SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Biotechnology	LP: BT18405 Rev. No: 00 Date:7/02/2023
B.E/B.Tech/M.E/M.Tech : B.Tech Regulation: R 2018 PG Specialisation : Not Applicable Sub. Code / Sub. Name : BT18405 CELL BIOLOGY Unit : I	

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 9+3 Hours

Eukaryotic, Prokaryotic cells, Subcellular Organelles and Functions Principles of membrane organization membrane proteins, cytoskeletal proteins Eg. RBC cytoskeletal contractile proteins, Actin, myosin, Actin Polymerization Act, Myosin complex, Mechanism of myosin, ATPase activity, Contraction, Microtubules, Microfilaments activity in Organelle movement

Objective: The students will gain knowledge on the basics structure of cellular system and their functions.

Session No *	Topics to be covered	Ref	Teaching Aids
01	Eukaryotic cell – Origin of eukaryotes, Development of Multicellular organisms	T1 (1-8),T2(16-17) R2(9-14)	LCD/GCR
02	Prokaryotic cells- Unicellular organisms and their Structure, Types	T1 (4-6), T2(11- 15),	LCD/GCR
03	Sub cellular Organelles and Functions – Nucleus, Mitochondria, chloroplast, endoplasmic reticulum, golgi Apparatus	T1(372-379), T2(11-25)	LCD/GCR
04	Principles of membrane organization – Mosaic fluid model, Membrane lipid bilayers, Membrane proteins – Association with lipid bilayer	T1(409-414), T1(421-428), T2 (366-375)	LCD/GCR
05	Cytoskeletal proteins – Directed Cell movement Eg. RBC cytoskeletal contractile proteins	T1(429-435), T2 (22, 574)	LCD/GCR
06	Actin – Myosin - Actin Polymerization – Cytoskeleton and cellular movement	T1 (716- 717) T2(592-594)	LCD/GCR
07	Actin - Myosin complex to contractile structure	T1(731-739), T2 (598)	LCD/GCR
08	Mechanism of myosin in muscle contraction	T1(719), T2 (598)	LCD/GCR
09	ATPase activity – Polymerization process of actin filaments	T1(453-456&474)	LCD/GCR
10	Contraction – Muscular contraction versus Actin filaments, Contraction related with raise in ca^{2+}	T1(738-739), T2 (600-605)	LCD/GCR
11	Microtubules – Organizing center of cell - centrosome, Microtubules assembly and disassembly, organizing the cell interior	T1(758-760), T2(579-585)	LCD/GCR
12	Microfilaments activity in Organelle movement	T1(796-797)	LCD/GCR
Content beyond syllabus covered (if any): Recent findings on Cell models, Muscle cells performance			

* Session duration: 50 minutes

Sub. Code / Sub. Name: BT18405 CELL BIOLOGY

Unit : II

UNIT II CELL DIVISION, CANCER AND APOPTOSIS OF CELLS 9+3 Hours

Cell cycle Mitosis, Meiosis, Molecules controlling cell cycle, Extra cellular matrix, Role of matrix in cell enthrone: cancer, Role of Ras and Raf in oncogenesis and apoptosis.

Objective:. To explore the students on cellular division mechanism and the basics of cancer mechanisms

Session No *	Topics to be covered	Ref	Teaching Aids
13	Cell cycle – Overview of cell cycle – Eukaryotic cell cycle and cell division,	T1(18-19), T2(612-613)	LCD/GCR
14	Cell cycle – Mitotic and interphase, Central control system triggers cell cycle	T1(892-898), T2(612-622) R1(657)	LCD/GCR
15	Mitosis – Prophase, Metaphase, Anaphase, Telophase and cytokinesis	T1(849-851), T2(640-655), R1(678, 669)	LCD/GCR
16	Meiosis – Special process of chromosome pairing – first Meiotic and second meiotic division for gametes formation	T1(892-898), T2(663- 671)	LCD/GCR
17	Molecules controlling cell cycle depends on cyclic activated protein kinases, activity of cdks, complexes of cdks in cell cycle control- checkpoints	T1(849-851), T2(615-625), R1(672)	LCD/GCR
18	Extra cellular matrix- Animal cells require extra cellular signals to divide, grow and survive – Extra cellular growth factors	T1(816-817, 820-825), T2(628-629)	LCD/GCR
19	Role of matrix in cell enthrone	T1(816-817, 820-825) R1(416, 575-579), T2 (628)	LCD/GCR
20	Cancer – cells proliferate, invade and metastasize – Accumulation of mutation in cell cycle control	T1(1111-1116), T2(726-728)	LCD/GCR
21	Cancer- Many diverse genes are critical for cancer - Caspases	T1(1111-1116), T2(731-734), R1 (690, 721)	LCD/GCR
22	Role of Ras and Raf in oncogenesis	T1(1119-11240	LCD/GCR
23	Apoptosis – Programmed cell Death – Mediated by intracellular cascades	T1(937-943), T2(625-626)	LCD/GCR
24	Apoptosis- Genetic level Controlling of apoptosis, BcI2 – Death Program regulating intracellular protein	T1(937-943), T2(627), R1(695)	LCD/GCR

Content beyond syllabus covered (if any): Recent advances in genetic level controlling of apoptosis

* Session duration: 50 mins

Sub. Code / Sub. Name: BT18405 CELL BIOLOGY

Unit : III

UNIT III TRANSPORT ACROSS CELL MEMBRANE 9+3 Hours

Passive and Active Transport, Permeases, Ion channels, ATP pumps, Na+ /K+ /Ca2+ pumps uniport, Symport antiport system, Ligand gated / voltage gated channels, Agonists and Antagonists

Objective: Students will gain knowledge on signalling molecules which are enables cellular functions.

Session No *	Topics to be covered	Ref	Teaching Aids
24	Passive Transport – Membrane transport – concentration gradient and electrical forces drive the passive transport	T1(498-440) , T2 (393), R1(541)	LCD/GCR
25	Active transport – Moves solutes against electrochemical gradients	R1(64-65,555), T2 (395)	LCD/GCR
26	Permeases – Membrane Transport proteins – carriers and channels – Imports variety of nutrients from the cell	T1-454, R1(259,261), T2(391)	LCD/GCR
27	Ion channels – Ion selective and gated – Randomly open and closes states, Different types of stimuli influencing opening of ion /gated channels	T1(9,434,444, 458-461), T2 (407- 408), R1 543)	LCD/GCR
28	ATP pumps – Cells use the energy of AT hydrolysis to pump out Na^+	T1(446), T2(394)	LCD/GCR
29	ATP pumps- P class proton pumps , V class proton pumps and F class proton pumps	T1(446, 447)	LCD/GCR
30	ATP pumps- Driven by transient addition of phosphate group	T1(446,448), T2 (397)	LCD/GCR
31	Na+ /K+ /Ca2+ pumps- Gradient to take up nutrient activity, helps to maintain the osmotic balance in animal cells	T1(458-460), T2 (397-399)	LCD/GCR
32	Uniport, Symport andAntiport system – Molecular drive membrane transports in cells	T1(440&460)	LCD/GCR
33	Ligand gated channels s respond to membrane potential	T1(1023), T2(417)	LCD/GCR
34	voltage gated channels respond to the membrane potential – Action potential mediation, conversionsion of electrical to chemical signals in	T1(1024), T2(407, 412)	LCD/GCR
35	Agonists – Similar respond to the chemical and receptor- G protein coupled receptors function	T1(629,965)	LCD/GCR
36	Antagonists- Signal induction influence cell fates and tissue induction	T1(965)	LCD/GCR
Content beyond syllabus covered (if any): Synaptic connections enable to think, act and remember			

* Session duration: 50 mins

Sub. Code / Sub. Name: BT18405 CELL BIOLOGY

Unit : IV

UNIT IV SIGNAL TRANSDUCTION 9+3 Hours

Receptors extracellular signaling, Cell surface / cytosolic receptors and examples, Different classes of receptors autocrine / paracrine / endocrine models, Secondary messenger molecules.

Objective: Students will understand about the concepts of receptors of cellular system.

Session No *	Topics to be covered	Ref	Teaching Aids
37	Receptors extracellular signaling – General principles of cell signaling – Binds to ligand specifically	T1(548, 624- 627), T2 (533)	LCD/GCR
38	Signaling molecules -Signals can act over long or short range	T1(624- 627) T2(534)	LCD/GCR
39	Cell surface receptors and examples – Ion channels, G protein linked and enzyme Linked receptors	T1(548, 624- 627), T2 (543)	LCD/GCR
40	Cell surface receptors - Characteristics of cell surface receptors	T1(632-642) T2 (545- 548)	LCD/GCR
41	cytosolic receptors – Intra cellular signaling proteins act as molecular switches,	T1(548, 624- 627)	LCD/GCR
42	cytosolic receptors – Respond to Hydrophobic ligand molecules – Tyrosine Kinase receptors	T1(625)	LCD/GCR
43	Different classes of receptors from extracellular signal to cellular response	T1(625)	LCD/GCR
44	Autocrine - signaling molecules are synthesized and secreted by signaling cells, hormones mediate the signaling	T1(625-626)	LCD/GCR
45	Paracrine - signaling molecules released by a cell affect only those target cells in close proximity	T1(626)	LCD/GCR
46	Endocrine signaling cells respond to substances that they themselves release	T1(627)	LCD/GCR
47	Secondary messenger molecules – carry and amplify signals from many receptors	T1(657-659), T2 (550)	LCD/GCR
48	Secondary messenger molecules-Cyclic AMP, IP3 and DAG	T1(667-670), T2(550)	LCD/GCR
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

Sub. Code / Sub. Name: BT18405 CELL BIOLOGY

Unit : V

UNIT V TECHNIQUES USED TO STUDY CELLS 9+3Hours

Cell fractionation and flow cytometry, Morphology and identification of cells using microscopic studies like SEM, TEM and Confocal Microscopy. Localization of proteins in cells –Immunostaining

Objective: To provide knowledge to the students on the cell and their organelles observation various microscopy techniques

Session No *	Topics to be covered	Ref	Teaching Aids
49	Cell fractionation - Various centrifugation, velocity sedimentation and equilibrium sedimentation	T1(392,407), T2(161), R2(31-33)	LCD/GCR
50	Cell isolation and subcellular fractionation using cell fractionation methods	T1(396- 400) T2(161)	LCD/GCR
51	Flow cytometry – cell sorting instrumentation	T1(394-395) T2(325)	LCD/GCR
52	Flow cytometry- Working operation and application in cell sorting and identification process	T1(395-396)	LCD/GCR
53	Identification of cells using microscopic studies – Historical aspects, Resolution, sample preparation, single particle tracking	T1(380-381) T2(5-11)	LCD/GCR
54	Various types of microscopes – Light and Electron microscopes	T1(380-381), R3(21-24, 27-29)	LCD/GCR
55	SEM- Scanning Electron Microscope	T1(390), T2(11) R1(27-29)	LCD/GCR
56	TEM- Tanning Electron microscope	T1(388), R1(27-29)	LCD/GCR
57	Confocal Microscopy –Identification of cells	T1(386), R1(26-27)	LCD/GCR
58	Localization of proteins in cells	T1(381-387)	LCD/GCR
59	Methods used in protein isolations – electrophoresis, chromatography, Isoprecipitation, ligand receptor interactions	T1(384-387)	LCD/GCR
60	Immunostaining – Protein identification	T1(385-387)	LCD/GCR

Content beyond syllabus covered (if any): Recent advancement in protein isolation and purification

* Session duration: 50 mins

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Reference books:

1. Cooper G.M, "The Cell: A Molecular Approach", 4 th Edition, ASM Press, 2007.
2. James D. W, Tania A. B, Stephen B. B, Alexander G, Michael L and Richard L,"Molecular Biology of the Gene", 7 th Edition, Cold Spring Harbor Laboratory Press, 2013.
3. Robert F. W, "Molecular Biology", 5th Edition, McGraw Hill Science, 2012.

Text books:

1. Lodish H, Berk A, Kaiser C.A, Krieger M, Scott M.P, Bretscher A, Ploegh H and Matsudaira P, "Molecular Cell Biology," 6th Edition, W.H.Freeman, 2008.
2. Alberts B, Bray D, Hopkin K, Johnson A, Lewis J, Raff M, Roberts K and Walter P, "Essential Cell Biology", 2nd Edition, Garland Science, 2004.
3. Alberts J, Lewis R, Roberts and Walter, "Molecular Biology of Cell", 5th Edition, Garland Science, 2008.

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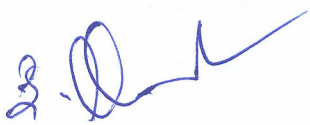
Signature		
Name	Mr. S. Naga Vignesh	Prof. E. Nakkeeran
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Date	7/2/2023	7/2/2023
Remarks *: This lesson plan can be followed in future		