



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTOR

Course Title	TELECOMMUNICATION SWITCHING THEORY AND APPLICATIONS				
Course Code	AEC523				
Programme	B.Tech				
Semester	V	ECE			
Course Type	Elective				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Chief Coordinator	Mr.U.Somanaidu, Assistant Professor				
Course Faculty	Dr. P Ashok Babu, Professor				
	Mr.A.Karthik, Assistant Professor				

I. COURSE OVERVIEW:

This course provides the knowledge about the telecommunication industry, its services and market, the theoretical basis about performance (queuing theory) and operation (multiplexing, switching, routing, and signaling) in telecom networks. It also provides working of EPABX systems, data transmission in PSTNs, data rates in PSTNs, modems, switching techniques for data transmission, circuit switching, store and forward switching data communication architecture.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AEC005	IV	Analog Communications	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Telecommunication Switching Theory And Applications	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Chalk & Talk	✓	Quiz	✓	Assignments	✗	MOOCs
✓	LCD / PPT	✓	Seminars	✗	Mini Project	✓	Videos
✗	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with “either” or “choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory		Total Marks
	CIE Exam	Quiz/AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question

paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency Assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Lectures, Assignments, Exercises
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Design Exercises
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Design Exercises
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	3	Assignments, Exercises

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	Professional Skills: To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	2	Lectures and Assignments.
PSO 2	Software Engineering Practices: An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	-	-
PSO 3	Successful Career and Entrepreneurship: To build the nation, by imparting technological inputs and managerial skills to become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES:

The course should enable the students to:	
I	Learn to consider tele-traffic demands, quality of service, scalability, performance and cost into consideration to develop requirements and architectures.
II	Underlying technologies and applications including wireless communications, including mobility, optical communications, wavelength routing, packet networks and the Internet.
III	Coordinated with CS 440, computer networks, where communications protocols and the TCP/IP protocols suite are addressed.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Review, analyse, interpret and explain the main concepts of telecommunication network.	CLO 1	Understand basic and some advanced concepts And techniques of telecommunications networks.
		CLO 2	Discuss the simple telephone communication.
		CLO 3	Ability to analyse the characteristics of the telephone systems.
		CLO 4	Ability to analyse the processes used in telecommunication.
CO 2	Evaluate, compare, classify and explain the operation of fundamental telecommunication switching network configurations models.	CLO 5	Ability to make use of the parameters in designing telephone switches
		CLO 6	Discuss the basic settings in the operation of telecommunications systems and devices. Problem like sick versus healthy.
		CLO 7	Determine the traffic engineering and traffic load Parameters.

COs	Course Outcome	CLOs	Course Learning Outcome
		CLO 8	Understand the, grade of service and blocking probability.
		CLO 9	Implement the performance of a digital
		CLO 10	Evaluate the Time Division Multiplexing Services.
CO 3	Discuss, classify and determine the significance of basic modern signalling system.	CLO 11	Explain network and transport layer functions and describe Internet routing algorithms and TCP/IP protocols
		CLO 12	Understand the concept of ISO/OSI models.
		CLO 13	Acquire the purpose of layering and describe the current layered architecture for the Internet
		CLO 14	Analyse the LAN and metropolitan network.
		CLO 15	Apply the fiber optics into data networks
CO 4	Analyse, interpret and discuss the concepts of OSI/ISO and explain its role in design of telephone network.	CLO 16	Design network synchronization and network management
		CLO 17	Understand the cellular communication networks.
		CLO 18	Develop problem solving approaches as applied in telecommunications networking areas.
		CLO 19	Able to analyse performance of basic communication networks using both analytical and simulation techniques.
CO 5	Analyse, interpret and discuss the concepts Integrated Services Digital Networks, types of networks, charging procedures and routing mechanisms.	CLO 20	Apply the telecommunication network design Techniques and practical implementation issues.
		CLO 21	Understand the network and protocol architecture.
		CLO 22	Determine the voice data integration.

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEC523.01	CLO 1	Understand basic and some advanced concepts and techniques of telecommunications networks.	PO 1	3
AEC523.02	CLO 2	Discuss the simple telephone communication.	PO 1	3
AEC523.03	CLO 3	Ability to analyse the characteristics of the telephone systems.	PO 5	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEC523.04	CLO 4	Ability to analyse the processes used in telecommunication.	PO 5	2
AEC523.05	CLO 5	Ability to make use of the parameters in designing telephone switches	PO 1	3
AEC523.06	CLO 6	Discuss the basic settings in the operation of Telecommunications systems and devices.	PO 1	2
AEC523.07	CLO 7	Determine the traffic engineering and traffic load Parameters.	PO 4	2
AEC523.08	CLO 8	Understand the, grade of service and blocking probability.	PO 4	1
AEC523.09	CLO 9	Implement the performance of a digital telephone switch.	PO 4	2
AEC523.10	CLO 10	Evaluate the Time Division Multiplexing services.	PO 4	2
AEC523.11	CLO 11	Explain network and transport layer functions and describe Internet routing algorithms and TCP/IP protocols	PO 5	3
AEC523.12	CLO 12	Understand the concept of ISO/OSI models.	PO 5	3
AEC523.13	CLO 13	Acquire the purpose of layering and describe the current layered architecture for the Internet	PO 5	3
AEC523.14	CLO 14	Analyse the LAN and metropolitan network.	PO 5	2
AEC523.15	CLO 15	Apply the fiber optics into data networks	PO 1	2
AEC523.16	CLO 16	Design network synchronization and network management	PO 2	2
AEC523.17	CLO 17	Understand the cellular communication networks.	PO 1	2
AEC523.18	CLO 18	Develop problem solving approaches as applied in Telecommunications networking areas.	PO 2	3
AEC523.19	CLO 19	Able to analyse performance of basic communication Networks using both analytical and simulation techniques.	PO1	2
AEC523.20	CLO 20	Apply the telecommunication network design techniques and practical implementation issues.	PO 2	2
AEC523.21	CLO 21	Understand the network and protocol architecture.	PO 2	2
AEC523.22	CLO 22	Determine the voice data integration.	PO 2	2

3= High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes (COs)	Program Outcomes (POs)				Program Specific Outcomes(PSOs)
	PO 1	PO 2	PO 4	PO 5	PSO1
CO 1	3			3	2
CO 2	2		2		
CO 3			2	2	2
CO 4	2				
CO 5		2			

3= High; 2 = Medium; 1 = Low

XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												3		
CLO 2	3														
CLO 3					3								3		
CLO 4					2										
CLO 5	3														
CLO 6				2									2		
CLO 7				1									2		
CLO 8				1									2		
CLO 9				2											
CLO 10				2											
CLO 11					3										
CLO 12					3								2		
CLO 13					3										
CLO 14					2								2		
CLO 15	2														

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 16		2											2		
CLO 17	2														
CLO 18		3													
CLO 19	2														
CLO 20		2											2		
CLO 21		2													
CLO 22		2											2		

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO4, PO5, PSO1	SEE Exams	PO1, PO2, PO4, PO5, PSO1	Assignments	-	Seminars	PO1, PO2, PO4, PO5, PSO1
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO1, PO2, PO4, PO5, PSO1						

XIV. ASSESSMENT METHODOLOGIES – INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XV. SYLLABUS

UNIT-I	INTRODUCTION	Classes: 10
Introduction: Evolution of telecommunications, simple telephone communication, manual switching system, major telecommunication networks, strowger switching system, crossbar switching; Electronic Space Division Switching: Stored program control, centralized SPC, distributed SPC, enhanced services, two stage networks, three stage network n-stage networks.		

UNIT-II	TIME DIVISION SWITCHING	Classes: 09
<p>Time Division Switching: Time multiplexed space switching, time multiplexed time switching, combination Switching, three stage combination switching, n-stage combination switching; Traffic Engineering: Network traffic load and parameters, grade of service and blocking probability, modeling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, delay systems.</p>		
UNIT-III	DATA NETWORKS	Classes: 08
<p>Data networks: Block diagram, features, working of EPABX systems, data transmission in PSTNs, data rates in PSTNs, modems, switching techniques for data transmission, circuit switching, store and forward switching data communication architecture.</p> <p>ISO-OSI reference model, link to link layers, physical layer, data link layer, network layer, end to end layers, transport layer, session layer, presentation layer, Satellite based data networks, LAN, Metropolitan area network, fiber optic networks, and data network standards.</p>		
UNIT-IV	TELEPHONE NETWORKS	Classes: 08
<p>Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, numbering plan, charging plan, signaling techniques, in channel signaling, common channel signaling, and cellular mobile telephony.</p>		
UNIT-V	INTEGRATED SERVICES DIGITAL NETWORKS	Classes: 10
<p>Integrated Services Digital Networks: Motivation for ISDN, new services, network and protocol Architecture, transmission channels, user network interface, signaling, numbering and addressing, service characterization, interworking, ISDN standards, broadband ISDN, voice data Integration.</p>		
Text Books:		
<ol style="list-style-type: none"> 1. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks"; PHI Publications, 1992. 2. J. E. Flood, "Telecommunications Switching, Traffic and Networks", Pearson Education, 2nd Edition, 2007. 3. John C. Bellamy, "Digital Telephony", Wiley Publications, 3rd Edition, 2000. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Wayne Tomasi, "Electronic Communications Systems", Pearson Education, 5th Edition, 2009. 2. William C.Y.Lec, "Mobile Cellular Telecommunication, Analog and Digital Systems", McGraw- Hill Inc, 2nd Edition, 1995. 3. Kaveh Pahlavan, Allen H. Levesque" Wireless Information Networks", Wiley Series, John Wiley and Sons Inc, 1st Edition, 2005. 		

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

LectureNo.	Topics to be covered	CLOs	Reference
1-2	Understand the evolution of telecommunications.	CLO 1	T1:1.1
3-4	Analyze the simple telephone communication.	CLO 2	T1:1.2
5-6	Analyze the manual switching system and major telecommunication networks	CLO 4	T1:1.5,R2:3.5
7	Determine the strowger switching system.	CLO 4	T1:2.1-2.3
8-9	Study the crossbar switching and their capabilities.	CLO 5	T1:3.1,3.4,R2:3.7
10	Understand the electronic Space Division Switching.	CLO 6	T1:4.1
11-12	Discuss the Stored program control and centralized SPC.	CLO 3	T1:4.2
13	Evaluate the Performance of distributed SPC.	CLO 3	T1:4.3
14	Study the enhanced services.	CLO 6	T1:4.6,R2:3.9
15-16	Examine the two stage networks, three stage network n-stage networks.	CLO 4	T1:4.7
17	Design Time Division Switching.	CLO 10	T1:6.1
18-19	Perform the Time multiplexed space switching	CLO 10	T1:6.3
20	Understand time multiplexed time switching and Combination Switching.	CLO 10	T1:6.4,6.5
21-22	Design of three stage combination switching.	CLO 10	T1:6.6
23-24	Design n-stage combination switching.	CLO 10	T1:6.7
25	Analyze Traffic Engineering.	CLO 7	T1:8.1
26-27	Evaluate Network traffic load and parameters, grade of service and blocking probability.	CLO 7	T1:8.1,8.2
28	Modeling switching systems.	CLO 5	T1:8.1
29-30	Characterize the incoming traffic and service time.	CLO 7	T1:8.3
31-32	Blocking models and loss estimates, delay systems.	CLO 8	T1:8.3
33	Study the Data networks, Block diagram, features.	CLO 11	T1:10.1
34	Explain working of EPABX systems.	CLO 9	T1:10.1,R2:3.1
35	Perform data transmission in PSTNs.	CLO 9	T1:10.1
36	Perform data rates in PSTNs, modems.	CLO 9	T1:10.1
37	Design switching techniques for data transmission.	CLO 9	T1:10.2

LectureNo.	Topics to be covered	CLOs	Reference
38	Design circuit switching, store and forward switching data communication architecture.	CLO 13	T1:10.3
39-40	Explain ISO-OSI reference model. Design link to link layers, physical layer. Design data link layer, network layer.	CLO 12	T1:10.4
41	Design end to end layers, transport layer, session layer.	CLO 12	T1:10.4
42	Classify the LAN, metropolitan area network.	CLO 12	T1:10.4
43	Understand the fiber optic networks, and data network standards.	CLO 12	T1:10.4
44	Review the Telephone Networks. Understand Subscriber loop systems, switching hierarchy and routing	CLO 12	T1:10.4-10.6,R1:3.6
45	Determine transmission plan, transmission systems. Classify the numbering plan, charging plan,	CLO 14	T1:10.7-10.8
46	Distinguish in channel signaling, common channel signaling.	CLO 15	T1:10.9-10.10
47	Cellular mobile telephony. Analyze the Integrated Services Digital Networks.	CLO 16	T1:9
48	Motivation for ISDN, new services. Classify the network and protocol architecture, transmission channels.	CLO 16	T1:9.1-9.2
49	Understand the user network interface, signaling, numbering and addressing.	CLO 16	T1:9.3-9.4
50	Apply the service characterization, interworking, Performance ISDN standards, broadband ISDN, voice data Integration.	CLO 16	T1:9.5-9.7 R2:3.9

XVII. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S.No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	Design of telephone switching system	Seminars	PO1	PS01
2	To improve the signaling techniques	Seminars / NPTEL	PO2	PS01
3	Design of transmission channels and new services	NPTEL	PO1	PS01

Prepared by:
Mr. U.Somanaidu, Assistant Professor

HOD, ECE