RK.UNIVERSITY

DETAIL TEACHING SCHEME

SCHOOL OF SCIENCE	PROGRAM : M.Sc. Microbiology
ACADEMIC YEAR - 2018-2019	SEMESTER – II
DEFINATION OF ONE CREDIT : 1. **Lecture(L):** 4 hour / week / semester, **2. Practical(P)**: 3 hour / week / semester **.**	

TEACHING SCHEME

Course Code	Course Name	Teaching Hours			Credits	Audit course	CIE	PSEE	Remarks if any
		Theory	Tutorial	Practical					
MB202	IMMUNOLOGY	4	0	3	7	N	Y	Y	
MB205	VIROLOGY, MYCOLOGY AND PHYCOLOGY	4	0	3	7	N	Y	Y	
MB206	MICROBIAL GENETICS AND GENETIC ENGINEERING	4	0	3	4	N	Y	Y	
MB207	CELL AND CANCER BIOLOGY	4	0	0	7	N	Y	N	
	Total	**16**	**0**	**9**	**25**				
		Total Hours		**25**					

N- No	CIE – Continuous internal evaluation
Y – Yes	PSEE – Practical semester end examination including ITD, Dissertation, Industrial project, Industrial training etc.

Date:

Director,

School of Science

RK UNIVERSITY

SYLLABUS

Course Title	**CELL AND CANCER BIOLOGY**
Course Code	MB 207
Course Credit	Lecture : 4
	Practical : 0
	Tutorial : 0
	Total : 4

DETAILED SYLLABUS

Sr. No.	NAME OF CHAPTER	Sessions Allotted
	SECTION-I	**28**
1	**Overview of the Cell cycle and its control**, : The molecular mechanisms for regulating mitotic events, Cell cycle control in mammalian cells, Checkpoints in cell cycle regulation , Cell Cycle: Mitosis, Meiosis, Cell Cycle, Role of Cyclins and Cyclin Dependent Kinases, Regulation of Cdk Cycline Activity, Regulation of Cell cycle	
2	**Structure of Cell plant and Animal):** Cell membranes, Composition & architecture of Cell Signalling via G protein linked receptors (PKA, PKC, CaM kinase) (Growth factor receptor signaling; JACKSTAT pathway, NOTCH Patway, PI3K-AKT Pathway organelle biogenesis **Animal cloning and *in vitro* fertilization**	
3	**Protein Trafficking and Sorting**: Three Modes of Intracellular Protein: Transport, Targeting Sequences, Retention, Transport to and from the Nucleus, The Nuclear Pore Complex, Gated Transport Through the Nuclear Pore, GTPases and the GDP/GTP Cycle, GTPases in Nuclear Transport, Transport Across Membranes, Transport to Mitochondria, Chaperones and Protein Folding, Transport to Peroxisomes, Synthesis on the Rough Endoplasmic Reticulum, Glycosylation: The Endoplasmic Reticulum and Golgi System, Vesicular Trafficking Between Intracellular Compartments. Enzyme linked receptor signalling**:**	

	SECTION-II	**28**
4	**Introduction to the course:** Cancer Definition**,** Overview of the hallmarks of cancer**,** Cell transformation and tumourigenesis**,** Cell cycle check point and cancer**,** Oncogenes**,** Tumour suppressor genes**,** DNA repair genes and genetic instability	
5	**Cancer Cause and prevention**: Mutagens, carcinogens, and mutations, Tumor viruses and the discovery of oncogenes, Tumor cells possess genetic abnormalities, Mechanisms of oncogene activation, Role of growth factors and receptors in carcinogenesis. AMES test.	
6	**Cancer Therapies and its limitations**: Treatment traditional chemotherapies & radiotherapy, Treatment immunotherapy, What is the rationale behind conventional therapies, and what are some of the drawbacks to this approach to treatment?, Treatment targeted therapy, New genomic and proteomic technologies, CRISPR Technology	

Instructional Method and Pedagogy:

- Lectures will be conducted with the aid of multi-media projector, black board, Audio/Video clips etc relevant to the content.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum ten experiments shall be there in the laboratory related to course contents.

Course Learning Outcomes:

- Cell and Cancer biology course provides an understanding of the cellular behavior in isolation, in tissue, and organ levels and basic principles of carcinogenesis and metastasis. It also provides a molecular understanding of cancer onset, progression, role of various environmental cancer causing agents and contribution of genetic component in cancer predisposition.

Reference books:

1. Molecular Biology of the Cell,Alberts et al
2. The Cell: A molecular approach, Cooper and Hausman
3. Molecular Cell Biology, Lodish et al

4. Molecular Biology of Cancer by F. Macdonald, C.H.J. Ford, and A.G. Casson; Garland Science / Bios Scientific Publishers

5. .Molecular Biology of Human Cancers by Wolfgang Arthur Schulz Springer

	SYLLABUS
Course Title	**MICROBIAL GENETICS AND GENETIC ENGINEERING**
Course Code	MB 206
Course Credit	Lecture : 4
	Practical : 3
	Tutorial : 0
	Total : 7

DETAILED SYLLABUS

Sr. No.	NAME OF CHAPTER	Sessions Allotted
	SECTION-I	**28**
1	**Mutation:** Importance and uses of mutation analysis. Types of mutations, spontaneous and induced mutagenesis, Spontaneous mutations (Random v/s adaptive nature of mutation, Luria and Delbruck experiment, Newcombe experiment, Lederberg's experiment, Mutation rate and its determination, Origin of spontaneous mutations). **DNA damage and Repair:** DNA damages (Deamination of bases, alkylation, damage due to reactive oxygen, UV induced damage) and its repair pathways (Methyl-directed mismatch repair, Nucleotide excision repair, Base excision repair, recombinational repair, SOS inducible repair, specific repair for oxidative DNA damage, pyrimidine dimers and alkylation induced damage and adaptive response).	

2	**Plasmid Biology:** Types, compatibility, replication, control of copy number and plasmid segregation**.** **Transposable elements:** Types of transposable elements, Structure, genetic organization and mechanism of transposition of Tn5, Tn3 and related transposons, Bacteriophage Mu, Tn7 and IS911, Integrons, Retrotransposons, Conjugative and Mobilizable transposons. Assays of transposition.	
3	**Methods of genetic transfer:** Transformation, Conjugation, Transduction and sexduction, mapping genes by interrupted mating, fine structure analysis of genes. **Agrobacterium genetics:** Ti-plasmid, Interkingdom gene transfer (Key early experiments, vir regulon, protein secretion apparatus, conjugation model of T-DNA transfer, Integration products).	
	SECTION-II	**28**
4	**Scope of Genetic Engineering:** Concept and importance of Genetic Engineering, General strategies and steps involved in gene cloning. **Cloning strategies** mRNA and cDNA preparation, Chemical synthesis of gene/DNA, Cloning and expression vectors- Plasmids, bacteriophages, M-13 based vectors, Phagemids, Cosmids, YAC, BAC, HAC/MAC, etc.	
5	**Recombinant selection and screening:** Southern blotting & hybridization, Northern analysis, Western blot analysis, Agarose gel electrophoresis, Pulse Field Gel Electrophoresis, Rotating Gel Electrophoresis (RGE), PAGE, SDS-PAGE, Isoelectric Focusing, Two Dimensional Electrophoresis, Capillary Electrophoresis, Capillary Gel Electrophoresis **Reporter genes:**	

	Significance and various types of reporter gene systems, Chloramphenicol acetyl transferase (cat), neomycin phosphoryltransferase II (nptII), Luciferase and β-galactosidese system: applications in expression studies
6.	**Application and ethics of cloning:** Expression of cloned gene in heterologous host, mutagenesis, genomics and functional genomics, metagenomics, metabolic engineering, gene therapy, recombinant hormones, recombinant DNA vaccines, polymerase chain reaction, transgenic plants, transgenic animals, genetic engineering guidelines

LIST OF LABORATORY EXPERIMENTS (3 HOUR/WEEK)

1. To isolate bacterial genomic DNA and amplification of a gene by thermal cycler.
2. To determine Nucleic acid concentration by non-destructive method (UV-Visible Spectroscopy).
3. To perform Amplified Ribosomal DNA Restriction Analysis (ARDA) and Restriction Fragment Length Polymorphism (RFLP)
4. To analyze ARDA and RFLP products by agarose gel electrophoresis.
5. To perform fluctuation test.
6. To determination of plasmid copy number by alkaline lysis method.
7. To perform mutagenesis of *E.coli* using physical and chemical mutagens.
8. To screen for *rec*$^{-}$*E. coli* strains using physical mutagenesis.
9. Demonstration of Bacterial Conjugation.
10. To study plasmid curing frequency for a given plasmid in *E. coli*

Instructional Method and Pedagogy:

- Lectures will be conducted with the aid of multi-media projector, black board, Audio/Video clips etc relevant to the content.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.

- Surprise tests/Quizzes/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum ten experiments shall be there in the laboratory related to course contents.

Course Learning Outcomes:

On the completion of the course, students will be able to:

- To provide insights into basic concepts and applications of genetic engineering.
- To understand various aspects of genomics and proteomics
- To provide basic insights into various bioinformatics tools and techniques.

Reference books:

1. Gene XI. Benjamin Lewin, (2010). Oxford University press.
2. Genes V. Benjamin Lewin,1994 .Oxford University press.
3. Molecular Biology. Freifelder D, (2008). Jones and Bartlett Publishers USA
4. Molecular Cell Biology. Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P, Darnell J., (2007). W. H. Freeman; 6th edition.
5. Molecular Biology of the Gene. Watson J.D, Baker T.A, Bell S.P, Levine M, Losick R. 5th edition. The Benjamin/Cummings publishing company. CSHL Press
6. Molecular Cloning: A Laboratory Manual. J. Sambrook, E. F. Fritsch and T. Mania tis, Cold Spring Harbor Laboratory Press, New York, 2000.
7. Principles of Gene Manipulation, 4th Ed., R.S.Old and S.B.Primrose. 1989. Blackwell Scientific Publications, London.

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SYLLABUS

Course Title	**IMMUNOLOGY**
Course Code	MB202
Course Credit	Lecture : 4
	Practical : 3
	Tutorial : 0
	Total : 7

DETAILED SYLLABUS

Sr. No.	NAME OF CHAPTER	Sessions Allotted
	SECTION-I	**28**
1	**General Immunology** Adaptive immunity and innate immunity: inflammation, role of cells, receptors and proteins in innate immunity, ubiquity of the innate system. Cells and organs of the immune system: Hematopoiesis, cells of the immune system, primary and secondary lymphoid organs. Antigens and antibodies: properties of immunogens, haptens, epitopes, structure and classes of immunoglobulins, biological activities and effector functions, monoclonal antibodies and abzymes.	
2	**Antigen-antibody interactions** principles and applications. Major histocompatibility complex and antigen presentation: MHC- organization, inheritance, genes, molecules and peptide binding, expression, disease susceptibility, immune responsiveness, self MHC restriction	
3	**T- cell and B cell Response** T-cell receptor, T-cell maturation, activation and differentiation: TCR- genetic organization and rearrangement of genes, TCR-complex, peptide binding, thymic selection, activation and differentiation of T cells..	
	SECTION-II	**28**
4	**B cell response and Complement system** Generation, activation and differentiation of B cells: B cell maturation, activation and proliferation, germinal centers, regulation of the responses. Complement: components of the system, activation, regulation, biological consequences and deficiency diseases	

5	**Cytokinesis and Cell mediated toxicity** Cytokines: properties, receptors, associated diseases, therapeutic applications. Leukocyte activation and migration: CAM, chemokines, recirculation and extravasation, inflammation and anti-inflammatory agents. Cell mediated cytotoxicity: effector T cells, cytotoxic T cells, NK cells, ADCC. Hypersensitivity reactions: classification and types of hypersensitivity reactions.
6	**Immune tolerance and autoimmunity** Immune tolerance and autoimmunity: establishment and failure of tolerance, autoimmune diseases, mechanisms for the induction, animal models, treatment. Transplantation immunology: basis and manifestation of graft rejection, immunosuppressive therapy, immune tolerance.

LIST OF LABORATORY EXPERIMENTS (3 HOUR/WEEK)

1. To learn collection and handling of blood samples
2. To separate serum and plasma from blood sample
3. To detect blood group of given blood sample
4. To perform estimation of haemoglobin by sahli's method
5. To perform Total leukocyte count of blood sample.
6. To perform differential count of leukocytes
7. To determine bleeding time and clotting time
8. To demonstrate agglutination reaction by WIDAL test
9. To perform Urine sample Analysis: Physical, chemical and microbiological test
10. To Isolate of drug resistant bacteria from clinical sample

Instructional Method and Pedagogy:

- Lectures will be conducted with the aid of multi-media projector, black board, Audio/Video clips etc relevant to the content.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum ten experiments shall be there in the laboratory related to course contents.

Course Learning Outcomes:

At the end of the course the students will be able to:

- Know behaviour of immune system and molecules involved therein towards development of diagnostic methods and vaccines.
- Know the architecture of the immune system and various aspects of immunity and immune responses.

Reference books:

1. Kuby Immunology by Kindt TJ, Goldsby RA, Osborne BA, Kuby J: 6th edition. New York. WH Freeman; 2006.
2. Cellular and Molecular Immunology by Abbas AK, Lichtman AH, Pillai S: Saunders Elsevier; 2007.
3. Immunobiology: The immune system in health and disease by Janeway CA,Travers P,Walport M, Shlomchik MJ: 6th edition. New York. Garland Science Publishing; 2005.
4. Medical Microbiology and Immunology by Levinson W, Jawetz E: Lange publication; 2001.
5. Fundamental Immunology by Paul WE: 4th edition. New York. Raven Press; 2000.
6. Roitt's Essential Immunology by Delves PJ, Martin SJ, Burton DR, Roitt IM; 11th edition. Blackwell Publishing/Oxford Univ. Press; 2006.

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SYLLABUS

Course Title	**VIROLOGY, MYCOLOGY AND PHYCOLOGY**
Course Code	MB 205
Course Credit	Lecture : 4
	Practical : 3
	Tutorial : 0
	Total : 7

DETAILED SYLLABUS

Sr. No.	Name of chapter & Details	Sessions Allotted
	SECTION-I	**28**
1	**Introduction to virology:** Early development of virology, general properties of virus, structure of virus, nucleic acids, viral envelopes and enzymes. **Classification and cultivation of viruses:** Principles of viral taxonomy (nature of the host, nucleic acid characteristics, capsid symmetry). Cultivation of virus (in embryonated eggs, experimental animals and cell lines; primary and secondary cell lines, diploid cell lines).	
2	**Assays and purification of viruses**: Physical and chemical methods; plaque method, pock counting and end point method. Serological methods (hemagglutination, hemagglutination inhibition, neutralization test, complement fixation, ELISA, RIA). Methods of virus purification (gradient centrifugation, electrophoresis and chromatography). **Bacteriophages**: Classification, morphology and ultra structure. One step growth curve, life cycle (lytic and lysogenic life cycle, molecular mechanism, choice and switchover between cycles). Life cycle of M 13, Mu, T4, Φx 174, lambda phage, cynobacteria and mycophages.	
3	**Plant viruses:** History, classification, structure and pathogenesis of TMV. Transmission of plant viruses with vectors (insect, nematodes and fungi) and without vectors (contact, seed and pollination). **Animal viruses:** Nomenclature, classification and replication of animal viruses. Viroids, and Prions.	
	SECTION-II	**28**

4	**An Introduction to mycology and classification of fungi.** Scope and significance of mycology. Major contributions of P.A.Micheli, Anton de Bary, E.J.Butler, G.C.Ainsworth, K.S.Thind, S.B.Saksena, C.V.Subramanian. Concept of biodiversity**.** Current status of fungi, criteria used in classification with reference to Ainsworth, Alexopoulos and Mims and Kirk *et al*. system of classification. **Ultra structure of fungi:** Distribution, importance, structure, nutrition, metabolism and reproduction (Heterothallism, Heterokaryosis, parasexual cycle, dimorphism in fungi, asexual and sexual reproduction).
5	**Characteristics of the fungal divisions and their life cycle:** *Zygomycota, Ascomycota, Basidiomycota, Deuteromycota, Chytridiomycota* . **Slime Molds and Water Molds**: Division *Myxomycota* (Acellular Slime Molds); *Acrasiomycota* (Cellular Slime Molds); *Oomycota*. Lichen, Mycorrhiza and Actinomycetes.
6	**An Introduction to Phycology:** Distribution of algae, Classification of algae, ultra-structure of the algal cell, algal nutrition, structure of the algal thallus (vegetative form), algal reproduction. **An introduction to Protozoa**: Distribution, Importance, Morphology, Nutrition, Encystment and Excystment, Locomotory Organelles, Reproduction. General characteristics, classification and life cycle (of genus: *Entamoeba, Naegleria* and *Acanthamoeba*). Flagellated and Apicomplexan protozoa. Application aspect of fungi, algae and protozoa.

LIST OF LABORATORY EXPERIMENTS (3 HOUR/WEEK)

1. To prepare selective media for fungal isolation (PDA and SDA).
2. To isolate and identify keratinophilic fungi from soil sample based on their colony morphology and microscopic characterization.
3. To perform Lactophenol cotton blue staining for fungal identification.
4. To isolate and enumerate fungi from air sample.
4. To isolate bacteriophage from sewage sample.
5. To determine bacteriophage concentration by plaque assay method.
6. To study plant diseases (at least four different diseases).

Instructional Method and Pedagogy:

- Lectures will be conducted with the aid of multi-media projector, black board, audio/video clips etc. relevant to the content.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Tutorials will be conducted.

- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum five experiments shall be there in the laboratory related to course contents.

Course Learning Outcomes:

At the end of the course the students will be able to:

- Describe various structural details of virus, fungi, algae and fungi.
- Explain and demonstrate the life cycle of animal and plant virus, fungi, algae and protozoa.
- Determine presence of bacteriophage and quantify it.
- Identify plant diseases caused due to fungi and virus

Reference books:

1. Prescott`s Microbiology. Lansing M Prescott, John P Harley, Donald A Klein, 9th Edition, MacGraw Hill Higher education.
2. Principles of Virology, Molecular Biology, Pathogenesis and Control. Flint, S.J., Enquist,L.W., Ranconiello,V.R. and Stalka,A.M.(2000). American Society for Microbiology, Washington DC.
3. Textbook of Microbiology Paniker, C.K.J.(2007). Anantha Narayan and Paniker's Orient Longman Pvt. Limited, India.
4. Medical Microbiology, A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control. Greenwood, D., Slack, R.C.B. and Peutherer,J.F.(2006). Churchill Livingstone, Elsevier, India.
5. Immunology. Kuby, Goldsby, kindt and Osborne(2006). W.H. Freeman & co.
6. General Microbiology. Stanier Roger, Ingraham John, Wheelis Mark. Painter Page. 5th Edition. Macmillan Press, London.