Sacred Heart College (Autonomous)

Department of Zoology

Master of Science [Zoology]

Course plan

Academic Year: 2018-19

Semester III

Course 09: 16P3ZOOT09: ANIMAL PHYSIOLOGY

PROGRAMME	**MASTER OF SCIENCE [ZOOLOGY]**	**SEMESTER**	**3**
COURSE CODE AND TITLE	**16P3ZOOT09 : ANIMAL PHYSIOLOGY**	**CREDIT**	**4**
HOURS/WEEK	**4**	**HOURS/SEM**	**72**
FACULTY NAME	**MONCEY VINCENT & GISHA SIVAN**		

COURSE OBJECTIVES
To explain and compare the functioning of organ systems across the animal world
To illustrate the mechanism of regulating food intake in human beings as well as problems related with overeating and resultant obesity
To explain the structure of different types of hearts in animals, and examine the functioning of respiratory and circulatory systems of human beings together with their diseases
To explain the osmoregulatory and excretory systems of human body and the factors regulating these processes
To outline the functioning of neurons, nerves and muscles
To illustrate the structure of sense organs and the transduction processes which convert changes in physical/chemical environment into nerve signals
To examine the mechanism of thermoregulation in human body
To analyze the chemical coordination system of animal body and examine the reproductive physiology in relation to endocrinology of mammals

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
	MODULE I- NUTRITION			
1	Nutrition in animals, mechanisms of food intake in different animals.	ICT Enabled (ppt & images, video clippings)	Q & A Session	
2	Neuronal and hormonal regulation of nutritional intake, hunger drive, thirst.	ICT Enabled (ppt & images, video clippings)		
	MODULE II: CIRCULATION			
3	Circulatory mechanisms and fluid compartments, movement of body fluids by somatic muscles	ICT Enabled (ppt & images, video clippings)		
4	open system, closed system, lymph channels.	ICT Enabled (ppt & images, video clippings)		
5	Circulatory shock, Circulatory arrest. Types of hearts – chambered heart, tubular heart, ampullar heart, lymph heart, neurogenic and myogenic heart.	ICT Enabled (ppt & images, video clippings)	Video	
6	Pace makers and specialized conducting fibers.	ICT Enabled (ppt & images, video clippings)		
7	Cardiac cycle, cardiac output, blood pressure, effect of drugs on heart beat,	ICT Enabled (ppt & images, video clippings)		
8	effects of exercise on cardiaovascular physiology.	ICT Enabled (ppt & images, video clippings)	Video	
9	ECG - its principle and significance.	ICT Enabled (ppt & images, video clippings)		
10	Blood buffers, Human congenital heart diseases.	ICT Enabled (ppt & images, video clippings)		

MODULE III: RESPIRATION				
11	**Pulmonary ventilation, respiratory muscles, surfactants.**	**ICT Enabled (ppt & images, video clippings)**	**Q & A Session**	
12	**Respiratory centers and periodic breathing. Regulation of respiration.**	**ICT Enabled (ppt & images, charts, video clippings)**		
13	**Respiration in unusual environment - foetal and neonatal respiration, high altitude, diving.**	**ICT Enabled (ppt & images, video clippings)**		
14	**Structure and functioning of respiratory pigments.**	**ICT Enabled (ppt & animations, images, video clippings)**	**Quiz**	
15	**Metabolic rate : basal metabolic rate and its measurement.**	**ICT Enabled (ppt & images, video clippings)**		
16	**CIA I**	**1 hr; descriptive answers only**		
MODULEV IV: OSMOREGULATION AND EXCRETION				
17	**Osmoregulation in fresh water, marine and terrestrial animals. Excretion in vertebrates.**	**ICT Enabled (ppt & images, video clippings)**		
18	**Physiology and regulation of urine formation.**	**ICT Enabled (ppt & images, video clippings)**	**Q & A Session**	
19	**Hormonal regulation of urine formation.**	**ICT Enabled (ppt & images, video clippings)**		
20	**Regulation of water balance, electrolyte balance and acid-base balance..**	**ICT Enabled (ppt & images, video clippings)**		
21	**Dialysis, artificial kidney, kidney transplantation**	**ICT Enabled**	**Quiz**	

		(ppt & images, video clippings)		
MODULE V: NERVE PHYSIOLOGY				
22	Neuroanatomy of the central and peripheral nervous system.	ICT Enabled (ppt, images, animations & video clippings)		
23	Electrical and chemical transmission. Synaptic transmission.	ICT Enabled (ppt & images, charts, video clippings)	Video	
24	Modifications of synaptic transmission during fatigue, acidosis, alkalosis, hypoxia and drugs.	ICT Enabled (ppt & images, video clippings		
25	Mechanism of excitatory and inhibitory pathway.	ICT Enabled (ppt & images, video clippings		
26	Neuromuscular Junction: organization and properties of neuromuscular junction,	ICT Enabled (ppt & images, video clippings		
27	neuromodulators	ICT Enabled (ppt & images, video clippings		
28	Neural control of muscle tone and posture.	ICT Enabled (ppt & images, video clippings		
MODULEVI: SENSORY AND EFFECTOR PHYSIOLOGY				
29	Classification of somatic senses and somatic receptors, exteroceptors, interoceptors, modality of sensation, secondary sense cells, transduction, relationship between stimulus, intensity and response, sensory coding.	ICT Enabled (ppt & images, video clippings	Q & A Session	
30	Chemical senses: taste, smell, mechanism of reception.	ICT Enabled (ppt & images, video clippings		

31	Mechanoreceptors: hair cell, organs of equilibrium, vertebrate ear, mechanism of hearing, electro and thermoreceptors.	ICT Enabled (ppt & images, video clippings		
	Physiology of vision.			
32	Pain: pain receptors, headache and thermal senses, pain suppression (analgesia).	ICT Enabled (ppt & images, video clippings	Q & A Session	
33	Tactile sensation: touch receptors, transmission of signals,	ICT Enabled (ppt & images, video clippings		
34	special problems of premature infants,Physiological role of touch and environment in premature infants-Kangaroo care, infant massage, supportive environment.	ICT Enabled (ppt & images, video clippings		
MODULE VIII: MUSCLE PHYSIOLOGY				
35	Red and white muscles	ICT Enabled (ppt & images, video clippings	Q & A Session	
36	muscle proteins.	ICT Enabled (ppt & images, video clippings		
37	Effect of exercise on muscles.	ICT Enabled (ppt & images, video clippings		
38	Catch muscle and	ICT Enabled (ppt & images, video clippings		
39	fibrillar muscle.	ICT Enabled (ppt & images, video clippings		
MODULE VIII: THERMOREGULATON				
40	body temperature - physical, chemical,	ICT Enabled (ppt & images, video clippings		
41	neural regulation, acclimatization.	ICT Enabled	Video	

		(ppt & images, video clippings)		
42	Comfort zone,	ICT Enabled (ppt & images, video clippings)		
43	acclimatization	ICT Enabled (ppt & images, video clippings)		
MODULE X: REPRODUCTIVE PHYSIOLOGY				
44	Anatomy and histology of adult ovary.	ICT Enabled (ppt, maps, images & video clippings)	Q & A Session	
45	Anatomy and histology of adult testis	ICT Enabled (ppt, maps, images & video clippings)		
46	Reproductive cycles of mammals and their hormonal control.	ICT Enabled (ppt, maps, images & video clippings)		
47	Physiology of pregnancy,	ICT Enabled (ppt, maps, images & video clippings)		
48	parturition	ICT Enabled (ppt, maps, images & video clippings)		
49	lactation	ICT Enabled (ppt, maps, images & video clippings)		

50	**Impact of senescence and age on reproduction.**	**ICT Enabled (ppt, maps, images & video clippings)**		
51	**Physiology of implantation**	**ICT Enabled (ppt, maps, images & video clippings)**	**Quiz**	
MODULE IX: ENDOCRINOLOGY				
52	**Endocrine glands.**	**ICT Enabled (ppt, maps, images & video clippings)**	**Q & A Session**	
53	**Endocrinology**	**ICT Enabled (ppt, maps, images & video clippings)**		
54	**Synthesis, physiologic role, control and mechanisms of hormone action.**	**ICT Enabled (ppt, maps, images & video clippings)**		
55	**Hormone receptors**	**ICT Enabled (ppt, maps, images & video clippings)**		
56	**Hypothalamus**	**ICT Enabled (ppt, maps, images & video clippings)**		
57	**Pituitary Gland**	**ICT Enabled (ppt, maps, images & video clippings)**		
58	**Pituitary Hormones**	**ICT Enabled (ppt, maps, images &**		

		video clippings)		
59	Growth Hormone	ICT Enabled (ppt, maps, images & video clippings)		
60	Thyroid Gland	ICT Enabled (ppt, maps, images & video clippings)		
61	CIA II			
62	Thyroid Hormones	ICT Enabled (ppt, maps, images & video clippings)		
63	Adrenal cortex	ICT Enabled (ppt, maps, images & video clippings)		
64	Mineralocorticoids	ICT Enabled (ppt, maps, images & video clippings)		
65	Glucocorticoids	ICT Enabled (ppt, maps, images & video clippings)		
66	Adrenal sex steroids	ICT Enabled (ppt, maps, images & video clippings)		
67	Endocrine Pancreas	ICT Enabled (ppt, maps, images & video clippings)		
68	Insulin and diabetics mellitus	ICT Enabled		

		(ppt, maps, images & video clippings)		
69	Sex steroLs	ICT Enabled (ppt, maps, images & video clippings)		
70	Neuroendocrine system	ICT Enabled (ppt, maps, images & video clippings)		
71	neurohormones	ICT Enabled (ppt, maps, images & video clippings)		
72	Local Hormones	ICT Enabled (ppt, maps, images & video clippings)		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual – Written/Presentation – Graded or Non-graded etc)
1	14/8/2018	Hormones
2	15/8/2018	Structure of eye

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	15/9/2018	Urine formation

References

- **Bentley,P.J. 1998. Comparative Vertebrate Endocrinology (3rd edn). Cambridge University Press Bray, J.J., Cragg, P. A, Macknight, A.D, Mills, R.S and Taylor, D.W 1986. Lecture Notes on human Physiology. ELBS, New Delhi.**
- **Brijlal Gupta and J.A. Ramsay, 1977. Transport of Ions and Water in Animals. Academic Press, New York.**
- **Chatterjee, C.C. 1997. Human Physiology. Medical allied agency, Calcutta.**
- **Ganong, W.F 1987. Review ofMedical physiology. Appleton and lang, Norwalk.**
- **Guyton, A.C. 1996. Text Book of Medical physiology. Prism Books**
- **Pvt.Ltd.Bangalore**
- **Hill, W.R., Wyse, G.A and Anderson, M. 2007. Animal Physiology (2nd edn). Sinauer Associates Inc. Publishers, MA, USA.**
- **Hoar, W.S. 1983. General and Comparative Physiology. Prentice Hall of India,New Delhi.**
- **Hochachka, P.W. and Somero, G.N. 1984. Biochemical Adaptation. Princeton University Press, New Jersey.**
- **Hochachka, P.W. and Somero, G.N 2002. Biochemical Adaptation: Mechanism and Process in Physiological Evolution. Oxford University Press, New York.**
- **Ian Kay.1998. Introduction to Animal Physiology. Bios Scientific Publishers Ltd., Oxford, UK**
- **Keele, C.A , Neil, E. and Joels, N. 1982. Samson Wright's Applied Physiology. Oxford University Press**
- **Knut Schmidt-Neilsen. 1997. Animal physiology: Adaptations and Environment Cambridge University Press**
- **Larsson, P.R. et al., 2002. William's Text Book of Endocrinology (10th edn).W.B. Saunders, Philadelphia**
- **Moyers, D.C and Schulte ,P.M. 2007. Principles of Animal Physiology (2nd edn). Benjamin Cummings,CA, USA**

COURSE 10: 16P3ZOOT10: CELL AND MOLECULAR BIOLOGY

PROGRAMME	**MASTER OF SCIENCE [ZOOLOGY]**	**SEMESTER**	**3**
COURSE CODE AND TITLE	**16P3ZOOT10: CELL AND MOLECULAR BIOLOGY**	**CREDIT**	**4**
HOURS/WEEK	**4**	**HOURS/SEM**	**72**
FACULTY NAME	**JOBI M.J., MATHEW M.J. & SMITHA S.**		

COURSE OBJECTIVES
To understand the structure of a living cell and its associations at molecular level
To appreciate the role played by various cell organelles and cytoskeleton
To analyze the role played by cell signaling pathways
To describe the process involved in cell cycle and molecules involved
To distinguish between a cancerous cell from non-cancerous one
To examine the concept of gene expression
To discuss the role played by various molecules at different levels of gene regulation

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
	Module I. Cellular Membranes			
1	A brief historical overview on the study of cell membrane structure	Lecture	Q & A Session	
2	Fluid mosaic model	ICT Enabled (ppt & images); discussion		
3	Chemistry of cell membrane – membrane lipids, carbohydrates, proteins and the roles they performed.	ICT Enabled (ppt & images); discussion		
4	Dynamic nature of the plasma membrane; Membrane fluidity, lipid raft	ICT Enabled (ppt & images, video clippings); discussion		
	Module II. Cell junctions, Cell adhesion and Extracellular matrix			
5	Chemical nature of Extracellular matrix; Cellular interactions – with other cells, with extracellular matrix,	ICT Enabled (ppt & images, video clippings); discussion		

6	Chemical nature of Extracellular matrix.	ICT Enabled (ppt & images, video clippings); discussion	Q & A Session	
7	Interaction of cells with extracellular matrix: Integrins.	ICT Enabled (ppt & images, video clippings); discussion		
8	Focal adhesion and hemidesmosomes.	ICT Enabled (ppt & images, video clippings); discussion		
9	Interaction of cells with other cells: Selectins,	ICT Enabled (ppt & images, video clippings); discussion		
10	Immunoglobulins, Cadherins,	ICT Enabled (ppt & images, video clippings); discussion		
11	Adherens Junctions and desmosomes.	ICT Enabled (ppt & images, video clippings); discussion		
12	Tight junctions	ICT Enabled (ppt & images, video clippings); discussion	Quiz	
13	Gap junctions and Plasmodesmata	ICT Enabled (ppt & images, video clippings); discussion		
Module III. Cell Organelles				
14	Endoplasmic reticulum	ICT Enabled (ppt & images); Seminar		
15	Golgi complex	ICT Enabled (ppt & images); Seminar		
16	Vesicular transport of secretory products	ICT Enabled (ppt & images); Seminar		
17	Lysosomes - Role in autophagy	ICT Enabled (ppt & images); Seminar		
18	Ribosome	ICT Enabled (ppt & images); Seminar		

19	Mitochondria.	ICT Enabled (ppt & images); Seminar		
Module IV. Cytoskeleton and Cell Motility				
20	Microtubules	ICT Enabled (ppt & images); Seminar		
21	Microfilaments	ICT Enabled (ppt & images); Seminar		
22	Intermediate filaments	ICT Enabled (ppt & images); Seminar		
23	Molecular motors	ICT Enabled (ppt & images); Seminar		
24	Non muscle motility and contractility.	ICT Enabled (ppt & images); Seminar		
Module V. Cell Signaling				
25	An overview of cell signaling system	ICT Enabled (ppt & images); discussion	Q & A Session	
26	Extracellular messengers (signaling molecules)	ICT Enabled (ppt & images); discussion		
27	Cell surface Receptors: G- Protein coupled receptors,	ICT Enabled (ppt & images, video clippings); discussion		
28	Receptor tyrosine kinases (RTK)	ICT Enabled (ppt & images); discussion		
29	Ion channel receptors, Cytokine receptors (Tyrosine kinase linked receptors).	ICT Enabled (ppt & images); discussion		
30	Second messengers: Cyclic-AMP, Cyclic-GMP,	ICT Enabled (ppt & images, video clippings); discussion		
31	Inositol 1,4,5-trisphosphate (IP3), Di-acyl glycerol (DAG).	ICT Enabled (ppt & images, video clippings); discussion	Quiz	
32	Signaling pathways: G-protein coupled receptor (GPCR) pathway –GPCR pathway in sensory perception	ICT Enabled (ppt & images, video clippings); discussion		
34	Signaling pathways: cyclic AMP pathway	ICT Enabled (ppt & images); discussion		
35	Signaling pathways: Receptor	ICT Enabled (ppt &		

	protein tyrosine kinase and Ras-MAP kinase pathway	images); discussion		
36	Calcium phosphatidyl- inositol pathway,	ICT Enabled (ppt & images); discussion		
37	Phospho Inositide 3-kinase (PI-3 kinase).	ICT Enabled (ppt & images); discussion		
	CIA-I			
Module VI. Cellular Reproduction				
38	Cell cycle: Steps in cell cycle, Control of cell cycle.	ICT Enabled (ppt & images, video clippings); discussion	Q & A Session	
39	Checkpoints in cell cycle	ICT Enabled (ppt & images, video clippings); discussion		
40	Control of cell division and cell growth.	ICT Enabled (ppt & images, video clippings); discussion		
41	Apoptosis- extrinsic and intrinsic pathways, significance	ICT Enabled (ppt & images); discussion		
42	Revision			
Module VII. Cancer				
43	Basic properties of a cancer cell.	Seminar; discussion	Q & A Session	
44	Types of cancer, Causes of cancer	Seminar; discussion		
45	Genetics of cancer	Seminar; discussion		
46	Genetics of cancer contd..	Seminar; discussion		
47	Tumor suppressor genes	Seminar; discussion		
48	Oncogenes	Seminar; discussion		
49	New strategies for combating cancer: Immunotherapy, Gene therapy, Inhibiting cancer promoting proteins, Inhibiting formation of new blood vessels.	Seminar; discussion	Group discussion	
50	Revision			

Module VIII. Gene Expression				
51	**Introduction to transcription and translation**	**Discussion**	**Q & A Session**	
52	**Transcription in prokaryotes**	**ICT Enabled (ppt) Discussion**		
53	**Transcription in eukaryotes-mRNA**	**ICT Enabled (ppt) Discussion**		
54	**Transcription in eukaryotes-rRNA, tRNA**	**ICT Enabled (ppt) Discussion**		
55	**Post transcriptional modifications**	**ICT Enabled (ppt) Discussion**		
56	**Translation in prokaryotes**	**ICT Enabled (ppt) Discussion**		
57	**Translation in prokaryotes - termination**	**ICT Enabled (ppt) Discussion**		
58	**Translation in eukaryotes-initiation**	**ICT Enabled (ppt) Discussion**		
59	**Translation in eukaryotes-elongation & termination**	**ICT Enabled (ppt) Discussion**		
60	**CIA-II**			
Module XI. Gene Regulation				
61	**Gene regulation in prokaryotes**	**ICT Enabled (ppt & images); discussion**	**Q & A Session**	
62	**Lac operon**			
63	**Repression and attenuation**	**ICT Enabled (ppt & images); discussion**		
64	**General introduction to gene regulation in eukaryotes**	**ICT Enabled (ppt & images, video clippings); discussion**		
65	**Gene regulation in eukaryotes at transcriptional level**	**ICT Enabled (ppt & images, video clippings); discussion**		

66	Gene regulation in eukaryotes at post transcriptional level	ICT Enabled (ppt & images, video clippings); discussion		
67	Gene regulation in eukaryotes at translational levels	ICT Enabled (ppt & images, video clippings); discussion		
68	Chromatin-remodelling complexes	ICT Enabled (ppt & images); discussion		
69	Riboswitches	ICT Enabled (ppt & images); discussion		
70	RNA interference (RNAi).	ICT Enabled (ppt & images); discussion		
71	Revision			
72	Revision			

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	13/9/2018	Biology of cancer

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	28/9/2018	New developments in cancer research

References

- **Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. And Walter, P. 2008. *Molecular Biology of the Cell*. Garland Science.- Taylor and Francis group, USA.**

- **Becker, W.M.,Kleinsmith, L.J. and Hardin, J. 2007. *The World of the Cell*. Pearson, New Delhi.**
- **Clark, D.P. 2010. *Molecular Biology*. Elsevier Publishers, London.**
- **Cooper, G.M. and Hausman, R.E. 2009. *The cell: A Molecular Approach* (5thedn). Sinauer Associates, Inc, ASM Press, Washington DC.**
- **Griffiths, A.J.F., Wesler, S.R., Carroll, S.B. and Doebley, J. 2008. *Introduction to Genetic Analysis.* W H Freeman and Company,USA**
- **Hyde, D.R. 2010.*Genetics and Molecular Biology*. Tata McGraw Hill Education Private Ltd., New Delhi.**
- **Karp, G. 2010. C*ell and Molecular Biology* (6thedn). John Wiley and Sons,Inc.NJ,USA.**
- **Klug, W.S. and Cummings, M.R. 2004. *Concepts of Genetics*. Pearson International, New Delhi.**
- **Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T. 2011. *Lewin's Genes X*. Jones and Bartlett publishers,NY.**
- **Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Scott, M.P., Bretscher, A., Ploegh, H. and Matsudaira, P. 2007. *Molecular Cell Biology* (6th edn). W H Freeman & Company.**
- **Pierce, B.A. 2008. *Genetics: A conceptual approach*. W H Freeman and Company.**
- **Pollard, T.D. and Earnshaw, W.C. 2008. *Cell Biology*. Saunders Elsevier.**
- **Snustad, D.P. and Simmons, M.J. 2010. *Principles of Genetics*. John Wiley and Sons.**
- **Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. 2009. *Molecular Biology of the Gene.* Pearson.**

COURSE 11: 16P3ZOOT11: MICROBIOLOGY AND BIOTECHNOLOGY

PROGRAMME	**MASTER OF SCIENCE [ZOOLOGY]**	**SEMESTER**	**3**
COURSE CODE AND TITLE	**16P3ZOOT11: MICROBIOLOGY AND BIOTECHNOLOGY**	**CREDIT**	**4**
HOURS/WEEK	**4**	**HOURS/SEM**	**72**
FACULTY NAME	**MATHEW M.J., SMITHA S. & RAAGAM P.M.**		

COURSE OBJECTIVES
To perceive the basic concepts of microbiology – Methods, classification, functional anatomy of prokaryotic cells
To discuss the advanced concepts of microbial metabolism, nutrition, growth, interactions and ecology
To discuss the advanced concepts of virology
To explain the concepts of applied microbiology – Bacteriology of air, water and soil; food microbiology, medical microbiology, bioweapons and bioterrorism
To know the basic definitions and scope of biotechnology, intellectual property rights, biosafety and bioethics
To differentiate the various tools and techniques in Recombinant DNA Technology
To differentiate the various tools and techniques in Animal Biotechnology
To extend the advanced concepts of the applications of biotechnology in healthcare, industry, agriculture and environmental biotechnology

SESSION	**TOPIC**	**LEARNING RESOURCES**	**VALUE ADDITIONS**	**REMARKS**
Module I. Introduction to Microbiology				
1	**Methods of Microbiology, Main group of microorganisms, general characters.**	**ICT Enabled (ppt & images, video clippings); discussion**	**Q & A Session**	
2	**Classification, approaches to microbial classification, outline classification, Bergey's manual.**	**ICT Enabled (ppt & images, video clippings); discussion**	**https://www.bergeys.org/**	
Module II. Functional Anatomy of Prokaryotic Cells				
3	**Cell structure, plasma membrane, cytoskeleton, cytoplasm, nucleoid, cytoplasmic inclusions.**	**ICT Enabled (ppt & images, video clippings); discussion**		

4	**The prokaryotic cell envelope, peptidoglycan structure, gram positive and negative cell walls.**	**ICT Enabled (ppt & images, video clippings); discussion**		
5	**Components outside the cell wall: capsules, slime layers and s-layers, pili and fimbriae, flagella and motility.**	**ICT Enabled (ppt & images, video clippings); discussion**		
6	**The endomembrane system, mitochondria and chloroplasts, cell wall and pellicle in protists**	**ICT Enabled (ppt & images, video clippings); discussion**		
Module III. Microbial Metabolism				
7	**Energy acquisition by chemotrophs and phototrophs**	**Seminar; discussion**	**Q & A Session**	
8	**glycolysis (Embden- Meyerhof pathway).**	**Seminar; discussion**		
9	**Fermentation, anaerobic oxidations, chemosynthesis.**	**Seminar; discussion**		
10	**Photosynthesis, carbon assimilation. Regulation of metabolism.**	**Seminar; discussion**		
Module IV. Nutrition and Growth				
11	**Common nutrient requirements, nutritional types, growth factors, uptake of nutrients by the cell. Culture media.**	**Seminar; discussion**	**Q & A Session**	
12	**Reproduction and exponential growth, the growth curve.**	**Seminar; discussion**		
13	**Physical requirements for bacterial growth and influence of environmental factors on growth.**	**Seminar; discussion**		

Module V. Microbial Interactions and Microbial Ecology				
14	**Symbiosis, commensalism. Mutualism between microbes,**	**Seminar; discussion**		
15	**microbes and plants, microbes and animals.**	**Seminar; discussion**		
16	**Cooperation, competition, predation, antagonism**	**Seminar; discussion**		
17	**Parasitism, plant parasites, animal parasites**	**Seminar; discussion**		
Module VI. Virology				
18	**Properties of viruses, structure and chemical composition, genetic composition eclipse,**	**ICT Enabled (ppt & images, video clippings); discussion**	**Q & A Session**	
19	**host interaction and specificity. Classification, RNA virus , DNA virus, plant virus, animal virus**	**ICT Enabled (ppt & images, video clippings); discussion**		
20	**bacteriophage, lysis and lysogeny, Viral replication. Virioids and prions. Nature and significance. Pathogenic virus, oncovirus.**	**ICT Enabled (ppt & images, video clippings); discussion**	**Animated video**	
MODULE VII. Applied Microbiology				
21	**Bacteria of air, water and soil.**	**ICT Enabled (ppt & images, video clippings); discussion**	**Quiz**	
22	**Microbes associated with food production and spoilage,**	**ICT Enabled (ppt & images, video clippings); discussion**		
23	**microbiology of milk and dairy products**	**ICT Enabled (ppt & images, video clippings); discussion**		
24	**Epidemiology of human diseases**	**ICT Enabled (ppt & images, video**		

		clippings); discussion		
25	Mechanism of microbial pathogenicity. Normal microbial population on human body	ICT Enabled (ppt & images, video clippings); discussion	video	
26	Microbial diseases	ICT Enabled (ppt & images, video clippings); discussion		
27	Nosocomial infections.	ICT Enabled (ppt & images, video clippings); discussion		
28	Medical mycology.	ICT Enabled (ppt & images, video clippings); discussion		
29	Control of microorganism-physical, chemical and antimicrobial agents.	ICT Enabled (ppt & images, video clippings); discussion		
30	Biological weapons and bioterrorism.	ICT Enabled (ppt); discussion	Group discussion	
31	CIA-1			
BIOTECHNOLOGY; Module 1.Introduction to Biotechnology				
32	Historical aspects, definitions and scope of Biotechnology.	ICT Enabled (ppt); discussion		
33	Biotechnology in India	Lecture with PowerPoint	Group Discussion	
Module II. Tools and Techniques in Recombinant DNA Technology				
34	Vectors: cloning and expression vectors	Discussion and lecture	Q & A Session	
35	Vectors with combination features; PUC19 and Bluescript	ICT Enabled (ppt) Lecture		

	vectors, Shuttle vectors, viral vectors, BAC and YAC vectors			
36	**Shuttle vectors, viral vectors, BAC and YAC vectors**	**ICT Enabled (ppt) Lecture**		
37	**Restriction enzymes and DNA modifying enzymes.**	**ICT Enabled (ppt) Lecture**		
38	**Polymerase chain Reaction**	**ICT Enabled (ppt) Lecture**		
39	**Chromosome walking**	**ICT Enabled (ppt) Lecture**		
40	**chromosome jumping, DNA foot printing.**	**ICT Enabled (ppt) Lecture**		
41	**Molecular Markers and Probes- SNP, VNTR, RAPD**	**ICT Enabled (ppt) Lecture**		
42	**RFLP, SSR, STMS, FISH and GISH.**	**ICT Enabled (ppt) Lecture**		
43	**DNA sequencing methods- Maxam and Gilberts chemical degradation method, Sanger and Coulson method, Automated DNA sequencers.**	**ICT Enabled (ppt) Lecture**		
44	**Site directed mutagenesis, molecular chimeras.**	**ICT Enabled (ppt) Lecture**		
45	**Cloning Methodologies- Gene isolation: Shot gun method, Genome libraries, cDNA libraries, Chemical synthesis**	**ICT Enabled (ppt) Lecture**		
46	**Blue-white screening, Colony hybridization methods, Reporter genes, Fusion proteins**	**ICT Enabled (ppt) Lecture**		
Module III. Animal Biotechnology				
47	**Cell and Tissue culture: Basic techniques of mammalian cell culture**	**Lecture and Discussion**		

48	**Growth media; Manipulation of cultured cell and tissues**	**Lecture and Discussion**		
49	**Contamination: Source of contamination, Type of microbial contamination, Monitoring, Eradication of contamination**	**Lecture and Discussion**		
50	**Cryopreservation - importance and process of cryopreservation, cryopreservation of embryos, Cryogenics.**	**ICT (ppt & images, video clippings) and discussion**		
51	**Transfection Methods: CaPO4 precipitation, Shotgun, Electroporation, Lipofection, Microinjection, Agrobacterium mediated gene transfer**	**ICT (ppt & images, video**		
52	**Somatic cell nuclear transfer-reproductive cloning and therapeutic cloning.**	**ICT (ppt & images, video clippings) and discussion**		
53	**Gene knockout and knockin technology.**	**ICT (ppt & images, video clippings) and discussion**		
54	**Applications of transgenic animals.**	**ICT (ppt & images, video clippings) and discussion**		
55	**Stem cell culture : General and historical aspects, properties and types of stem cells, advantages and disadvantages, stem cell niche, application of stem cell technology in medicine.**	**ICT (ppt & images, video clippings) and discussion**		

Module IV. Biotechnology in Healthcare				
56	**Disease prevention – DNA vaccines. Disease diagnosis - Probes, Monoclonal antibodies, detection of genetic disorders.**	**ICT (ppt & images, video clippings) and discussion**	**Q & A Session**	
57	**Disease treatment - Therapeutic proteins, hormones and growth factors.RNAi,**	**ICT (ppt & images, video clippings) and discussion**		
58	**Drug targeting, Gene therapy. Forensic medicine.**	**ICT (ppt & images, video clippings) and discussion**		
59	**Biosensors-different types, applications - medical and non medical. Introduction to Biochips and their application in modern sciences**	**ICT (ppt & images, video clippings) and discussion**		
60	**CIA-II**			
Module V. Biotechnology in Industry and Agriculture				
61	**Metabolite production. Antibiotics, Organic acids, Amino acids, Vitamins, Upstream processing, downstream processing. Microbial enzymes and biotranformation- Microbial production of enzymes, fermentation**	**ICT (ppt & images, video clippings) and discussion**		
62	**Enzyme engineering and applications. Food industry-Single cell protein, probiotics.**	**ICT (ppt & images, video clippings) and discussion**		
63	**Transgenic plants- Plants with resistance to Pests, plants with increased shelf life.Biofertilizers and microbial inoculants**	**ICT (ppt & images, video clippings) and discussion**		
64	**Biotechnology of nitrogen fixation, biocontrol**	**ICT (ppt & images, video clippings) and**		

	agents, Biopesticides, bioinsecticides Terminator gene technology –concept and basics.	**discussion**		
Module VI. Environmental Biotechnology				
65	**Sewage treatment. Solid waste management. Biodegradation of xenobiotic compounds.**	**ICT (ppt & images, video clippings) and discussion**		
66	**Bioremediation and Biorestoration. Microbial leaching and mining. Biofuels.**	**ICT (ppt & images, video clippings) and discussion**		
67	**Transgenics and environment.**			
Module VII. Intellectual Property Rights, Biosafety and Bioethics				
68	**Introduction to Intellectual Property Rights, Types of IP: Patents, Trademarks, Copyrights.** **Basics of Patents Types of patents; Indian Patent Act 1970; Recent Amendments. IPs of relevance to Biotechnology and few Case Studies (Rice, Neem, Curcumin).**	**Seminar; discussion**		
69	**Introduction to History of GATT, WTO, WIPO and TRIPS.**	**Seminar; discussion**		
70	**Biosafety concepts and issues. General guidelines for recombinant DNA research activity. Biosafety protocol 2000.**	**Seminar; discussion**		
71	**Bioethics: Principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity *etc.* Ethics in post genomic era-genetic testing and genetic screening.**	**Seminar; discussion**		

72	**Revision**			

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	**09/09/2018**	**Microbial physiology and interactions**
2	**21/09/2018**	**IPR Case studies**

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	**30/09/2018**	**Biotechnology Research Institutes in India**

References

Microbiology

- **Arora,D.R. and Arora,B. 2008*. Text Book of Microbiology*. CBS Publishers and Distributers, New Delhi**
- **Chakraborty, P. A.2009. *Text Book of Microbiology*. New Central Book Agency.New Delhi**
- **Harma and Kanika.2009.*Manual of Microbiology Tools and Techniques*. Ane Books Pvt. Ltd. New Delhi**
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- **Laning, M Prescot. John,P. Harley and Donald A Klein. 2008. *Microbiology* (7thedn). McGraw Hill International,NJ, USA**
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- **Wheelis, Mark. 2010. *Principles of Modern Microbiology*. Jones and Bartlett Publishers,NY,USA.**

Biotechnology

- **Dale, Jeremy W and Schantz, Malcom V. 2002. *From Gene to Genomes*. John Wiley and Sons Ltd,NY,USA**
- **Das, H.K. 2007. *Text book of Biotechnology*.Wiley India Pvt. Ltd. New Delhi**
- **Doyle, Alan and Griffith Bryan J. 1999. *Cell and Tissue Culture- Laboratory Procedures in Biotechnology*.WileyInternational,NY.**
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- **Sobti R. C. and Pachauri, Suparna S. 2009. *Essentials of Biotechnology*. Ane Books Pvt. Ltd. New Delhi.**

COURSE 12: 16P3ZOOT12: IMMUNOLOGY

PROGRAMME	**MASTER OF SCIENCE [ZOOLOGY]**	**SEMESTER**	**3**
COURSE CODE AND TITLE	**16P3ZOOT12: IMMUNOLOGY**	**CREDIT**	**3**
HOURS/WEEK	**3**	**HOURS/SEM**	**54**
FACULTY NAME	**JOBIN C THARIAN & RAAGAM P M**		

COURSE OBJECTIVES

To explain the overview of immune system
To have an idea about antigens and antibodies and their interactions
To explain the complement system
To classify and interpret the Immune effector mechanisms
To explain about allergy and hypersensitivity
To explain about the Major Histocompatibility Complex (MHC)
To explain the mechanism of immune reactions behind health problems and diseases
To explain and intepret the basics of immunological techniques

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
Module I. Overview of the Immune System				
1.	Types of Immunity- Innate and acquired, Passive and active.	Lecture/PPT	Video/e - resources	
2.	Pattern recognition receptors- scavenger receptors and Toll – like receptors	Lecture/PPT	Video/e - resources	
3.	Humoral and cell-mediated immune responses	Lecture/PPT	Video/e - resources	
4.	Haematopoiesis	Lecture/PPT	Video/e - resources	
5.	Bcell and T-cell maturation and differentiation	Lecture/PPT	Video/e - resources	
Module II. Antigens and Antibodies				
6.	Antigen processing and presentation.	Lecture/PPT	Video/e - resources	
7.	Monoclonal antibodies and abzymes	Lecture/PPT	Video/e - resources	
8.	Genetic model compatible with Ig structure	Lecture/PPT	Video/e - resources	
9.	Multi- gene organization of Ig genes	Lecture/PPT	Video/e - resources	
10.	Variable region gene arrangements. Generation of antibody diversity	Lecture/PPT	Video/e - resources	
11.	Expression of Ig genes and regulation of Ig genes transcription	Lecture/PPT	Video/e - resources	
12.	Antibody genes and antibody engineering	Lecture/PPT	Video/e - resources	
Module III. Antigen –Antibody Interactions				
13.	Antigen- Antibody reactions.	Lecture/PPT	Video/e - resources	
14.	Biological consequences of antigen-antibody reaction	Lecture/PPT	Video/e - resources	
Module IV. The Complement System				
15	Terminal sequence of complement activation (MAC).	Lecture/PPT	Video/e - resources	
16	Classical Pathway	Lecture/PPT	Video/e - resources	
17	Alternate Pathway	Lecture/PPT	Video/e - resources	
18	Lectin Pathway	Lecture/PPT	Video/e - resources	

19	Complement activation, Regulation of complement system	Lecture/PPT	Video/e - resources	
20	Biological consequences of complement activation	Lecture/PPT	Video/e - resources	
21	Complement deficiencies	Lecture/PPT	Video/e - resources	
	Module V. Immune Effector Mechanisms			
22	Inflammatory Cells.	Lecture/PPT	Video/e - resources	
23	Types of Inflammation- acute and chronic	Lecture/PPT	Video/e - resources	
24	Chemokines. Role of cytokines in immune system	Lecture/PPT	Video/e - resources	
25	Properties and functions of Cytokines	Lecture/PPT	Video/e - resources	
26	Therapeutic uses of cytokines	Lecture/PPT	Video/e - resources	
	Module VI. Hypersensitivity			
27	Allergy and hypersensitivity. Genetics of allergic response in humans	Lecture/PPT	Video/e - resources	
28	Type 1	Lecture/PPT	Video/e - resources	
29	Type 11	Lecture/PPT	Video/e - resources	
30	Type 111	Lecture/PPT	Video/e - resources	
31	Type 4	Lecture/PPT	Video/e - resources	
	Module VII. Major Histocompatibility Complex			
32	General organization and inheritance of MHC.	Lecture/PPT	Video/e - resources	
33	MHC molecules and genes.	Lecture/PPT	Video/e - resources	
34	Genomic map of H-2 Complex in the mouse. HLA Complex in humans. MHC-peptide interaction.	Lecture/PPT	Video/e - resources	
35	Expression of MHC molecules on different cell types. Regulation of MHC expression	Lecture/PPT	Video/e - resources	
36	MHC and graft rejection. MHC and disease susceptibility. Biological significance of MHC	Lecture/PPT	Video/e - resources	
37	HLA typing	Lecture/PPT	Video/e - resources	
	Module.VIII. Immunity in Health and Disease			

38	Immune response during bacterial (tuberculosis),	Lecture/PPT	Video/e - resources	
39	Parasitic (Malaria) and viral (HIV) infections	Lecture/PPT	Video/e - resources	
40	Congenital immunodeficiency diseases (SCID, WAS, CVI, Ataxia, CGD, LAD)	Lecture/PPT	Video/e - resources	
41	Acquired Immunodeficiency Disease (AIDS)	Lecture/PPT	Video/e - resources	
42	Autoimmunity. Organ- specific autoimmune diseases. Systemic auto-immune diseases	Lecture/PPT	Video/e - resources	
43	Animal models for autoimmune disease. Evidences implicating CD4+ T cell, MHC and TCR in autoimmunity.	Lecture/PPT	Video/e - resources	
44	Induction of autoimmunity. Treatment of autoimmune diseases	Lecture/PPT	Video/e - resources	
45	Transplantation immunology. Immunologic basis of graft rejection. Clinical manifestation of graft rejection	Lecture/PPT	Video/e - resources	
46	General and specific immunosuppressive therapy. Clinical transplantation. Tumour immunology	Lecture/PPT	Video/e - resources	
47	Vaccines, Whole organism vaccines, Purified macromolecules as Vaccines, Recombinant vector vaccines, Synthetic peptide vaccines, Multivalent subunit vaccines.	Lecture/PPT	Video/e - resources	
48	Serological Reactions. Radio-allergosorbent Test (RAST).Immunoprecipitation. Immunofluorescence. Flow cytometry and fluorescence. Immunoelectron microscopy	Lecture/PPT	Video/e - resources	
49	Radio-allergosorbent Test (RAST).Immunoprecipitation. Immunofluorescence.	Lecture/PPT	Video/e - resources	
50	Flow cytometry and fluorescence. Immunoelectron microscopy	Lecture/PPT	Video/e - resources	
51	Assignment on any research paper in Immunology	Lecture/PPT	Video/e - resources	
52	Lens regeneration in amphibia	Lecture/PPT	Video/e - resources	
53	Revision			
54	Revision			

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual – Written/Presentation – Graded or Non-graded etc)
1	20/9/2018	Complement
2	16/9/2018	vaccines

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	18/9/2018	MAC

References

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- Ashim K. Chakravarthy. 1998. Immunology. Tata McGraw-Hill, New Delhi.
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