Model curriculum for VI semester

Government of Karnataka

Model Curriculum

Program Name	**BSc in Microbiology**	Semester	**VI**
Course Title	**IMMUNOLOGY AND MEDICAL MICROBIOLOGY (Theory)**		
Course Code:	**MIC C13-T**	No. of Credits	**4**
Contact hours	**60 Hours(4 hours per week)**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Common to the Course Programme at Entry Level
Course Outcomes (COs): After the successful completion of the course, the student will be able to: CO1: To gain a preliminary understanding about various immune mechanisms. CO2: To familiarize with Immunological techniques and serodiagnosis of infectious diseases CO3: To understand pathogenic bacterial infections, symptoms, diagnosis and treatment process. CO4: To understand pathogenic bacterial infections, symptoms, diagnosis and To understand pathogenic bacterial infections, symptoms, diagnosis and treatment process treatment process

Contents	60 Hrs
UNIT-I Normal microflora of the human body and host pathogen interaction Normal microflora of the human body: Importance of normal microflora, normal microflora of skin,throat, gastrointestinal tract, urogenital tract Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmissionof infection, Pathophysiologic effects of LPS. Sample collection, transport and diagnosis. Clinical Microbiology Medical Bacteriology The following diseases in detailwith Symptoms, mode of transmission, prophylaxis and control respiratory diseases: *Streptococcus pyogenes*, *Haemophilus influenzae, Mycobacterium tuberculosis* Gastrointestinal Diseases: *Escherichia coli*, *Salmonella typhi*, *Vibrio cholerae*, Others: *Staphylococcus aureus, Bacillus anthracis, Clostridium tetani,(10 hrs)*	**15 hrs.**
UNIT-II	**15 Hrs**
Medical Virology, parasitology and Mycology The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, Corona, Influenza, swine flu, Ebola, Chikungunya, Japanese Encephalitis Protozoan diseases: Malaria, Kala-azar, Entamoeba Fungal infections- Cutaneous mycoses: Tinea, pedis (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis(10 Hrs) Antimicrobial agents: General characteristics and mode of action Antibacterial agents: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine . Antibiotic resistance, MDR, XDR, MRSA, NDM-1 5hrs	

UNIT-III	15 Hrs
Historical perspective of immunology; Edward Jenner, Luis Pasteur, attenuation. Immunity; Natural (active and passive) and artificial (active and passive) with example, Innate and acquired, Humoral and cell mediated. Early theories to explain the formation and specificity of antibody; Selective, instructional and clonal selection. Cells and organs of immune system: Hematopoiesis, cytokines, properties and functions of B and T Lymphocytes, Natural killer (NK) cells, Granulocytes (Neutrophils, Eosinophils and Basophils), Monocytes and macrophages, Dendritic cells and Mast cells. Primary lymphoid organs; Bone marrow and Thymus. Secondary lymphoid organs; Spleen and Lymphnodes.	
UNIT-IV **Antigen**: Immunogenicity and antigenicity, epitopes, haptens. Properties of antigen contribute to immunogenicity; Chemical nature (proteins, carbohydrates, lipids and nucleic acids), degree of foreignness, molecular weight, chemical composition and complexity, degradability. Adjuvants (alum, freunds incomplete and complete) and their importance. B and T cell epitopes. **Antibody**: Basic structure of antibody, light and heavy chain, variable and constant region,hinge region, Fab and Fc. Structure and functions of different types of antibodies (IgM, IgG, IgA, IgE, and IgD). Antibody mediated effector functions; opsonization, complement activation and antibody dependent cell mediated cytotoxicity (ADCC). Antigenic determinants on immunoglobulins: Isotype, allotype and idiotype. Monoclonal antibody production by hybridoma technology **10hrs** Principles and applications of antigen-antibody interactions: Definition of affinity and avidity. Immunoprecipitation; Radial (Mancini) and double (Ouchterlony) immunodiffusion. Agglutination reactions: Hemagglutination, Bacterial agglutination, passive agglutination, and agglutination inhibition. Enzyme linked immune-sorbent assay (ELISA): Direct, indirect, sandwich and competitive ELISA. Radioimmunoassay (RIA). Immunofluorescence. Complement system: Functions of complement components, Complement activation by classical, alternative and lectin pathway to develop membrane attack complex (MAC). Complement mediated opsonization, complement fixation test. Hypersensitive reactions: Classification, Humoral Immunity mediated hypersensitivity; Type I (IgE), Type II (IgG and IgM-ADCC), Type III (Antigen-antibody complex), and Cell mediated hypersensitivity Type IV (DTH). **5 Hrs**	**15 Hrs**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	1	12	13	14	15
To gain a preliminary understanding about various immune mechanisms.	√														
To familiarize with Immunological techniques and serodiagnosis of infectious diseases		√	√							√					
To understand pathogenic bacterial infections, symptoms, diagnosis and treatment process	√			√						√					
To understand pathogenic bacterial infections, symptoms, diagnosis and To understand pathogenic bacterial infections, symptoms, diagnosis and treatment process treatment process	√				√	√				√					

Pedagogy : Lectures, Seminars, Industry/Institute Visits, Debates, Quiz, Project and Assignments

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Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Attendance	10 Marks
Class Test	10 Marks
Debate/Quiz/Assignment	10 Marks
Seminar	10 Marks
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

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Course Title	**IMMUNOLOGY AND MEDICAL MICROBIOLOGY (Practical)**	Practical Credits	**2**
Course Code	**MIC C14-P**	Contact Hours	**4Hours/week**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

1	Identify pathogenic bacteria (any three of *E. coli, Salmonella, Pseudomonas, Staphylococcu Bacillus*) on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitratereduction, urease production and catalase tests
2	Study of composition and use of important differential media for identification of pathogenicbacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS
3	Study of bacterial flora of skin by swab method
4	Perform antibacterial sensitivity by Kirby-Bauer method
5	Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chicken pox,HPV warts, AIDS (candidiasis), dermatomycoses (ring worms)
6	Study of various stages of Malarial parasite in RBCs using permanent mounts.
7	Identification of human blood groups.
8	Perform Total Leukocyte Count of the given blood sample.
9	**Perform Differential Leukocyte Count of the given blood sample.**
10	Separate serum from the blood sample (demonstration).
11	Perform immunodiffusion by Ouchterlony method.
12	Perform DOT ELISA.
13	**Perform immunoelectrophoresis.**

Pedagogy: Experiential learning, Problem solving, Project

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Attendance	05 Marks
Records	05 Marks
Performance	05 Marks
Test	10 Marks
Total	25 Marks
Formative Assessment as per guidelines are compulsory	

REFERENCES

1	Ananthanarayan R and Paniker C.K.J (2009) Textbook of Microbiology, 8th Edition, University Press, Publication.
2	Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3	Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4	Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology.9th edition. McGraw Hill Higher Education
5	Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition. Pearson International Edition
6	Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th editionSaunders Publication, Philadelphia.
7	Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
8	Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
9	Murphy K, Travers.P,Walport M. (2008).Janeway's Immunobiology.7th edition Garland Science,Publishers,New York.
10	Peakman.M.and Vergani D. (2009).Basic and Clinical Immunology,2nd edition Churchill,Livingstone Publishers, Edinberg.
11	Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

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Model Curriculum

Program Name	**BSc in Microbiology**	Semester	**VI**
Course Title	**MICROBIAL GENETIC ENGINEERING (Theory)**		
Course Code:	**MIC C15-T**	No. of Credits	**3**
Contact hours	**45 Hours(3 Hours per week)**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Common to the Course Programme at Entry Level

CO1 : To acquire knowledge on the concepts and terminology in genetic engineering
CO2 : To learn about principles involved in manipulating genes and DNA
CO3 : Familiar with various cloning strategies in prokaryotes
CO4 : Learn techniques in genetic engineering
CO5 : To have awareness of IPR, the social and the ethical issues concerning cloning by genetic engineering

MICROBIAL GENETIC ENGINEERING	**45Hrs**
Unit 1: Introduction to Microbial Genetic Engineering	**15 Hrs**

Historical prospectives: Definition of genetic engineering, milestones in genetic engineering, prospects and problems of genetic engineering.

Tools in Microbial Genetic Engineering: Restriction modification systems- Types, Mode of action, nomenclature, applications of restriction enzymes in genetic engineering. DNA modifying enzymes and their applications: DNA polymerases, methylases, Terminal deoxynucleotidyl transferase, kinases and phosphatases and DNA ligases.

Unit 2: Cloning vectors, DNA transfer methods and identification of recombinants	**15 Hrs**

Cloning Vectors: Definition and Properties. Characteristics of cloning vectors. Plasmid vectors: pBR and pUC series. Bacteriophage lambda, cosmids, BACs, YACs. Use of linkers and adaptors. Expression vectors: Baculovirus based vectors, mammalian SV40-based expression vectors.

Cloning host- Cloning in *Escherichia coli*, cloning in *Saccharomyces cerevisiae*, cloning in GRAS microorganism. Gene Library: Construction of cDNA library, genomic library. DNA transfer methods: Microinjection, Biolistic, Electroporation, Calcium phosphate and Liposome mediated DNA transfer. Identification and selection of recombinants: DNA hybridisation, blue white selection, antibiotic selection, colony and plaque hybridization.

Unit 3: Techniques and applications in Microbial Genetic Engineering	**15 Hrs**

Isolation and Detection of DNA: Isolation of DNA, restriction digestion and ligation of DNA, Agarose gel electrophoresis, Blotting techniques- Southern blotting, Northern blotting, dot blot, DNA microarray analysis, Western blotting. DNA sequencing- Sanger's method. PCR techniques and applications.

Recombinant microorganisms: Application of recombinant microorganisms in basic research, industry, medicine, agriculture, environment.

Products of recombinant DNA technology: Products of human therapeutic interest - insulin, hGH, antisense molecules. Bt transgenic - cotton, brinjal, Gene therapy, recombinant vaccines. Biological, ethical and social issues of gene cloning and IPR.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
To acquire knowledge on the concepts and terminology in genetic engineering	√					√									
To learn about principles involved in manipulating genes and DNA	√		√						√						
Familiar with various cloning strategies in prokaryotes									√	√					
Learn techniques in genetic engineering						√						√			
To have awareness of IPR, the social and the ethical issues concerning cloning by genetic engineering										√					

Pedagogy: Lectures, Seminars, Industry/Institute Visits, Debates, Quiz, Project and Assignments

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Attendance	10
Seminar	10
Debate/Quiz/Assignment	10
Class test	10
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

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Course Title	MICROBIAL GENETIC ENGINEERING (Practical)		Practical Credits	02
Course Code	MIC C16-P	Contact Hours	4 Hours/ week	
Formative Assessment	25 Marks	Summative Assessment	25 Marks	
Practical Content				

Practical: Microbial Genetic Engineering

Preparation of buffers-TE, TAE and Lysis buffer.
Isolation of plasmid DNA from *Escherichia coli.*
Estimation of DNA by DPA method.
Demonstration of estimation of DNA by spectrophotometric method.
Resolution and visualization of DNA by agarose gel electrophoresis.
Induction of mutations in bacteria by UV light.
Preparation of competent cells and demonstration of bacterial transformation.
Demonstration of bacterial transformation and calculation of transformation efficiency.
Digestion of DNA with restriction enzymes.
Demonstration of ligation of DNA fragments.
Preparation of master and replica plates.
Designing of primers for DNA amplification.
Demonstration of amplification of DNA by PCR.
Demonstration of Southern blotting.
Study of recombinant products-as per theory syllabus.

Pedagogy: Experiential learning, Problem solving, Project

Formative Assessment for Practical	
Assessment Occasion/ type	**Marks**
Class Records	05
Test	10
Attendance	05
Performance	05
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

REFERENCES :

1	Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
2	Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
3	Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
4	Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
5	Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
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7	Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education.

Internship for graduate Programme (As Per UGC & AICTE)

Course title	Internship Discipline specific
No of contact hours	90
No credits	2
Method of evaluation	Presentations/Report submission/Activity etc.,

- Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.
- Internship may be full-time/part-time (full-time during semester holidays and part-time in theacademic session)
- Internship mentor/supervisor shall avail work allotment during 6th semester for a maximum of 20hours.
- The student should submit the final internship report (90 hours of Internship) to the mentor forcompletion of the internship.
- The detailed guidelines and formats shall be formulated by the universities separately asprescribed in accordance to UGC and AICTE guidelines.

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CBCS Question Paper Pattern for UG Semester DSC

Paper Code:	**Paper Title:**		
Duration of Exam	**2 Hours**	Max Marks	**60**
Instruction:	**Answer all the sections**		

Section-A

.....	**15 Marks**
I. Answer any Five of the following questions (5x3=15) 1. 2. 3. 4. 5. 6. 7.	

Section-B

.....	**25 Marks**
II. Answer any **FIVE** of the following questions (5X5=25) 8. 9. 10. 11. 12. 13. 14.	

Section-C

.....	**20 Marks**
III. Answer any TWO of the following questions	**(2X10=20)**
15. **16.** **17.** **18.**	

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