ACADEMIC CURRICULA

Basic Science Courses

Regulations - 2018

SRM INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Kancheepuram, Tamil Nadu, India

Course Code	18BTB101T	Course Name	BIOLOGY	Course Category	B	Basic Sciences	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Recall the cell structure and function from its organization			
CLR-2 :	Discuss molecular and biochemical basis of an organism			
CLR-3 :	Compare enzyme reaction and photosynthesis			
CLR-4 :	Explain different types of biosensors			
CLR-5 :	Analyze the different types of bioremediation			
CLR-6 :	Relate the concept of nervous and immune system pertaining to diseases			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Describe the cell growth, metabolism and reproduction.	1	80	80	L	H	H	H	-	M	L	H	H	H	-	H	L	H	H
CLO-2 :	Explain the concepts and experiments in biochemistry	2	85	75	M	H	H	M	-	-	M	H	L	H	-	H	L	H	H
CLO-3 :	Recognize the significance of photosynthesis	2	75	80	M	H	M	H	M	M	-	M	H	H	-	H	L	H	H
CLO-4 :	Discuss the different methods in enzyme catalytic functions	2	85	80	L	H	H	H	-	-	H	L	L	H	-	H	M	H	H
CLO-5 :	Analyze the role of biosensors and its applications	3	85	75	L	H	H	M	-	M	H	H	H	L	-	H	H	H	H
CLO-6 :	Explain the concepts of nervous system disorder and the diseases associated with it	2	80	80	M	H	H	H	L	H	M	M	H	H	-	H	H	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Basics of cell biology: Relevance to Engineers	Biochemistry: Macromolecules, Biodiversity and its importance	Bioenergetics and metabolism	Molecular machines and motors	Nervous system:History of neuroscience
	SLO-2	Cell basic unit of life, Evidence for cell theory	Chemistry of life	Enzymes as biological catalysts, Significance of enzymes	Properties of ATP based protein molecular machines	Glial cells, Neurons
S-2	SLO-1	Cell structure and function	Biochemistry and human biology, DNA replication	Thermodynamics of enzymes	F0F1 ATP synthase motors, Coupling and coordination of motors	Action potential, Organization of nervous system
	SLO-2	Genetic Information, Protein structure	Transcription, Protein synthesis	Factors affecting enzyme activity, Effect of inhibitors on enzyme activity	Bacterial flagellar motor, Cytoskeleton	Central Nervous system, Peripheral nervous system
S-3	SLO-1	Cell metabolism	Eukaryotic and prokaryotic protein synthesis difference	Mechanism of enzyme action	Microtubules	Diseases of nervous system
	SLO-2	Carbohydrate metabolism, Fatty acid metabolism	Concept of genetic code, Stem cells	Enzyme strategies, Restriction enzymes	Microfilaments, Intermediate filaments	Computer- based neural networks
S-4	SLO-1	Homeostasis	Source of stem cells, Classification of stem cells	NMP kinases, Photosynthesis	Kinesin linear motor, Dynein motor	Immune system
	SLO-2	Pathways that alter homeostasis, Cell growth	Human embryonic stem cell, Importance and applications of stem cells	Light reactions, Photosystems	Biosensor	Fluid systems of the body, Innate immune system
S-5	SLO-1	Reproduction	Therapeutic cloning	ATP synthesis in chloroplasts	Resonant biosensors, Glucose biosensors	Cells of innate immune system, Adaptive immunity

	SLO-2	*Eukaryotic cell division, Mitosis*	*Regenerative medicine*	*Calvin cycle*	*Bio detectors, Biosensor detection in pollutants*	*Diseases of immune system, Immune engineering*
S-6	SLO-1	*Meiosis, Cell differentiation*	*Bone tissue engineering*	*Significance of photosynthesis*	*Bioremediation*	*Cell signaling*
	SLO-2	*Neural crest*	*Gene therapy*	*Metabolism, Glycolysis*	*Bioventing and bio augmentation*	*Cell- surface receptors*

Learning Resources	**1.** *S. Thyagarajan, N.Selvamurugan, R.A.Nazeer et.al., Biology for engineers McGraw Hill Education. 2012*	2. *Norman Lewis, Gabi Nindl Waite, Lee R. Waite et.al., Applied Cell and Molecular Biology for Engineers. McGraw-Hill Education. 2007*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. C. N. Ramchand, Saksin Life sciences,ramchand@saksinlife.com	*1. Dr. K Subramaniam, IITM Chennai, subbu.iitm.ac.in*	*Dr. S. Thyagarajan, SRMIST*
2. Dr. Karthik Periyasamy, Aurobindo Pharma Limited, Hyderabad, karthikmpk@gmail.com	*2. Dr. R. B. Narayanan, SVCE Chennai, rbn@svce.ac.in*	*Dr.S.Barathi, SRMIST*

Course Code	18BTB103T	Course Name	HUMAN PHYSIOLOGY AND HEALTH	Course Category	B	Basic Sciences	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	18BTC102J -Cell biology, 18BTC106J -Immunology
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Devise understanding of human physiological systems for a better comprehension of the problems faced by human	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Create an understanding about nervous system that controls and maintains homeostasis			
CLR-3 :	Analyze about circulatory and respiratory system			
CLR-4 :	Analyze about digestive and excretory system			
CLR-5 :	Create an understanding about endocrine and reproductive system			
CLR-6 :	Create an understanding about how human body functions			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Describe the structure and function of cell, communication and gene expression and homeostasis	1	80	70	H	H	H	H	-	M	L	H	H	H	-	H	H	H	H
CLO-2 :	Describe the classification of nervous system, function and diseases associated with it	2	80	70	H	H	H	H	-	H	M	H	H	H	-	H	H	H	H
CLO-3 :	Discuss the structure and function of heart, lung, abnormal functioning	2	80	70	M	H	M	H	M	M		M	H	H	-	H	H	H	H
CLO-4 :	Describe anatomy and function of digestive system and urinary system and its disturbances	2	80	70	H	H	H	H	-	L	H	L	H	H	-	H	H	H	H
CLO-5 :	Describe the types of endocrine system, its role in maintaining homeostasis and reproductive biology	2	80	70	H	H	H	H	-	M	H	H	H	L	-	H	H	H	H
CLO-6 :	Explain how human body function and reproduce with maintaining homeostasis	2	80	70	H	H	H	H	L	M	M	M	H	H	-	H	H	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Cell structure and function	Classification of Nervous System	Heart: Structure, Chambers, valve	Anatomy of Digestive system	Endocrine organs and structure
	SLO-2	Adaptation, Degeneration and aging	Neuron structure and function	Cardiac cycle and Electro cardio gram	Mouth and Salivary glands	Pituitary gland: Parts
S-2	SLO-1	Cell junctions – Gap, Tight and contact	Nerve fibers classification and properties.	chronotropic, ionotropic agents, dromotropic, bathmotropic agents	Stomach: Parts, Structure, Glands, Functions, Properties	Pituitary gland: Regulation, Histology
	SLO-2	Active, Passive transport	Glial cells types, structure and function	Blood vessels – thromboembolism	composition and functions of gastric juice	Pituitary gland: Hormones secreted, functions
S-3	SLO-1	Types of transport	Synapse – Classification	atherosclerosis and arteriosclerosis	Pancreas, Liver	Thyroid gland: Histology and function
	SLO-2	Special type of transport of molecules across biological membranes	Synapse - Anatomy	Septal and valvular defects.	Gall bladder – Role in digestive system	Thyroid gland: Hormones
S-4	SLO-1	Homeostasis– Chemical equilibrium	Synapse - Functions (IPSP and EPSP	Circulation – Systemic and Pulmonary	Small intestine, large intestine	Synthesis of Thyroxine
	SLO-2	Tonicity and osmolality	Synapse - properties	Properties of cardiac muscle: Excitability – electrical potential and action potential	Digestion of Biomolecules	Parathyroid gland structure and function
S-5	SLO-1	control of homeostasis	Neurotransmitters synthesis	Rhythmicity – Natural and artificial pacemakers	Movements of gastrointestinal tracts and disorders	Mode of action and function - disorders

	SLO-2	*Role of ions in homeostasis*	*Neurotransmitters – Types and function*	*Conductivity, Contractility and Refractory period*	*Digestion of carbohydrates protein and lipid.*	*Adrenal gland structure*
S-6	SLO-1	*Positive feedback regulation of Homeostasis*	*Action potential*	*Cardiac cycle and heart sounds and Heart disease*	*Gastrointestinal hormones*	*Cortical and medullary - functions*
	SLO-2	*Negative feedback regulation of Homeostasis*	*graded potential*	*Respiratory system: Introduction*	*Digestive system disorders*	*Endocrine functions of pancreas*
S-7	SLO-1	*Acid-Base Balance: Hydrogen Ion and pH.*	*Brain anatomy and function*	*Types – external and internal respiration*	*Kidney structure and function*	*Insulin and glucagon*
	SLO-2	*Regulation by buffer systems*	*Spinal cord anatomy– Grey and White matter*	*Inspiration and expiration, Anatomy, functional unit*	*nephron structure*	*Diabetes*
S-8	SLO-1	*Acidosis*	*Limbic system: Autonomic Nervous System*	*Non-respiratory functions of respiratory tract*	*Role of hormone in urinary system.*	*Male reproduction organ structure*
	SLO-2	*Alkalosis.*	*Effects on various organ systems.*	*Mechanics of respiration, Pulmonary function tests: Lung volume – Tidal*	*Juxtaglomerular apparatus functions*	*Female reproduction organ structure*
S-9	SLO-1	*Regulation of gene expression*	*Nervous system disease and disorders*	*Inspiratory, Expiratory, Residual volumes; Lung capacities*	*Process of urine formation*	*Oogenesis*
	SLO-2	*Cell signaling and Signal transduction*	*Parkinson's disease,*	*Inspiratory, vital, Functional residual, Total lung capacities.*	*Factors affecting urine formation*	*Spermatogenesis*

Learning Resources	**1.** *K. Sembulingam, Prema Sembulingam, Essentials of Medical Physiology, Jaypee brothers medical publishers, 7th ed., 2016*	2. *Guyton and Hall, Textbook of Medical Physiology, (Guyton Physiology), Saunders, 13th ed., 2015)*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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2. Dr. Karthik Periyasamy, Aurobindo Pharma Limited, Hyderabad, karthikmpk@gmail.com	*2. Dr. Tamil Selvan, Anna University,Chennai, tamilselvan@annauniv.edu*	*Dr. S. Nageswaran, SRMIST*

Course Code	18MAB201T	Course Name	TRANSFORMS AND BOUNDARY VALUE PROBLEMS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Describe types of Partial differential equations interpret solutions relate PDE to the respective branches of engineering	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Relate Fourier series expansion in solving problems under RMS value and Harmonic Analysis.			
CLR-3 :	Infer the most general form to the PDE and relate to half range sine and cosine series, as the case may be			
CLR-4 :	Evaluate the various types of integral transforms			
CLR-5 :	Conclude that the purpose of studying z transform is to solve linear difference equations having constant coefficients			
CLR-6 :	Predicting the importance of PDE, Fourier series, Boundary value problems and Fourier ,Z – transform applications			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Determine Partial differential equation	2	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-2 :	Explain the expansion of a discontinuous function as an infinite form of trigonometric sine and cosine series.	2	85	80	M	H	-	M	M	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Decide a proper form of solution for the differential equations which are of hyperbolic and parabolic type	2	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	justify the relationship between aperiodic signals and linear combination of exponentials.	2	85	80	M	H	-	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Relate signal analysis with that of z transform	2	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Relate PDE, Fourier series, Boundary value problems, Fourier and Z transforms	2	85	80	L	L	L	H	H	H	L	H	H	H	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Formation of partial differential equation by eliminating arbitrary constants	Introduction of Fourier series - Dirichlet's conditions for existence of Fourier Series	Classification of second order partial differential equations	Introduction of Fourier Transforms	Introduction of Z-transform
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary constants	Fourier series –related problems in $(0,2\pi)$	Method of separation of variables	Fourier Transforms- problems	Z-transform-elementary properties
S-2	SLO-1	Formation of partial differential equation by eliminating arbitrary functions	Fourier series –related problems in $(-\pi,\pi)$	One dimensional Wave Equation and its possible solutions	Properties of Fourier transforms	Z-transform- change of scale property, shifting property
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary functions	Change of interval Fourier series –related problems in $(0,2l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 1 Algebraic function	Standard results of Fourier transform	Z-transform of $a^n, \frac{1}{n}, \frac{1}{n+1}$
S-3	SLO-1	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u,v)=0$	Fourier series –related problems in $(-l,l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 2 Trigonometric function	Fourier Sine Transforms - problems	Z-transform of $\frac{1}{n^2}, \frac{1}{(n+1)^2}$
	SLO-2	Solution of first order non-linear partial differential equations-standard type I F(p,q)=0	Fourier series –half range cosine series related problems$(0,\pi)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 3 – Midpoint of the string is displaced	Fourier Cosine Transforms - problems	Z-transform of $r^n \cos n\theta$
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2					

S-5	SLO-1	*Solution of first order nonlinear partial differential equations-standard type –II Clairaut's form*	*Fourier series –half range cosine series related problems* $(0, l)$	*One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 1 Algebraic function*	*Properties of Fourier sine Transforms*	*Z-transform of* $r^n \sin n\theta$
	SLO-2	*Solution of first order non-linear partial differential equations-standard type III F(z, p, q)=0*	*Fourier series –half range sine series related problems* $(0, \pi)$	*One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 2 Trigonometric function*	*Fourier sine Transforms applications*	*Initial value theorem*
S-6	SLO-1	*Solution of first order non-linear partial differential equations-standard type-IV separation of variable f(x, p) = g(y, q)*	*Fourier series –half range sine series related problems* $(0, l)$	*Wave Equation-initial displacement with non-zero initial velocity Type 3 split function*	*Properties of Fourier cosine Transforms*	*Finial value theorem*
	SLO-2	*Lagrange's linear equation: Method of grouping*	*Parseval's Theorem (without proof)-related problems in Fourier series*	*One dimensional heat equation and its possible solutions*	*Fourier cosine Transforms applications*	*Inverse Z-transform- long division method*
S-7	SLO-1	*Lagrange's linear equation: Method of multipliers*	*Parseval's Theorem (without proof)-related problems in cosine series*	*One dimensional heat equation related problems*	*Convolution of two function*	*Inverse Z-transform, related problems, long division method*
	SLO-2	*More problems in Lagrange's linear equation: Method of multipliers*	*Parseval's Theorem (without proof)-related problems in sine series*	*One dimensional heat equation -Steady state conditions*	*Convolution Theorem*	*Inverse Z-transform, Partial fraction method*
S-8	SLO-1	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
	SLO-2					
S-9	SLO-1	*Linear Homogeneous partial differential equations of second and higher order with constant coefficients-CF and PI Type 1:* e^{ax+by}	*Introduction to Harmonic Analysis*	*One dimensional heat equation -Steady state conditions more problems*	*Parseval's Identity for Fourier transform*	*Inverse Z-transform, Partial fraction method related problems*
	SLO-2	*PI Type2.: sin(ax+by) or cos(ax+by)*	*Harmonic Analysis for finding harmonic in* $(0,2\pi)$	*One dimensional heat equation -Steady state conditions with zero velocity*	*Parseval's Identity for Fourier sine & cosine transforms*	*Inverse Z-transform - residue theorem method*
S-10	SLO-1	*Type 3: PI of polynomial*	*Harmonic Analysis for finding harmonic in* $(0,2l)$	*One dimensional heat equation -Steady state conditions with zero velocity more problems*	*Parseval's Identity for Fourier sine & cosine transforms applications*	*Inverse Z-transform - residue theorem method-problems*
	SLO-2	*Type 4 Exponential shifting* $e^{ax+by}f(x,y)$	*Harmonic Analysis for finding harmonic in periodic interval* $(0,T)$	*One dimensional heat equation -Steady state conditions with zero velocity more related problems*	*Fourier Transforms Using Differentiation property*	*Convolution theorem (without proof)*
S-11	SLO-1	*Linear Homogeneous partial differential equations of second and higher order with constant coefficients type 5 General rule*	*Harmonic Analysis for finding cosine series*	*Steady state conditions and Non-zero boundary conditions- related problems*	*Solving integral equation*	*Convolution theorem applications*
	SLO-2	*Applications of Partial differential equations in Engineering*	*Harmonic Analysis for finding sine series*	*Steady state conditions and Non-zero boundary conditions- more problems*	*Self-reciprocal using Fourier Transform, sine and cosine transform*	*Solution of linear difference equations with constant coefficients using Z-transform*
S-12	SLO-1	*Problem solving using tutorial sheet 3*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*
	SLO-2	*Problem solving using tutorial sheet 3*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*

Learning Resources	1. *B. H. Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons,2006* 2. *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015* 3. *Veerarajan T., Transforms and Partial Differential Equations, Tata McGraw-Hill, New Delhi,2012*	4. *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 3rd Edition, 2010* 5. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, for third semester, Laxmi Publications, 3rd Edition, 2014*

Learning Assessment											
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		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com*	*2. Prof. Ganapathy Subramanian K S, SRMIST*

Course Code	18MAB202T	Course Name	NUMERICAL METHODS FOR ENGINEERS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Acquire ability in solving mathematical problems numerically as applied to the respective branches of Engineering	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Apply the concept of interpolation for finding intermediate values of a well-known data			
CLR-3 :	Study the concept of numerical differentiation and integration			
CLR-4 :	Apply the numerical techniques for solutions of ordinary differential equations			
CLR-5 :	Apply the numerical techniques for solutions of partial differential equations			
CLR-6 :	Acquire analytical ability in solving mathematical problems numerically applied to the respective branches of Engineering			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		2	85	80	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Solve the algebraic, transcendental and simultaneous equations.	2	85	80	L	-	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-2 :	Find the finite differences and interpolation.	2	85	80	L	-	-	M	M	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Solve numerical Differentiation and integration.	2	85	80	-	M	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Solve the numerical solutions of ordinary differential equations.	2	85	80	L	M	-	M	-	-	-	-	M	-	-	H	-	-	-
CLO-5 :	Solve the numerical solutions of partial differential equations	2	85	80	-	M	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Solve the problems numerically in science and engineering	2	85	80	H	-	H	-	-	-	-	-	H	-	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Method of Least Squares – Curve fitting.	First and Higher order differences.	Numerical Differentiation.	Numerical solutions for ordinary differential equations.	Numerical solutions for partial differential equations.
	SLO-2	Fitting a straight line.	Forward differences and backward differences.	Newton's forward difference formulae to compute first and higher order derivatives.	Solution by Taylor's series method.	Classification of partial differential equations.
S-2	SLO-1	Fitting a parabola.	Central Differences.	Newton's backward differences formulae to compute first and higher order derivatives.	Solutions of First order simultaneous differential equations by Taylor's series method.	Solution of Elliptic Equations.
	SLO-2	Calculation of the sum of the squares of the residuals of straight line and parabola.	Operators– Relations between the operators.	Problems by Newton's forward and backward differences formulae.	Euler's method.	Solution of Laplace Equations by Leibmann's Iterative process.
S-3	SLO-1	Solution of Algebraic and Transcendental equations.	Interpolation – Newton-Gregory Forward Interpolation formulae.	Applications of Newton's forward difference formulae to compute first and higher order derivatives.	Applications of Euler's method.	Solution of Laplace Equations by Leibmann's Iterative process.
	SLO-2	Newton-Raphson method.	Interpolation – Newton-Gregory Backward Interpolation formulae.	Applications of Newton's backward difference formulae to compute first and higher order derivatives.	Improved Euler's method.	Solution of Poisson Equations.
S-4	SLO-1	Problem solving using tutorial sheet 1.	Problem solving using tutorial sheet 4.	Problem solving using tutorial sheet 7.	Problem solving using tutorial sheet 10. Modified Euler's method	Problem solving using tutorial sheet 13.
	SLO-2					

S-5	SLO-1	*Bisection method and its applications.*	*Additional problems using Newton-Gregory Forward Interpolation formulae.*	*Additional problems for Newton's forward formulae to compute the application problems.*	*Applications of Improved and Modified Euler's method.*	*Problems for Poisson Equations.*
	SLO-2	*Problems using bisection method.*	*Additional problems using Newton-Gregory Backward Interpolation formulae.*	*Additional problems for Newton's backward formulae to compute the application problems.*	*Runge-Kutta method of fourth order.*	*Additional problems for Poisson Equations.*
S-6	SLO-1	*Regula-Falsi method.*	*Divided differences.*	*Numerical Integration.*	*Solution by Runge-Kutta method of fourth order.*	*Solution of Parabolic equations.*
	SLO-2	*Problems using false position method.*	*Formation of divided difference table.*	*Trapezoidal rule.*	*Additional problems using Runge-Kutta method of fourth order.*	*Bender-Schmidt formula*
S-7	SLO-1	*Solution of system of equations Direct Method - Gauss Elimination method.*	*Properties of Divided differences.*	*Simpson's one third rule.*	*Predictor-Corrector Methods.*	*Bender-Schmidt formula*
	SLO-2	*Solution of system of equations Direct Method – Gauss-Jordan method.*	*Properties of Divided differences.*	*Simpson's three eighth rule.*	*Milne-Thomson Method.*	*Bender-Schmidt formula*
S-8	SLO-1	*Problem solving using tutorial sheet 2.*	*Problem solving using tutorial sheet 5.*	*Problem solving using tutorial sheet 8.*	*Problem solving using tutorial sheet 11. Problems for Milne-Thomson Method.*	*Problem solving using tutorial sheet 14.*
	SLO-2					
S-9	SLO-1	*Solution of system of equations Iterative Method – Gauss- Jacobi method.*	*Newton's Divided difference formula.*	*More problems using Trapezoidal rule.*	*Application of Milne-Thomson Method.*	*Crank-Nicolson formula.*
	SLO-2	*Problems using Gauss-Jacobi method.*	*Problems by Newton's Divided difference formula.*	*More problems using Simpson's one third rule.*	*Adam's Bashforth method.*	*Crank-Nicolson formula.*
S-10	SLO-1	*Solution of system of equations Iterative Method – Gauss-Seidal method.*	*Additional problems by Newton's Divided difference formula.*	*More problems using Simpson's three eighth rule.*	*Problems using Adam's Bashforth method.*	*Crank-Nicolson formula.*
	SLO-2	*Problems using Gauss- Seidal method.*	*Lagrange's Interpolation formula.*	*Applications of Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.*	*Application of Adam's Bashforth method.*	*Solution of Hyperbolic equations.*
S-11	SLO-1	*Power method.*	*Problems by Lagrange's Interpolation formula.*	*Application problems for Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.*	*Additional problems for Milne-Thomson Method.*	*Solution of Hyperbolic equations by Explicit formula.*
	SLO-2	*Finding Eigen values by power method.*	*Inverse interpolation.*	*Applications problems for Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.*	*Additional problems for Adam's Bash forth Method*	*More problems in Hyperbolic equations using Explicit formula.*
S-12	SLO-1	*Problem solving using tutorial sheet 3.*	*Problem solving using tutorial sheet 6.*	*Problem solving using tutorial sheet 9.*	*Problem solving using tutorial sheet 12.*	*Problem solving using tutorial sheet 15.*
	SLO-2	*Applications of numerical techniques to solve algebraic, transcendental and simultaneous equations*	*Application of interpolation for finding intermediate values of a well-known data*	*Applications of Numerical integration.*	*Applications of ordinary differential equation.*	*Applications of partial differential equation.*

Learning Resources	1. *B.S. Grewal, Numerical Methods in engineering and science, Khanna Publishers, 42nd edition, 2012* 2. *S.S. Sastry, Introductory Methods of Numerical Analysis, PHI, 4th edition, 2005* 3. *E. Balagurusamy, Computer Oriented Statistical and Numerical Methods – Tata McGraw Hill., 2000*	4. *M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd., 4th edition, 2003* 5. *Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 2005*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Nanjundan, Bangalore University, nanzundan@gmail.com*	*2. Dr. Sundarammal kesavan, SRMIST*

Course Code	18MAB203T	Course Name	PROBABILITY AND STOCHASTIC PROCESSES	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Describe the applications on discrete and continuous random variables.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Assess the applications of two dimensional random variables.			
CLR-3 :	Infer the various modes of convergence of random variables and their limit theorems.			
CLR-4 :	Relate the specialized knowledge in random processes in signals and systems.			
CLR-5 :	Determine the applications of spectral density functions and linear time invariant systems			
CLR-6 :	Interpret random variables and stochastic processes in the application of practical engineering problems.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Compare the fundamentals between discrete and continuous random variables.	3	85	80	M	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Choose the model and analyze systems using two dimensional random variables.	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Describe limit theorems using various inequalities.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Interpret the characteristics of random processes.	3	85	80	M	H	-	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Evaluate problems on spectral density functions and linear time invariant systems.	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Explain how random variables and stochastic processes can be described and analyzed.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	One dimensional random variable: Discrete Case-Probability function, Cumulative Distribution Function	Two dimensional random variables-Discrete case	Limit theorems--Markov's inequality	Random Processes-Introduction	Power spectral density function- properties
	SLO-2	Continuous random variable-Probability density function	Probability function of (X,Y)-Marginal probability distribution	Chebyshev's inequality without proof	Classification of random processes	Proof of properties
S-2	SLO-1	Cumulative distribution function-properties	Conditional probability distribution of (X,Y)	Chebyshev's inequality - Applications	Distribution of the process	Problems on power spectral density function
	SLO-2	Problems on one dimensional random variables	Problems on discrete random variables	Chebyshev's inequality – Applications using Binomial distribution	Averages of the process	Problems on power spectral density function
S-3	SLO-1	Expectation, variance	Continuous random variables-Joint PDF	Chebyshev's inequality– Applications using Exponential distribution	Stationary, SSS,WSS processes	Power density spectrum
	SLO-2	Moments-raw and central moments	Marginal Probability distributions	The weak law of large numbers	Problems on stationary and SSS processes	Problems based on power density spectrum
S-4	SLO-1 SLO-2	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
S-5	SLO-1	Characteristic function - properties	Conditional probability distribution of (X,Y)	Central limit theorem without proof	Problems on WSS process	Linear system with random inputs
	SLO-2	Characteristic function	Problems on continuous two dimensional random variables	Central limit theorem - Applications	Problems on WSS process	Representation of system in the form of convolution
S-6	SLO-1	Binomial distribution -moments	Independent random variables	Central limit theorem- Applications using Poisson random variables	Autocorrelation function -properties	Unit impulse response of the system

	SLO-2	*Binomial distribution-Applications*	*Cumulative distribution function-properties of F(x,y)*	*Central limit theorem- Applications using Exponential random variables*	*Proof of properties*	*Properties*
S-7	SLO-1	*Poisson distribution-moments*	*Expected values of two dimensional random variables*	*The strong law of large numbers*	*Problems on autocorrelation function*	*Applications of unit impulse function*
	SLO-2	*Poisson distribution -Applications*	*Covariance and correlation*	*The strong law of large numbers*	*Application of autocorrelation function*	*Einstein Weiner- Khinchine Relationship*
S-8	SLO-1 SLO-2	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
S-9	SLO-1	*Exponential distribution-moments*	*Conditional expected values*	*One sided Chebychev's inequality*	*Cross correlation- properties*	*Problems on Khinchine relationship*
	SLO-2	*Exponential distribution-Applications*	*Problems on uncorrelated random variables*	*Cauchy Schwartz inequality*	*Proof of properties*	*Cross power density spectrum-properties*
S-10	SLO-1	*Normal Distribution-moments*	*Functions of two dimensional random variables*	*Chernoff bounds*	*Problems on cross correlation function*	*Properties of Power Spectral Density*
	SLO-2	*Normal Distribution-Applications*	*Probability density functions of the type Z=XY*	*Chernoff bounds for the standard normal variate*	*Ergodicity*	*Cross power density spectrum-problems*
S-11	SLO-1	*Function of a random variable*	*Probability density functions of the type Z=X-Y*	*Chernoff bounds for the Poisson random variate*	*Mean ergodic process*	*Cross power density spectrum*
	SLO-2	*Function of a random variable*	*Probability density functions of the type Z=X/Y*	*Jenson's inequality*	*Mean ergodic theorem*	*Cross power density spectrum*
S-12	SLO-1	*Problem solving using tutorial sheet 3*	*Problem solving using sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*
	SLO-2	*Applications of random variables in engineering*	*Application of two dimensional random variables in Engineering*	*Applications of Central limit Theorem in engineering*	*Applications of random process in engineering*	*Applications of Power spectral density functions in engineering*

Learning Resources	1. *A. Papoulis, S. Uniikrishna Pillai, Probability, Random Variables and Stochastic Processes 4th ed., Mcgraw Hill, 2002* 2. *Henry Stark, Probability and Random Processes with Applications to Signal Processing, 3rd ed., Pearson, 2002* 3. *Sheldon Ross, A first course in Probability, 6th ed., 2011*	4. *S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 11th ed., 2015* 5. *Veerarajan T., Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, 4th ed., McGraw-Hill Education, 2015*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Code	18MAB204T	Course Name	PROBABILITY AND QUEUEING THEORY	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Apply and evaluating probability using random variables	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Gain the knowledge and acquire the application of distribution to find the probability using Theoretical distributions			
CLR-3 :	To Assess the appropriate model and apply and soling any realistic problem situation to determine the probability			
CLR-4 :	To interpret the decision using Markov queueing applications			
CLR-5 :	To construct chain of decisions from the past situations using Monrovians			
CLR-6 :	Interpret random variables and Queuing theory in engineering problems.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	Solving problems on Discrete and Continuous Random variables	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-2 :	Identifying Distribution and solving the problems in Discrete and Continuous Distribution	3	85	80	M	H		M	M	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Decision Models using sampling techniques in Large and Small samples	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Solving Queuing problems using Kendall's notation	3	85	80	M	H	-	-	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	To Evaluate the probability in uncertain situations using Markov chain rule	3	85	80	M	H	L	M	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Solving and analyzing the problems in random variables and Queuing theory.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Probability Basic concepts and Axioms	Discrete Probability distribution	Sampling distribution, Null Hypothesis, Alternate Hypothesis	Introduction to F-test	Markov Process and Introduction of a Markov Chain
	SLO-2	Conditional probability, Multiplication theorem	Introduction to Binomial distribution	One tailed test, two tailed test	Problems on F-test	Past and Future -Step and State
S-2	SLO-1	Discrete and continuous Random variables	MGF, Mean, Variance of Binomial distribution	Level of significance,Critical region	Chi square test -Goodness of fit	One step Transition Probability N step transition Probability
	SLO-2	Probability mass function, cdf	Applications of Binomial distribution	Large samples test	Problems on Chi square test -Goodness of fit	Chapman-kolmogorov theorem definition
S-3	SLO-1	Continuous Random variables	Fit a Binomial distribution.	Student - t testSingle Proportion	Problems on Chi-square test Independent-Attributes	Initial Probability distribution problems Using Markov Chain
	SLO-2	pdf and cdf applications	Introduction to Poisson Distribution	Two Sample proportions	Problems on Chi-square test Independent-Attributes with standard distributions	Initial Probability distribution problems Using Markov Chain
S-4	SLO-1 SLO-2	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
S-5	SLO-1	Expectation and Variance	MGF , Mean , Variance of Poisson distribution	Large sample test-Single Mean	Introduction to Queueing Theory and Applications. Kendall, notation	Classification of States of a Markov Chain
	SLO-2	Problems on Expectation and Variance	Applications of Poisson Distribution	Difference of Means	Introduction toM/M/1 : infinity/ FIFO	Irreducible, Non irreducible, a period, Persistent, Non null Persistent
S-6	SLO-1	Moment Generating Function	Fit a Poisson Distribution	Problems on difference of Means	Ls, Lq, Ws,Wq	Problems on Classification of a Markov Chain

	SLO-2	*Problems on MGF*	*Introduction , MGF Mean, Variance of Geometric distribution*	*Applications of Difference of Means*	*M/M/1 :Infinity /FIFO problems*	*Problem on Classification of a Markov Chain*
S-7	SLO-1	*Functions of Random variables*	*Applications of Geometric Distribution, problems on Memory less property*	*Introduction to small samples*	*M/M/1 :Infinity /FIFO problems*	*Classification of states of a Markov Chain*
	SLO-2	*Problems on Functions of Random variable*	*Introduction , MGF, Mean, Variance of Uniform Distribution*	*Introduction to small Samples*	*M/M/1 :Infinity /FIFO problems*	*Stationary and steady state*
S-8	SLO-1	*Problem solving using tutorial sheet 2*	*Problem solving using tutorial sheet 5*	*Problem solving using tutorial sheet 8*	*Problem solving using tutorial sheet 11*	*Problem solving using tutorial sheet 14*
	SLO-2					
S-9	SLO-1	*Tchebycheffs inequality*	*Applications of Uniform Distribution problems*	*Problems on single mean -small samples*	*Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1) : (K/FIFO)*	*Problems on Classification-State-stationary using Markov Chain*
	SLO-2	*Introduction to theoretical distribution*	*Introduction , MGF, Mean, Variance of Exponential distribution*	*Problems on single mean -small samples*	*Effective arrival rate*	*Problems on Stationary and steady state*
S-10	SLO-1	*Formula and application of Tchebycheffs inequality*	*Applications of Exponential distribution problems*	*Problems on difference of mean-small samples*	*Problems on Model (M/M/1) : (K/FIFO)*	*Problems on Ergodicity using Markov Chain*
	SLO-2	*Applications of chebychevs inequality*	*Introduction to Normal distribution*	*Problems on difference of mean-small samples*	*Problems on Model (M/M/1) : (K/FIFO)*	*Problems on Ergodicity using Markov Chain*
S-11	SLO-1	*Applications of chebychevs inequality using distribution*	*Applications of Normal distribution problems*	*Applications of paired - t test*	*Problems on Model (M/M/1) : (K/FIFO)*	*Problems on Ergodicity*
	SLO-2	*Problems practice using chebychevs inequality*	*Practical applications of Normal distribution*	*Problems of paired - t test.*	*Problems on Model (M/M/1) : (K/FIFO)*	*Problems on Ergodic and Non Ergodic Using Markovchains*
S-12	SLO-1	*Problem solving using tutorial sheet 3*	*Problem solving using tutorial sheet 6*	*Problem solving using tutorial sheet 9*	*Problem solving using tutorial sheet 12*	*Problem solving using tutorial sheet 15*
	SLO-2	*Applications of random variables in engineering*	*Applications of distribution to find the probability using Theoretical distributions*	*Applications of solving any realistic problem situation to determine the probability*	*Applications of Queueing decision models*	*Applications of constructing chain of decisions from the past situations using Monrovians*

Learning Resources	1. *Veerarajan T, Probability , Statistics and Random Processes, Tata Mc.Graw Hill, 1st Reprint 2004* 2. *S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999* 3. *Gross. D and Harri.C.M. Fundamentals of Queuing theory, John Wiley and Sons, 1985*	4. *Trivedi K S, Probability and Statistics with reliability, Queueing and Computer Science Applications, prentice Hall of India, New Delhi, 1984* 5. *Allen .A.O. , Probability Statistics and Queueing theory, Academic Press*

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		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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