Ref No:

Sri Krishna Institute of Technology,
Bangalore

COURSE PLAN

Academic Year 2019-2020

Program:	B E – Electronics & Communication Engineering
Semester :	6
Course Code:	18EC44
Course Title:	*ENGINEERING STATISTICS AND LINEAR ALGEBRA*
Credit / L-T-P:	3/ 3-0-0
Total Contact Hours:	40
Course Plan Author:	N S MYTHREYE

Academic Evaluation and Monitoring Cell

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A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	EC
Semester:	6	Academic Year:	2019-20
Course Title:	ENGINEERING STATISTICS AND LINEAR ALGEBRA	Course Code:	18EC44
Credit / L-T-P:	3-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	40	SEE Marks:	80 Marks
CIA Marks:	30	Assignment	1 / Module
Course Plan Author:	N S MYTHREYE	Sign ..	Dt:
Checked By:		Sign ..	Dt:
CO Targets	CIA Target :	SEE Target:	

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute.

Module	Content	Teaching Hours	Blooms Learning Levels
1	Single Random Variables: Definition of random variables, cumulative distribution function continuous and discrete random variables; probability mass function, probability density functions and properties; Expectations, Characteristic functions, Functions of single Random Variables, Conditioned Random variables. Application exercises to Some special distributions: Uniform, Exponential, Laplace, Gaussian; Binomial, and Poisson distribution.	8	L1,L2,L3
2	Multiple Random variables: Concept, Two variable CDF and PDF, Two Variable expectations (Correlation, orthogonality, Independent), Two variable transformation, Two Gaussian Random variables, Sum of two independent Random Variables, Sum of IID Random Variables – Central limit Theorem and law of large numbers, Conditional joint Probabilities, Application exercises to Chi-square RV, Student-T RV, Cauchy and Rayleigh RVs	8	L1,L2,L3
3	Random Processes: Ensemble, PDF, Independence, Expectations, Stationarity, Correlation Functions (ACF, CCF, Addition, and Multiplication), Ergodic Random Processes, Power Spectral Densities (Wiener Khinchin, Addition and Multiplication of RPs, Cross spectral densities), Linear Systems (output Mean, Cross correlation and Auto correlation of Input and output), Exercises with Noise.	8	L1,L2,L3
4	Vector Spaces: Vector spaces and Null subspaces, Rank and Row reduced form, Independence, Basis and dimension, Dimensions of the four subspaces, Rank-Nullity Theorem, Linear Transformations Orthogonality: Orthogonal Vectors and Subspaces, Projections and Least squares, Orthogonal Bases and Gram- Schmidt Orthogonalization procedure.	8	L1,L2,L3
5	Determinants: Properties of Determinants, Permutations and Cofactors Eigenvalues and Eigen vectors: Review of Eigenvalues and Diagonalization of a Matrix, Special Matrices (Positive Definite, Symmetric) and their properties, Singular Value Decomposition	8	L1,L2,L3
-	**Total**	**40**	-

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).
1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1	Richard H Williams, "Probability, Statistics and Random Processes for Engineers" Cengage Learning, 1st Edition, 2003, ISBN 13: 978-0-534-36888-3, ISBN 10: 0-534-36888-3.	4,5,6	Not available
2	Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4th Edition, 2006, ISBN 97809802327 Telecommunication and Switching, Traffic and Networks - J E Flood: Pearson Education, 2002.	2,3,4,5	Not available
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1	Hwei P. Hsu, "Theory and Problems of Probability, Random Variables, and Random Processes" Schaums Outline Series, McGraw Hill. ISBN 10: 0-07- 030644-3.		Not available
2	K. N. HariBhat, K Anitha Sheela, Jayant Ganguly, "Probability Theory and Stochastic Processes for Engineers", Cengage Learning India, 2019, ISBN: Not in book Digital Telephony - John C Bellamy: Wiley India Pvt. Ltd, 3rd Ed, 2008.		Not available
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
D	**Software Tools for Design**	**-**	**-**
E	**Recent Developments for Research**	**-**	**-**
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
	Maths	Mathematics	Matrices, determinants	2nd pu	-	L2
					-	
					-	

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Mod	Topic / Description	Area	Remarks	Blooms

ules				Level

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1	18EC44.1	Identify and associate the random variables and random processes in communication events	16	Lecture	Test/ Assignment	L3
2	18EC44.2	Analyze and model the random events in typical communication events to extract quantitative statistical parameters	8	Lecture	Test/ Assignment	L3
3	18EC44.3	Analyze and model typical signal sets in terms of a basis function set of amplitude, phase and frequency	8	Lecture	Test/ Assignment	L3
4	18EC44.4	Demonstrate by way of simulation or emulation the ease of analysis employing basis functions, statistical representation and eigen values	8	Lecture	Test/ Assignment	L3
5						
-	**-**	**Total**	**40**	**-**	**-**	**L3**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Probability theory is applied in risk assessment and modeling. The insurance industry and markets use actuarial science to determine pricing and make trading decisions. Governments apply probabilistic methods in environmental regulation, entitlement analysis (Reliability theory of aging and longevity), and financial regulation. A good example of the use of probability theory in equity trading is the effect of the perceived probability of any widespread Middle East conflict on oil prices, which have ripple effects in the economy as a whole. An assessment by a commodity trader that a war is more likely can send that commodity's prices up or down, and signals other traders of that opinion. Accordingly, the probabilities are neither assessed independently nor necessarily very rationally. The theory of behavioral finance emerged to describe the effect of such groupthink on pricing, on policy, and on peace and conflict. In addition to financial assessment, probability can be used to analyze trends in biology (e.g. disease spread) as well as ecology (e.g. biological Punnett squares). As with finance, risk assessment can be used as a statistical tool to calculate the likelihood of undesirable events occurring and can assist with implementing protocols to avoid encountering such circumstances. Probability is used to design	CO1, CO2	L3

	games of chance so that casinos can make a guaranteed profit, yet provide payouts to players that are frequent enough to encourage continued play. The discovery of rigorous methods to assess and combine probability assessments has changed society. Another significant application of probability theory in everyday life is reliability. Many consumer products, such as automobiles and consumer electronics, use reliability theory in product design to reduce the probability of failure. Failure probability may influence a manufacturer's decisions on a product's warranty. The cache language model and other statistical language models that are used in natural language processing are also examples of applications of probability theory.		
2	Linear algebra finds its wide application in the fields of Loss Functions , Regularization, Covariance Matrix, Support Vector Machine Classification, Principal Component Analysis (PCA), Singular Value Decomposition, Word Embeddings, Latent Semantic Analysis (LSA), Image Representation as Tensors, Convolution and Image Processing	CO3, CO4	L3

3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1,2	CO1	Identify and associate the random variables and random processes in communication events	3	3	3	2												
3	CO2	Analyze and model the random events in typical communication events to extract quantitative statistical parameters	3	3	3	2												
4	CO3	Analyze and model typical signal sets in terms of a basis function set of amplitude, phase and frequency	3	3	3	2												
5	CO4	Demonstrate by way of simulation or emulation the ease of analysis employing basis functions, statistical representation and eigen values	3	3	3	2												
-	❒		3	3	3	2												-
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*															

4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Single Random Variables	8		2		1	1	2	CO1	L3
2	Multiple Random variables	8		2	2	1	1	2	CO1	L3
3	Random Processes	8			2	1	1	2	CO2	L3
4	Vector Spaces	8	2			1	1	2	CO3	L3
5	Determinants, Eigenvalues and Eigen vectors	8	2			1	1	2	CO4	L3
-	**Total**	**40**	**8**	**8**	**8**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO3,CO4	L3
3, 4	CIA Exam – 2	30	CO1	L3
5	CIA Exam – 3	30	CO2	L3
1, 2	Assignment - 1	10	CO3,CO4	L3
3, 4	Assignment - 2	10	CO1	L3
5	Assignment - 3	10	CO2	L3
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities – Mini Project	-		
	Final CIA Marks		**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	Single Random Variables	Appr Time:	8 Hrs
a		**CO**	**Blooms**
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	Network structure,	CO1	L1
2	Network services, terminology,	CO1	L1
3	Regulation, Standards.	CO1	L1

4	Introduction to telecommunications transmission,	CO1	L1
5	Power levels,	CO1	L2
6	Four wire circuits,	CO1	L2
7	Digital transmission, FDM,TDM,	CO1	L1
8	PDH and SDH	CO1	L1
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Development of telecommunications is used in network topology, broadcasting, transmission of	CO1	L2
2	It is used in wired communication, analog signals multiplexing	CO1	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain briefly with neat diagram,the national telecommunication network	CO1	L1
2	Explain the principle operation of a Four wire circuit with neat diagram	CO1	L2
3	Explain the following power levels in dBW I) 1mW ii)1 W iii) 2mW iv) 100mW	CO1	L3
4	Explain various types of network structures	CO1	L2
5	Explain FDM with respect to a suitable block diagram	CO1	L2
6	Design any one type of PDH with a suitable diagram	CO1	L2
7	Briefly explaint he regulations, standards in a telecommunication network	CO1	L2
8	Explain in brief power levels encountered in telecommunication transmission system	CO1	L2
9	Calculate the total bit rate for a 30 channel PCM system and draw figure for the same with all the details included. Also show calculation for length of the frame	CO1	L2
10	Derive the expressions for the stability margin M ina four wire circuit	CO1	L3
11	With frame structure explain the SDH.	CO1	L2
12	Give the need for Echo compressor and define i)AAR ii)PBX iii)BRL	CO1	L2
13	An amplifier has an input resistance of 600Ω and a resistive load of 75Ω. When it has an rms input voltage of 100mv, the rms output current is 20ma. Find the gain in dB.	CO1	L3
e	**Experiences**	-	-
1			
2			

Module – 2

Title:	Multiple Random variables	Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Describe the electromechanical switching systems and its comparison with the digital switching.	CO1	L2
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	Introduction, Message switching,Circuit switching,	CO1	L2
2	Functions of switching systems,	CO1	L2
3	Distribution systems,	CO1	L2
4	Basics of crossbar systems, Electronic switching.	CO1	L2
5	Switching system hierarchy, Evolution of digital switching systems,	CO1	L2
6	Stored program control switching systems,	CO1	L2
7	Building blocks of a digital switching system,	CO1	L2
8	Basic call processing.	CO1	L2

c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Switching systems are used in packet switching of data, emails	CO1	L2
2	Digital signals can be coded signalled, & controlled	CO1	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain message switching and circuit switching. Bring out the difference between them	CO1	L3
2	Define traffic: list different functions of switching systems	CO1	L2
3	Explain the working of basic central office linkages	CO1	L2
4	Highlight the advantages & disadvantages of crossbar switch	CO1	L2
5	Explain the working of distributionn frame in strowger exchange	CO1	L1
6	What are the functions of distribution frame in switching system	CO1	L2
7	Explain neatly with diagramthe evolution of digital switching systems	CO1	L1
8	Explain the functions of IDF,TDF in strowger exchange	CO1	L2
9	List the advantages of i)electronic switching system ii) cross point switch over step by step switch	CO1	L2
10	Describe the fundamentals of DSS with a neat diagram	CO1	L1
11	Explain the process of basic Call processing.	CO1	L1
e	**Experiences**	-	-
1			
2			

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	18EC44	Sem:	VI	Marks:	30	Time:	75 minutes
Course:	Digital switching systems						

-	-	**Note: Answer all questions, each carry equal marks. Module : 1, 2**	**Marks**	**CO**	**Level**
1	a	Explain briefly with neat diagram,the national telecommunication network	5	CO1	L3
	b	Explain the principle operation of a Four wire circuit with neat diagram	5	CO1	L2
	c	Explain message switching and circuit switching. Bring out the difference between them	5	CO1	L3
		OR			
2	a	Explain the following power levels in dBW I) 1mW ii)1 W iii) 2mW iv) 100mW	5	CO1	L2
	b	Explain various types of network structures	5	CO1	L2
	c	Explain the working of basic central office linkages	5	CO1	L2
3	a	Explain FDM with respect to a suitable block diagram16	5	CO1	L1
	b	Design any one type of PDH with a suitable diagram	5	CO1	L2
	c	Describe the fundamentals of DSS with a neat diagram	5	CO1	L1
		OR			
4	a	Briefly explaint he regulations, standards in a telecommunication network	5	CO1	L1
	b	Explain in brief power levels encountered in telecommunication transmission system	5	CO1	L2
	c	Explain the working of distributionn frame in strowger exchange	5	CO1	L1

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18EC44	Sem:	VI	Marks:	30	Time:	90 – 120 minutes
Course:	Digital Switching Systems				Module : 1, 2		
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	Assignment Description	Marks	CO	Level
1	Explain briefly with neat diagram,the national telecommunication network	5	CO1	L1
2	Explain the principle operation of a Four wire circuit with neat diagram	5	CO1	L2
3	Explain the following power levels in dBW I) 1mW ii)1 W iii) 2mW iv) 100mW	5	CO1	L3
4	Explain various types of network structures	5	CO1	L2
5	Explain FDM with respect to a suitable block diagram	5	CO1	L2
6	Design any one type of PDH with a suitable diagram	5	CO1	L2
7	Briefly explaint he regulations, standards in a telecommunication network	5	CO1	L2
8	Explain in brief power levels encountered in telecommunication transmission system	5	CO1	L2
9	Calculate the total bit rate for a 30 channel PCM system and draw figure for the same with all the details included. Also show calculation for length of the frame	5	CO1	L2
10	Derive the expressions for the stability margin M ina four wire circuit	5	CO1	L3
11	With frame structure explain the SDH.	5	CO1	L2
12	Give the need for Echo compressor and define i)AAR ii)PBX iii)BRL	5	CO1	L2
13	An amplifier has an input resistance of 600Ω and a resistive load of 75Ω. When it has an rms input voltage of 100mv, the rms output current is 20ma. Find the gain in dB.	5	CO1	L3
14	Explain message switching and circuit switching. Bring out the difference between them	5	CO1	L3
15	Define traffic: list different functions of switching systems	5	CO1	L2
16	Explain the working of basic central office linkages	5	CO1	L2
17	Highlight the advantages & disadvantages of crossbar switch	5	CO1	L2
18	Explain the working of distributionn frame in strowger exchange	5	CO1	L1
19	What are the functions of distribution frame in switching system	5	CO1	L2
20	Explain neatly with diagramthe evolution of digital switching systems	5	CO1	L1
21	Explain the functions of DF,IDF,TDF in strowger exchange	5	CO1	L2
22	List the advantages of i)electronic switching system ii) cross point switch over step by step switch	5	CO1	L2
23	Describe the fundamentals of DSS with a neat diagram	5	CO1	L1
24	Explain the process of basic Call processing.	5	CO1	L1

D2. TEACHING PLAN - 2

Module – 3

Title:	Random Processes	Appr Time:	8Hrs
a		**CO**	**Blooms**
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
1	TELECOMMUNICATIONS TRAFFIC: Introduction,	CO2	L1
2	Unit of traffic, Congestion,	CO2	L2
3	Traffic measurement, Mathematical model,	CO2	L3
4	lost call systems,Queuing systems.	CO2	L3
5	SWITCHING SYSTEMS: Introduction,	CO2	L2
6	Single stage networks, Gradings,	CO2	L1
7	Link Systems, GOS of Linked systems.	CO2	L2
8	Effective height, Antenna efficiency, Antenna Field Zones and Polarization	CO2	L3
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Telecommunication trafficsare used in TCP control, throughput measuring in systems	CO2	L2

2	To measure the Quality & oerformance of network& its linkages	CO2	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Define i) busy hour ii) holding time iii) unit of traffic iv) Grade of service	CO2	L1
2	During the busy hour a group of trunks is offered 100 calls having an average duration of 3 min one of the call fails to find a designated trunk. Find the traffic offered to the group, traffic carried by the group and the traffic lost.	CO2	L3
3	Derive an expression for iterative form of Erlangs lost call formula with explanation of assumptions made	CO2	L2
4	A progressive grading for connecting 20 trunks to switches having 10 outlets	CO2	L3
5	Explain traffic capacity of gradings with a curve, traffic in Erlangs (A)v/s number of trunks required(N)	CO2	L2
6	On an average, during the busy hour, a company makes 180 outgoing calls of average duration of 3 min. it receives 400 incoming calls of average duration 6 min. find outgoing traffic, incoming traffic, total traffic	CO2	L3
7	A group of 20 trunks provides a GOS of 0.01 when offered is the GOS improved if one extra trunk is added to the group. How much does the GOS deteriorate if one trunk is out of service	CO2	L3
8	Define and explain plain the following terms I) traffic intensity ii) blocking probability iii) blocking network. iv) statistical equilibrium	CO2	L2
9	During the Busy hour on average 30E is offered to a group of Trunks. On average total period during which all trunks are busy is 12secs and two calls are lost. Find the average no of calls carried by the group and average call duration	CO2	L3
10	What is grading exaplain any two types of gradings	CO2	L2
11	Derive an expression for gradee of service of a three stage network	CO2	L3
12	Derive a three stage network for connecting 100 incoming trunks to 100 outgoing trunks	CO2	L3
13	Design a progressive grading system connecting 30 outgoing trunks and having an availability of only 10 switches. Draw the grading diagram.	CO2	L3
14	Define I) graded groups ii) availability iii) skipped grading iv) homogeneous grading v) Congestion vi) CCR vii) peak busy hour	CO2	L2
15	Design a two stage switching network for connecting 200 incoming trunks to 200 outgoing trunks.	CO2	L2
e	**Experiences**	-	-
1			
2			

Module – 4

Title:	Vector Spaces	Appr Time:	8 Hrs
a		**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Define the technologies associated with the data switching operations.	CO3	L2
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
1	TIME DIVISION SWITCHING: Introduction,	CO3	L1
2	space and time switching,.	CO3	L2
3	Time switching networks, Synchronisation	CO3	L2
4	SWITCHING SYSTEM SOFTWARE: Introduction, Basic software architecture,	CO3	L1
5	Software architecture for level 1to 3 control,	CO3	L2
6	Digital switching system software classification,	CO3	L2
7	Call models, Software linkages during call,	CO3	L2
8	Feature flow diagram, Feature interaction.	CO3	L2

c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Used to measure strowger switching sytems	CO3	L2
2	Switching system software is used to make or break calls	CO3	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain the principle of operation of TST and STS network	CO3	L2
2	Explain with block diagram the frame alignment of PCM signal in digital exchange	CO3	L2
3	Explain in brief digital switching system software classification	CO3	L2
4	With the help of feature flow diagram, explain feature activation, feature operation and feature de-activation	CO3	L2
5	A TST network has 20 incoming and 20 outgoing PCM highway each conveys 30 channels the required GOS is 0.01,0.02. find the traffic capacity of network in mode 1 and mode 2.	CO3	L3
6	Explain frame synchronization	CO3	L1
7	With a suitable diagram, explain software linkages during a call	CO3	L1
8	With a neat sketch explain a space switch for K incoming PCM highways and m outgoing PCM highways	CO3	L1
9	Discuss the need for frame alignment in time division switching networks. Explain double ended unilateral and bilateral synchronization systems	CO3	L2
10	Briefly explain the basic call model.	CO3	L1
11	An STS switch has 16 incoming and 16 outgoing highways, each of which conveys 24 PCM channels. Between the incoming and outgoing space switches, there are 20 links containing time switches. During busy hour the network is offered 300 Erlangs of traffic. Estimate GOS if I) connection is required to aparticular free channel on a selected outgoing highway. ii) connection is required to a particular outgoing highway, but any free channel on it may be used.	CO3	L3
12	Explain in brief digital switching system software classification	CO3	L2
e	**Experiences**	-	-
1			
2			
3			
4			
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	18EC44	Sem:	VI	Marks:	30	Time:	75 minutes		
Course:	Digital switching systems								
-	**-**	**Note: Answer all questions, each carry equal marks. Module : 3, 4**					**Marks**	**CO**	**Level**
1	a	Define i) busy hour ii) holding time iii) unit of traffic iv) Grade of service					16	CO2	L1
	b	During the busy hour a group of trunks is offered 100 calls having an average duration of 3 min one of the call fails to find a designated trunk. Find the traffic offered to the group, traffic carried by the group and the traffic lost.						CO2	L3
	c	An STS switch has 16 incoming and 16 outgoing highways, each of which conveys 24 PCM channels. Between the incoming and outgoing space switches, there are 20 links containing time switches. During busy hour the network is offered 300 Erlangs of traffic. Estimate GOS if I) connection is required to aparticular free channel on a selected outgoing highway. ii) connection is required to a particular outgoing highway, but any free channel on it may be used.						CO2	L3

	d	**Explain in brief digital switching system software classification**		**CO2**	**L2**
2	a	Define I) graded groups ii) availability iii) skipped grading iv) homogeneous grading v) Congestion vi) CCR vii) peak busy hour	16	CO2	**L2**
	b	Design a two stage switching network for connecting 200 incoming trunks to 200 outgoing trunks.		CO2	**L2**
	c	Explain frame synchronization		**CO2**	L1
	d	With a suitable diagram, explain software linkages during a call		**CO2**	L1
3	a	During the Busy hour on average 30E is offered to a group of Trunks. On average total period during which all trunks are busy is 12secs and two calls are lost. Find the average no of calls carried by the group and average call duration	16	CO3	L3
	b	What is grading exaplain any two types of gradings		CO3	**L2**
	c	Explain the principle of operation of TST and STS network		CO3	L2
	d	Explain with block diagram the frame alignment of PCM signal in digital exchange		CO3	L2
4	a	A progressive grading for connecting 20 trunks to switches having 10 outlets	16	CO3	L3
	b	Explain traffic capacity of gradings with a curve, traffic in Erlangs (A)v/s number of trunks required(N)		CO3	L2
	c	Discuss the need for frame alignment in time division switching networks. Explain double ended unilateral and bilateral synchronization systems		**CO3**	**L2**
	d	Briefly explain the basic call model.		**CO3**	**L1**

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18EC44	Sem:	VI	Marks:	5	Time:	90 – 120 minutes
Course:	Digital Switching systems				Module : 3, 4		
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	Assignment Description	Marks	CO	Level
1	Define i) busy hour ii) holding time iii) unit of traffic iv) Grade of service	5	CO2	L1
2	During the busy hour a group of trunks is offered 100 calls having an average duration of 3 min one of the call fails to find a designated trunk. Find the traffic offered to the group, traffic carried by the group and the traffic lost.	5	CO2	L3
3	Derive an expression for iterative form of Erlangs lost call formula with explanation of assumptions made	5	CO2	L2
4	A progressive grading for connecting 20 trunks to switches having 10 outlets	5	CO2	L3
5	Explain traffic capacity of gradings with a curve, traffic in Erlangs (A)v/s number of trunks required(N)	5	CO2	L2
6	On an average, during the busy hour, a company makes 180 outgoing calls of average duration of 3 min. it receives 400 incoming calls of average duration 6 min. find outgoing traffic, incoming traffic, total traffic	5	CO2	L3
7	A group of 20 trunks provides a GOS of 0.01 when offered is the GOS improved if one extra trunk is added to the group. How much does the GOS deteriorate if one trunk is out of service	5	CO2	L3
8	Define and explain plain the following terms I) traffic intensity ii) blocking probability iii) blocking network. iv) statistical equilibrium	5	CO2	**L2**
9	During the Busy hour on average 30E is offered to a group of Trunks. On	5	CO2	L3

	average total period during which all trunks are busy is 12secs and two calls are lost. Find the average no of calls carried by the group and average call duration			
10	What is grading exaplain any two types of gradings	5	CO2	L2
11	Derive an expression for gradee of service of a three stage network	5	CO2	L3
12	Derive a three stage network for connecting 100 incoming trunks to 100 outgoing trunks	5	CO2	L3
13	Design a progressive grading system connecting 30 outgoing trunks and having an availability of only 10 switches. Draw the grading diagram.	5	CO2	L3
14	Define I) graded groups ii) availability iii) skipped grading iv) homogeneous grading v) Congestion vi) CCR vii) peak busy hour	5	CO2	L2
15	Design a two stage switching network for connecting 200 incoming trunks to 200 outgoing trunks.	5	CO2	L2
16	Explain the principle of operation of TST and STS network	5	CO3	L2
17	Explain with block diagram the frame alignment of PCM signal in digital exchange	5	CO3	L2
18	Explain in brief digital switching system software classification	5	CO3	L2
19	With the help of feature flow diagram, explain feature activation, feature operation and feature de-activation	5	CO3	L2
20	A TST network has 20 incoming and 20 outgoing PCM highway each conveys 30 channels the required GOS is 0.01,0.02. find the traffic capacity of network in mode 1 and mode 2.	5	CO3	L3
21	Explain frame synchronization	5	CO3	L1
22	With a suitable diagram, explain software linkages during a call	5	CO3	L1
23	With a neat sketch explain a space switch for K incoming PCM highways and m outgoing PCM highways	5	CO3	L1
24	Discuss the need for frame alignment in time division switching networks. Explain double ended unilateral and bilateral synchronization systems	5	CO3	L2
25	Briefly explain the basic call model.	5	CO3	L1
26	An STS switch has 16 incoming and 16 outgoing highways, each of which conveys 24 PCM channels. Between the incoming and outgoing space switches, there are 20 links containing time switches. During busy hour the network is offered 300 Erlangs of traffic. Estimate GOS if I) connection is required to aparticular free channel on a selected outgoing highway. ii) connection is required to a particular outgoing highway, but any free channel on it may be used.	5	CO3	L3
27	Explain in brief digital switching system software classification	5	CO3	L2

D3. TEACHING PLAN - 3

Module – 5

Title:	Determinants, Eigenvalues and Eigen vectors	Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Describe the software aspects of switching systems and its maintenance.	CO4	L2
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	Introduction , Software maintenance,	CO4	L2
2	Interface of a typical digital switching system central office,	CO4	L2
3	System outage and its impact on digital switching system reliability,	CO4	L2
4	Impact of software patches on digital switching system maintainability,	CO4	L2
5	A methodology for proper maintenance of digital switching system	CO4	L2

6	A GENERIC DIGITAL SWITCHING SYSTEM MODEL: Introduction, Hardware architecture	CO4	L2
7	Software architecture, Recovery strategy, Simple call through a digital system,	CO4	L2
8	Common characteristics of digital switching systems. Reliability analysis.	CO4	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Used in network control processor, OA&M funtions	CO4	L2
2	Data base management for recovery purpose, in servers, maintenance of computer systems.	CO4	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain in brief with neat diagram of organizational interfaces of a typical digital switching system central office	CO4	L2
2	With a block diagram explain the strategy used for improvement of software quality	CO4	L2
3	Explain with block diagram a generic switch software architecture	CO4	L2
4	Mention some common characteristics of DSS	CO4	L2
5	Writs a short note on analysis report of a DSS	CO4	L2
6	Explain recovery stage of initialization process with examples	CO4	L2
7	Explain in brief a methodology for proper maintaenance of a DSS such as diagnostic capabilities and firmware development	CO4	L2
8	Explain with block diagram a generic switch hardware architecture	CO4	L2
9	List the basic steps necessary to complete a simple call	CO4	L2
10	Write a brief note on defect analaysis	CO4	L2
11	What is system outage impact on DSS & its impact on DSS reliability	CO4	L2
12	What is the scheme that a digital switching environment follows for the internal and external reporting of faults. Discuss.	CO4	L2
e	**Experiences**	-	-
1			
2			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	18EC44	Sem:	VI	Marks:	30	Time:	75 minutes
Course:	Digital Switching Systems						

-	-	**Note: Answer all questions, each carry equal marks. Module : 5**	**Marks**	**CO**	**Level**
1	a	Write a brief note on defect analaysis	5	CO4	L2
	b	What is system outage impact on DSS & its impact on DSS reliability	5	CO4	L2
	c	What is the scheme that a digital switching environment follows for the internal and external reporting of faults. Discuss.	5	CO4	L2
2	a	Mention some common characteristics of DSS	5	CO4	L2
	b	Write a short note on analysis report of a DSS	5	CO4	L2
	c	Explain recovery stage of initialization process with examples	5	CO4	L2
3	a	Explain in brief with neat diagram of organizational interfaces of a typical digital switching system central office	5	CO4	L2
	b	With a block diagram explain the strategy used for improvement of software quality	5	CO4	L2
	c	Explain with block diagram a generic switch software architecture	5	CO4	L2
4	a	Explain in brief a methodology for proper maintaenance of a DSS such as diagnostic capabilities and firmware development	5	CO4	L2

	b	Explain with block diagram a generic switch hardware architecture	5	CO4	L2
	c	List the basic steps necessary to complete a simple call	5	CO4	L2

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18EC44	Sem:	VI	Marks:	5	Time:	90 – 120 minutes
Course:	Digital Switching Systems				Module : 5		
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	Assignment Description	Marks	CO	Level
1	Explain in brief with neat diagram of organizational interfaces of a typical digital switching system central office	5	CO4	L2
2	With a block diagram explain the strategy used for improvement of software quality	5	CO4	L2
3	Explain with block diagram a generic switch software architecture	5	CO4	L2
4	Mention some common characteristics of DSS	5	CO4	L2
5	Writs a short note on analysis report of a DSS	5	CO4	L2
6	Explain recovery stage of initialization process with examples	5	CO4	L2
7	Explain in brief a methodology for proper maintaenance of a DSS such as diagnostic capabilities and firmware development	5	CO4	L2
8	Explain with block diagram a generic switch hardware architecture	5	CO4	L2
9	List the basic steps necessary to complete a simple call	5	CO4	L2
10	Write a brief note on defect analaysis	5	CO4	L2
11	What is system outage impact on DSS & its impact on DSS reliability	5	CO4	L2
12	What is the scheme that a digital switching environment follows for the internal and external reporting of faults. Discuss.	5	CO4	L2

F. EXAM PREPARATION

1. University Model Question Paper

Course:	Digital Switching Systems					Month / Year	May /2018
Crs Code:	18EC44	Sem:	VI	Marks:	80	Time:	180 minutes

Module	Note	Answer all FIVE full questions. All questions carry equal marks.	Marks	CO	Level
1	a	Explain briefly with neat diagram,the national telecommunication network	5	CO1	L2
	b	Explain the principle operation of a Four wire circuit with neat diagram	5	CO1	L2
	c	Explain the following power levels in dBW I) 1mW ii)1 W iii) 2mW iv) 100mW	5	CO1	L3
	d	Explain various types of network structures	5	CO1	L2
		OR			
1	a	Define traffic: list different functions of switching systems	5	CO1	L2
	b	Explain the working of basic central office linkages	5	CO1	L2
	c	Highlight the advantages & disadvantages of crossbar switch	5	CO1	L2
	d	Explain the working of distributionn frame in strowger exchange	5	CO1	L2
2	a	Explain the working of basic central office linkages	5	CO1	L2
	b	Highlight the advantages & disadvantages of crossbar switch	5	CO1	L2
	c	Explain the working of distributionn frame in strowger exchange	5	CO1	L2
	d	What are the functions of distribution frame in switching system	5	CO1	L2
		OR			
2	a	Explain the functions of IDF,TDF in strowger exchange	5	CO1	L2
	b	List the advantages of i)electronic switching system ii) cross point switch over step by step switch	5	CO1	L2
	c	Describe the fundamentals of DSS with a neat diagram	5	CO1	L2
	d	Explain the process of basic Call processing.	5	CO1	L2

3	a	During the busy hour a group of trunks is offered 100 calls having an average duration of 3 min one of the call fails to find a designated trunk. Find the traffic offered to the group, traffic carried by the group and the traffic lost.	5	CO2	L3
	b	Derive an expression for iterative form of Erlangs lost call formula with explanation of assumptions made	5	CO2	L2
	c	A progressive grading for connecting 20 trunks to switches having 10 outlets	5	CO2	L2
	d	Explain traffic capacity of gradings with a curve, traffic in Erlangs (A)v/s number of trunks required(N)	5	CO2	L2
		OR			
3	a	Derive an expression for iterative form of Erlangs lost call formula with explanation of assumptions made	5	CO2	L2
	b	A progressive grading for connecting 20 trunks to switches having 10 outlets	5	CO2	L2
	c	On an average, during the busy hour, a company makes 180 outgoing calls of average duration of 3 min. it receives 400 incoming calls of average duration 6 min. find outgoing traffic, incoming traffic, total traffic	10	CO2	L3
4	a	Explain the principle of operation of TST and STS network	5	CO3	L2
	b	Explain with block diagram the frame alignment of PCM signal in digital exchange	5	CO3	L2
	c	Explain in brief digital switching system software classification	5	CO3	L2
	d	With the help of feature flow diagram, explain feature activation, feature operation and feature de-activation	5	CO3	L2
		OR			
4	a	Derive an expression for grade of service of a three stage network	5	CO3	L2
	b	Derive a three stage network for connecting 100 incoming trunks to 100 outgoing trunks	5	CO3	L2
	c	Design a progressive grading system connecting 30 outgoing trunks and having an availability of only 10 switches. Draw the grading diagram.	5	CO3	L2
	d	Define I) graded groups ii) availability iii) skipped grading iv) homogeneous grading v) Congestion vi) CCR vii) peak busy hour	5	CO3	L2
5	a	With a block diagram explain the strategy used for improvement of software quality	5	CO4	L2
	b	Explain with block diagram a generic switch software architecture	5	CO4	L2
	c	Mention some common characteristics of DSS	5	CO4	L2
	d	Write a short note on analysis report of a DSS	5	CO4	L2
		OR			
5	a	Explain in brief a methodology for proper maintaenance of a DSS such as diagnostic capabilities and firmware development	5	CO4	L2
	b	Explain with block diagram a generic switch hardware architecture	5	CO4	L2
	c	List the basic steps necessary to complete a simple call	5	CO4	L2
	d	Write a brief note on defect analysis	5	CO4	L2

2. SEE Important Questions

Course:		Digital switchingsystems						Month / Year	May /2018	
Crs Code:		18EC44	Sem:	6	Marks:	80		Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.						-	-	
Module	Qno.	Important Question						**Marks**	**CO**	**Year**
1	a	Explain briefly with neat diagram,the national telecommunication network						20	CO1	2004
	b	Explain the principle operation of a Four wire circuit with neat diagram							CO1	2013
	c	Explain the following power levels in dBW I) 1mW ii)1 W iii) 2mW iv)							CO1	2013

		100mW			
	d	Explain various types of network structures		CO1	2013
	e	Explain FDM with respect to a suitable block diagram		CO1	2012
		OR			
2	a	Define traffic: list different functions of switching systems	20	CO1	2012
	b	Explain the working of basic central office linkages		CO1	2010
	c	Highlight the advantages & disadvantages of crossbar switch		CO1	2010
	d	Explain the working of distributionn frame in strowger exchange		CO1	2012
	e	What are the functions of distribution frame in switching system		CO1	2012
3	a	Define i) busy hour ii) holding time iii) unit of traffic iv) Grade of service	16	CO2	2012
	b	During the busy hour a group of trunks is offered 100 calls having an average duration of 3 min one of the call fails to find a designated trunk. Find the traffic offered to the group, traffic carried by the group and the traffic lost.		CO2	2012
	c	Derive an expression for iterative form of Erlangs lost call formula with explanation of assumptions made		CO2	2013
	d	A progressive grading for connecting 20 trunks to switches having 10 outlets		CO2	2010
	e	Explain traffic capacity of gradings with a curve, traffic in Erlangs (A)v/s number of trunks required(N)		CO2	2014
4	a	Explain the principle of operation of TST and STS network	16	CO3	2009
	b	Explain with block diagram the frame alignment of PCM signal in digital exchange		CO3	2009
	c	Explain in brief digital switching system software classification		CO3	2011
	d	With the help of feature flow diagram, explain feature activation, feature operation and feature de-activation		CO3	2009
	e	A TST network has 20 incoming and 20 outgoing PCM highway each conveys 30 channels the required GOS is 0.01,0.02. find the traffic capacity of network in mode 1 and mode 2.		CO3	2009
5	a	Explain in brief with neat diagram of organizational interfaces of a typical digital switching system central office	16	CO4	2011
	b	With a block diagram explain the strategy used for improvement of software quality		CO4	2011
	c	Explain with block diagram a generic switch software architecture		CO4	2010
	d	Mention some common characteristics of DSS		CO4	2012
	e	Write a short note on analysis report of a DSS		CO4	2009