: Humana Press</i></li> </ul>



<b>M.SC. IN MICROBIOLOGY</b>		<b>II SEMESTER</b>	
COURSE CODE: MMB B02		COURSE TYPE: ECC	
<b>COURSE TITLE: PLANT PHYSIOLOGY</b>			
CREDIT:06		HOURS: 90	
MARKS: 100		THEORY EXAM: 70    CCA: 30	
<b>OBJECTIVE:</b>  The objective of this paper is to inculcate the knowledge of plant and their products during various vital activities and better understanding of plant physics.			
<b>UNIT-1</b>	<b>(15 Hrs)</b>	<b>Absorption of water:</b> passive and active transport, root pressure, factor effecting of water absorption. <b>Ascent of sap:</b> theories of ascent of sap, transpiration pull.	
<b>UNIT-2</b>	<b>(20Hrs)</b>	<b>Transpiration:</b> structure of stomata, types of stomata, mechanism of opening and closing of stomata. Anti-transpiration. Factors affecting transpiration.  Micro and macronutrients, Minerals and salt absorption: active absorption, passive absorption, Carrier concept, cytochrome pump theory, factors affecting salt absorption.	

<p style="text-align: center;">UNIT-3 (20Hrs)</p>	<p>Photosynthesis: History, photosynthetic pigments, Chlorophylls, Phycobolins, Carotinoides, Mechanism of photosynthesis, Absorption spectrum, Action spectrum, Red drop effect, PSI, PSII, Z- scheme of photosynthesis, Photorespiration, Photo oxidation of water, Cyclic and Acyclic photophosphrylation, Calvin cycle, Hatch Slack cycle, C<sub>3</sub> &amp; C<sub>4</sub> plants, CAM cycle, factors affecting rate of photosynthesis.</p>
<p style="text-align: center;">UNIT-4 (20Hrs)</p>	<p><b>Plant response:</b> Response of plants to Biotic (Pathogen/ insect) and abiotic (water, temperature and salt) Stresses, Mechanism of resistance to Biotic stress and tolerance to abiotic stress. <b>Secondary Metabolites:</b> Biosynthesis of Terpenoids, Alkaloids, Phenols, flavonoids and Nitrogenous compounds and their importance.</p>
<p style="text-align: center;">UNIT-5 (15 Hrs)</p>	<p><b>Dormancy and seed germination:</b> Methods of breaking seed dormancy, factors affecting germination, Vernalization, mechanism of vernalization, long days plants and short days plants, Devernalization, importance of vernalization. <b>Plant Hormones:</b> Types- Auxins Gibberellins, cytokinins, florigins, growth inhibitors, Biosynthesis , transport, mechanism of action of Hormones.</p>



<b>M.Sc. MICROBIOLOGY</b>		<b>II SEMESTER</b>	
<b>COURSE CODE: MMB B03</b>		<b>COURSE TYPE: ECC/CB</b>	
<b>COURSE TITLE: PHARMACEUTICAL MICROBIOLOGY</b>			
<b>CREDIT: 06</b>		<b>TEACHING HOURS: 90</b>	
<b>MARKS: 100</b>	<b>THEORY EXAM. : 70</b>	<b>CCA: 30</b>	
<p><b>Pharmaceutical Biotechnology is the science that covers all technologies required for the production, manufacturing and registration of biological drugs. Advances in recombinant genetics facilitate the routine cloning of genes and the creation of genetically modified organisms that can be used in industrial production. The objectives of this course are 1) to make the students well conversant with different molecules that exert a pharmacological action in the body and how the specific action is generated. 2) To impart knowledge how to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models.</b></p>			
<b>UNIT-1 19 Hours</b>	Herbal and naturally derived Products. Formulation development aspects - Delivery aspects for herbal and naturally derived medicinal products (Herbal extracts, crud extracts, incorporation of product performance enhancers, etc.). Product stabilization aspects with consideration of ICH guideline. - Regulatory considerations with consideration of global regulatory guidelines.		
<b>UNIT-2 17 Hours</b>	Industrial aspects: Stability studies of biotechnology derived products, Effects of various environmental /processing on the stability of the formulation and techniques for stabilization of the product against the same regulatory requirement related to stability testing with emphasis on matrixing bracketing techniques, Climatic zones.		
<b>UNIT-3 15 Hours</b>	Concepts for protein engineering. Isolation and purification of proteins, Stability and activity based approaches of protein engineering, Chemical and Physical Considerations in Protein and Peptide Stability, Different methods for protein engineering, Site directed mutagenesis, gene shuffling, and direct evolution.		

<b>UNIT-4</b> <b>21 Hours</b>	<p>Concept of biotech process validation, Cell line culture process validation and characterization, Purification process for viral clearance, validation of recovery, Purification, Cleaning, Filtration, Issues of DNA vaccines and plasmid DNA vaccines Analytical methods in protein formulation: concentration, size, purity, surface charge, identity, structure/sequence, shape, activity. Novel methods for enzyme and vaccine production.</p>
<b>UNIT-5</b> <b>17 Hours</b>	<p>Protein formulation: Different strategies used in the formulation of DNA and proteins, Analytical and biophysical parameters of proteins and DNA in pre-formulation, Liposomes, Neon-spears, Neon-particulate system, Pegilation, Biological Activity, Biophysical Characterization Techniques, Forced degradation studies of protein.</p>
<b>SUGGESTED READINGS</b>	<ul style="list-style-type: none"> <li>• <i>Chemical Biology: A practical course, Herbert Waldmann, Petra Janning, Wiley-VCH.</i></li> <li>• <i>Daan Crommelin, Robert D Sindelar, (2002) Pharmaceutical Biotechnology”, Tailor and Francis Publications, New York.</i></li> <li>• <i>Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher.</i></li> <li>• <i>Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.</i></li> <li>• <i>Heinrich Klefenz, (2002) Industrial Pharmaceutical Biotechnology WILEY-VCH Publication, Germany.</i></li> <li>• <i>Jay P Rho, Stan G Louie, (2003) Handbook of Pharmaceutical Biotechnology” Pharmaceutical product press, New York.</i></li> <li>• <i>Tim Johnson CRC (1998) Ethnobotany Desk Reference CRC Press.</i></li> </ul>

**M.Sc. MICROBIOLOGY**

**II SEMESTER**

**COURSE CODE: MMB 211**

**COURSE TYPE: PRACTICAL**

**COURSE TITLE: Lab Course 2**

**CREDIT: 06**

**PRACTICAL HOURS: 90**

**MARKS: 100**

**LABORATORY WORK**

1. Grouping of blood and Rh typing.
2. Latex agglutination test for rheumatoid factor and pregnancy.
3. ELISA - demonstration
4. Total RBC count, Total WBC count, Total platelet count
5. Radial Immuno diffusion and Double diffusion.
6. Isolation and purification of IgG from serum or IgY from chicken Egg.
7. Blood smear identification of leucocytes by Giemsa stain
8. Demonstration of Phagocytosis of latex beads
9. Preparation of different types of standard tissue culture media
10. Establishment of aseptic culture following sterilization procedures using seeds
11. Plant cell/tissue and organ culture of horticultural/medicinal plants
12. Isolation and identification of normal microflora of human skin.
13. Isolation and identification of bacteria causing UTI.
14. Diagnosis of enteric fever by serological test.
15. Determination of antibody titre by semi quantitative method.
16. Determination of antibiotic sensitivity of UTI causing infection.
17. Study catalase activity of microorganism.
18. Separation of amino acid mixture by TLC.
19. Separation of amino acid mixture by paper chromatography.
20. Study of bacterial growth by turbidity measurements.



