ALVA'S
Education Foundation®

ALVA'S INSTITUTE OF ENGINEERING &TECHNOLOGY

(Unit of Alva's Education Foundation (R), Moodbidri)

Shobhavana Campus, MIJAR-574225, Moodbidri, D.K., Karnataka, Affiliated to VTU, Belagavi

Approved by AICTE New Delhi. Recognized by Govt. of Karnataka.

Accredited with 'A+' grade by NAAC & NBA (ECE & CSE)

Electronics and Communication Engineering

A.Y 2023-24

Course Name: Digital Communication

Subject Code: 21EC51

Sem/Class: 5th sem A & B section

Faculty Details

Name	: Mrs. Vijetha T S
Qualification	: M.Tech
Department	: ECE
PhoneNumber	: 9964898933
EmailID	: tsvijetha@aiet.org.in
SpecimenSignature	:

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION OF THE INSTITUTE

Transformative education by pursuing excellence in engineering and management through enhancing skills to meet the evolving needs of the community

MISSION OF THE INSTITUTE

- **To bestow quality technical education to imbibe knowledge, creativity and ethos to students community.**
- **To include the best engineering practices through transformative education.**
- **To develop acknowledge able individual for a dynamic industrial scenario.**
- **To include research, entrepreneurial skills and human values in order to cater the needs of the society**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION OF THE DEPARTMENT

Centre of Excellence to Empower the young minds in the field of Electronics and Communication Engineering with research focus and skill development through Transformative Education catering to the needs of the Society.

MISSION OF THE DEPARTMENT

- **To create Learning Environment to enable the Students for Excellence in the field of Electronics and Communication Engineering.**
- **To Empower the Students with necessary Skills for Solving the Complex Technological Problems.**
- **To Inculcate Research Culture among Teaching-Learning Group by guiding them towards Research Activities to bridge the gap between Industry and Academia.**
- **By Imbibing the Students with Human Values andEthics through Transformative Education and make them Socially Responsible Professionals.**

The Program Outcomes are:

PO1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO2.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

PO3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PO4.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

PO5.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

PO6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12.Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

OGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: Understand and apply the principles of Electronics and Communication Engineering in various domains of Analog and Digital systems.

PSO2: Design and implement systems using the concepts of Electronics, Signal Processing, Embedded Systems and Semiconductor Technology.

PSO3: Apply modern Hardware and software tools to analyze and solve engineering problems.

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OGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1-KNOWLEDGE

Apply Mathematical, Scientific and Engineering skills for solving problems in the area of Electronics and Communication Engineering.

PEO2-EXPOSURE

Expose to Emerging Technologies and excel in Industries/Higher studies/research.

PEO3-SKILLS

Apply analytical skills in the area of Electronics and Communication Engineering to become competent and Employable.

PEO4-ATTITUDE

Inculcate professional ethics, human values, team work for solving engineering problems and contribute to societal needs.

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CALENDAR OF EVENTS (ODD SEMESTER 2023-24)
Department of Electronics & Communication Engineering

VISION

Centre of Excellence to Empower the young minds in the field of Electronics and Communication Engineering with research focus and skill development through Transformative Education catering to the needs of the Society.

MISSION

- To create Learning Environment to enable the Students for Excellence in the field of Electronics and Communication Engineering.
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- By Imbibing the Students with Human Values and Ethics through Transformative Education and make them Socially Responsible Professionals.

Week	Month	Days							Activities
		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
	SEP	11	12	13	14	15	16		11:Commencement Of VII Semester 15:Commencement of I Semester 28:EidMilad
		18	19	20	21	22	23		
		25	26	27	28	29	30		
	OCT								2 :GandhiJayanthi 14:MahalayaAmavasye 17: Internal Auditing 20 Technical Talk 1 23:Ayudhapooja 24 : Vijayadasami 25,26,27-: 1st IA for VII Sem 27th : Commencement of Internship for V sem
		2	3	4	5	6	7		
		9	10	11	12	13			
		16	17	18	19	20	21		
		23	24	25	26		28		
		30	31						
	NOV			1	2	3	4		1:KannadaRajyothsava 14:Balipadyami 15 : Commencement of III Semester 9,10,11-:1st IA for I Sem 21: Technical Talk 2 22:Industrial Visit 25: Internship ends for V sem 27: Commencement of classes for V semester
		6	7	8	9	10			
		13	14	15	16	17	18		
		20	21	22	23	24	25		
		27	28	29	30				
	DEC								1,2,4: 2nd IA for VII Sem 4: Technical Talk 3 19: Project Phase Presentation 25:Christmas 26,27,28:1st IAforIII Sem V Sem
		4	5	6	7	8	9		
		11	12	13	14	15	16		
		18	19	20	21	22	23		
		25	26	27	28	29	30		
	JAN-2024	1	2	3	4	5	6		1,2 3: 2nd IA for I Sem & 3rd IA for VII Sem 6:Last Working Day of I and VII Semester 2 - 14: Pre Placement training for V sem 24: Industrial Visit 14:Makar Sankranti 26:Republic Day 27,29,30:2nd IA for III Sem & VSem
		8	9	10	11	12	13		
		15	16	17	18	19	20		
		22	23	24	25	26			
		29	30	31					
	FEB-2024				1	2	3		15,16,17:3rd IA for III Sem 8: Technical talk 4 20:LastWorking Day of III Semester 27: Technical talk 5
		5	6	7	8	9	10		
		12	13	14	15	16	17	18	
		19	20	21	22	23	24	25	
		26	27	28	29				
	MAR-2024					1	2	3	2,4,5:3rd IA for VSem 8 :MahaShivaratri 9 :Last Working Day of V Semester
		4	5	6	7	8	9		

Electronics & Communication
Approved by IQAC Chairman/Principal
Alva's Institute of Engg. & Technology
Mijar, MOODBIDRI - 574 225

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CALENDAR OF EVENTS (ODD SEMESTER 2023-24) BE & MBA

VISION

"Transformative education by pursuing excellence in Engineering and Management through enhancing skills to meet the evolving needs of the community"

MISSION

- To bestow quality technical education to imbibe knowledge, creativity and ethos to students community.
- To inculcate the best engineering practices through transformative education.
- To develop a knowledgeable individual for a dynamic industrial scenario.
- To inculcate research, entrepreneurial skills and human values in order to cater the needs of the society.

Week	Month	Days							Activities
		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1	SEP					15	16	17	11 : Commencement of VII Semester 15 : Commencement of I Semester 29-30 : Student Mentoring 28 : Eid Milad 25 – 30 : Technical Talk/Club and Social Activity
2		18	19	20	21	22	23	24	
3		25	26	27	28	29	30		
6	OCT							1	2 : Gandhi Jayanthi 14 : Mahalaya Amavasye 23 : Ayudhapooja 24 : Vijayadasami 25, 26, 27 - : 1st IA for VII Sem 30-31 : Student Mentoring 25 – 31: Technical Talk/Club and Social Activity
7		2	3	4	5	6	7	8	
8		9	10	11	12	13	14	15	
9		16	17	18	19	20	21	22	
10		23	24	25	26	27	28	29	
11		30	31						
12	NOV			1	2	3	4	5	1 : Kannada Rajyothsava 14 : Balipadyami 15 : Commencement of III Semester 9, 10, 11 - : 1st IA for I Sem 29-30 – Student Mentoring 24– 30 Technical Talk/Club / Social Activity 25 : Commencement of V Semester
13		6	7	8	9	10	11	12	
14		13	14	15	16	17	18	19	
15		20	21	22	23	24	25	26	
16		27	28	29	30				
17	DEC					1	2	3	1: Commencement of III Semester MBA 1, 2, 4 : 2nd IA for VII Sem 12 : Industry Tour for III Sem MBA 25 : Christmas 26, 27, 28 : 1st IA for III Sem & V Sem 29-30 : Student Mentoring 25 - 30 : Technical Talk/Club / Social Activity
18		4	5	6	7	8	9	10	
19		11	12	13	14	15	16	17	
20		18	19	20	21	22	23	24	
21		25	26	27	28	29	30	31	
2	JAN-2024	1	2	3	4	5	6	7	1, 2 3 : 2nd IA for I Sem & 3rd IA for VII Sem 10, 11, 12 : 1st IA for III Sem MBA 14 : Makar Sankranti 26 : Republic Day 27, 29, 30 : 2nd IA for III Sem & V Sem 6 : Last Working Day of I and VII Semester 30-31 : Student Mentoring 25 - 31 : Technical Talk/Club / Social Activity
3		8	9	10	11	12	13		
4		15	16	17	18	19	20	21	
5		22	23	24	25	26	27	28	
		29	30	31					
	FEB-2024				1	2	3	4	15, 16, 17 : 3rd IA for III Sem 20 : Last Working Day of III Semester 21, 22, 24 : 2nd IA for III Sem MBA 28-29 : Student Mentoring 23 - 29 : Technical Talk/Club / Social Activity
		5	6	7	8	9	10	11	
		12	13	14	15	16	17	18	
		19	20	21	22	23	24	25	
		26	27	28	29				
	MAR - 2024					1	2	3	2, 4, 5 : 3rd IA for V Sem 8 : Maha Shivaratri 9 : Last Working Day of V Semester
		4	5	6	7	8	9		

Approved by IQAC Chairman/Principal

5th
23-

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ

(ಎ ವಿ ಯು ಅಧಿನಿಯಮ ೧೯೯೪ ರ ಅಡಿಯಲ್ಲಿ ಕರ್ನಾಟಕ ಸರ್ಕಾರದಿಂದ ಸ್ಥಾಪಿತವಾದ ರಾಜ್ಯ ವಿಶ್ವವಿದ್ಯಾಲಯ)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

(State University of Government of Karnataka Established as per the VTU Act, 1994)
"JnanaSangama" Belagavi-590018, Karnataka, India

Prof. Dr. B. E. Rangaswamy, Ph.D.
REGISTRAR

Phone: (0831) 24981
Fax : (0831) 2405

REF: VTU/BGM/ACA/2023-24/ 3252

DATE: 30 SEP 20

NOTIFICATION

Subject: Tentative Academic Calendar of 1st semester of B.Sc(Hons) program, 3rd and 5th seme B.E./B.Tech. programs, 4th semester of MBA(IEV) program regarding...

Reference: Hon'ble Vice-Chancellor's approval dated: 30.09.2023

The tentative academic calendar concerned to 1st semester of B.Sc.(Hons) program, 3rd an semesters B.E./B.Tech. programs, 4th semester of MBA(IEV) program for academic year 2023-24 hereby notified as mentioned below;

	III semester B.E./B.Tech. (2022 scheme)	V semester B.E./ B.Tech. (2021 scheme)	I sem B.Sc(Hons)	IV semester MBA(IEV)*
Commencement of the Semester	25.10.2023	25.10.2023	03.10.2023	09.10.2023
Internship	----	25.10.2023 To 23.11.2023	---	----
Commencement of Classes	25.10.2023	25.11.2023	03.10.2023	09.10.2023
Last Working day of the Semester	10.02.2024	09.03.2024	25.01.2024	27.01.2024
Practical Examination/ Internship Viva Voce/ Project viva	12.02.2024 To 22.02.2024	11.03.2024 To 20.03.2024	29.01.2024 To 09.02.2024	01.02.2024 To 08.02.2024
Theory Examinations	26.02.2024 To 15.03.2024	22.03.2024 To 20.04.2024	12.02.2024 To 01.03.2024	
Commencement of NEXT Semester	18.03.2024	22.04.2024	04.03.2024	-----

*Students have to complete skill certification and Internship within this duration (09.10.2023 to 27.01.2024)

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TIMETABLE

w.e.f: 25/11/2023

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING.

(Accredited by NBA) (V3)

Academic Year	Scheme	Semester	Section	Class Coordinator	Room No
2023-24	2018	V	A	Dr. Ganesh V N	306

TIME / DAY	9.00 To 9.50	9.50 To 10.40	10.40 To 11.00	11.00 To 11.50	11.50 To 12.40	12.40 To 1.40	1.40 To 2.30	2.30 To 3.20	3.30 To 5.00
MON	APT(RS)	EM	TEA BREAK	RM	DC (VTS)	LUNCH BREAK	SOFT SKILL		COA
TUE	CIV	EM		RM	DC (BG)		COA	DC (VTS)	CCN
WED	APT(RS)	CCN		COA	EM		COMM LAB A1(PK+ DA) IOT LAB A2(GP)		
THU	DC (BG)	EM		DC (BG)	CCN		MENTORING	COA	SEMINAR(DVM) /EM-CC
FRI	CCN	EM		SOFT SKILL			COMM LAB A2(NP+DA) IOT LAB A1(GP)		
SAT	CCN	APTI-TEST-(Sudha)		DC (VTS)	COA				

Allocation of Courses

Course Code	Course Initial	Course Title	Name of the Faculty	Faculty Initial
18EC51	DC	Digital Communication	Mrs. Vijetha T S/ Mrs.Bhagyashree K	VTS +BG
18EC52	ARM	Computer Organization & ARM Microcontroller	Dr. Guruprasadh / Dr. Pradeep Kumar	GP+PK
18EC53	CCN	Computer Communication Networks	Dr. Ganesh V N	GVN
18EC54	EM	Electromagnetic Waves	Mrs. Vijetha T S	VTS
18ECL55	Comm-Lab	Communication Lab -II	Dr. Pradeep Kumar +Mr.Nepolean Ms. Diana	PK+NP+ DA
18EC56	RM	Research Methodology & Intellectual property Rights	Dr. Ganesh V N	GVN
18CIV57	CIV	Environmental Studies	Dr. Umesh Chandra	UC
18EC581	IOT-LAB	IoT (Internet of Things) Lab	Dr. Guruprasadh	GP

Siddesh

Timetable Coordinator | HOD. Dept. Of Electronics & Communication | Dean Academics | Principal

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TIMETABLE

w.e.f: 25/11/2023

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING.

(Accredited by NBA) (V3)

Academic Year	Scheme	Semester	Section	Class Coordinator	Room No
2023-24	2018	V	B	Dr. Roshan Shetty	304

TIME / DAY	9.00 To 9.50	9.50 To 10.40	10.40 To 11.00	11.00 To 11.50	11.50 To 12.40	12.40 To 1.40	1.40 To 2.30	2.30 To 3.20	3.30 To 5.00
MON	CCN	COMM LAB B1(SKV+ DA) IOT LAB B2(GP)				LUNCH BREAK	RM	EM	SOFT SKILL
TUE	COA	CCN	TEA BREAK	COA	EM		CCN	DC (BG)	APT (RS)
WED	COA	EM		CCN	MENTOR ING		CCN	DC (VTS)	DC (BG)
THU	CIV	COMM LAB B2(SKV +DA) IOT LAB B1(GP)					EM	CCN	SEMINAR(DVM) /EM-CC
FRI	APT (RS)	COA	TEA BREAK	COA	EM		SOFT SKILL		DC (VTS)
SAT	DC (BG)	APTI-TEST-(MAHESH Rao)		RM	DC (VTS)				

Allocation of Courses

Course Code	Course Initial	Course Title	Name of the Faculty	Faculty Initial
21EC51	DC	Digital Communication	Mrs. Vijetha T S/ Mrs.Bhagyashree K	VTS +BG
21EC52	ARM	Computer Organization & ARM Microcontroller	Dr. Guruprasadh / Dr. Pradeep Kumar	GP+PK
21EC53	CCN	Computer Communication Networks	Dr. Ganesh V N	GVN
21EC54	EM	Electromagnetic Waves	Mrs. Vijetha T S	VTS
21ECL55	Comm-Lab	Communication Lab -II	Mr. Siddamal K V + Ms. Diana	SKV+ DA
21EC56	RM	Research Methodology & Intellectual property Rights	Dr. Ganesh V N	GVN
21CIV57	CIV	Environmental Studies	Dr. Umesh Chandra	UC
21EC581	IOT-LAB	IoT (Internet of Things) Lab	Dr. Guruprasadh	GP

Siddesh

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Phone: 08258-262725, Fax: 08258-262726
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Faculty Personal Time Table

Mrs. Vijetha T S

Designation: Assistant Professor

Academic Year: 2023-24

Effective form: 27/11/2023 (V3)

	9.00 To 9.50	9.50 To 10.40	10.40 To 11.00	11.00 To 11.50	11.50 To 12.40	12.40 To 1.40	1.40 To 2.30	2.30 To 3.20	3.30 To 5.00
MON		EM-5A	TEA BREAK		DC-5A	LUNCH BREAK		EM-5B	
TUE		EM-5A			EM-5B			DC-5A	
WED		EM-5B			EM-5A			DC-5B	MENTORING-7TH
THU		EM-5A					EM-5B		EM-CC
FRI		EM-5A			EM-5B				DC-5B
SAT				DC-5A	DC-5B				

Theory Work Load (Units)	Lab Work Load (Units)	ACTIVITY	Total (Units)

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Ph: 08258-262725; Mob:7022262724,7026262725,mail:principalaiet08@gmail.com

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Academic Year 2023-24

5th Semester 'A' Section

#	USN	Student Name
1	4AL21EC001	A. S. Pavithra
2	4AL21EC002	Abhishek S
3	4AL21EC003	Akash A H
4	4AL21EC005	Akshay Kumar H
5	4AL21EC006	Amaresha M
6	4AL21EC007	Anchita
7	4AL21EC008	Anush S Amargol
8	4AL21EC009	B.Vennela
9	4AL21EC010	Basangouda Patil
10	4AL21EC011	Basavakiran
11	4AL21EC013	Bharath N
12	4AL21EC014	Bhaskar T
13	4AL21EC015	Bhavana.B
14	4AL21EC016	ChakravarthyJaipalTereda
15	4AL21EC018	Charan Raj R V
16	4AL21EC019	Chethan M
17	4AL21EC020	Chethan K.M
18	4AL21EC021	Chiranjeevi U B
19	4AL21EC022	Chithra L
20	4AL21EC023	Darshan T S
21	4AL21EC024	Darshana Basavaraj ✓
22	4AL21EC025	Deeksha S
23	4AL21EC026	Deekshith D Shetty
24	4AL21EC027	Diya
25	4AL21EC028	Gagan H S
26	4AL21EC029	Gowtham M A
27	4AL21EC030	Harshitha B S ✓
28	4AL21EC031	Hemanth R
29	4AL21EC032	Hemashri H N
30	4AL21EC033	HuriyaSanadi
31	4AL21EC034	Inchara S Shetty
32	4AL21EC035	Jeevan K G
33	4AL21EC036	Jeevan V
34	4AL21EC037	Kalmesh G Galigoudra
35	4AL21EC038	KaluvaChandrashekar
36	4AL21EC039	Keerthan S
37	4AL21EC040	Kiran Kashyap M
38	4AL21EC041	Kishor U
39	4AL21EC042	Lakshan ✓

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Year 2023-24

40	4AL21EC043	Lakshmi Keerthana B
41	4AL21EC044	Lekhan T
42	4AL21EC045	Madugonde Sandeep
43	4AL21EC046	Mahantesh
44	4AL21EC047	Mailaragouda N P
45	4AL21EC049	Manupriya Y
46	4AL21EC050	Meghana L
47	4AL21EC051	Mohammed Iqbal
48	4AL21EC052	Muhammad Razi
49	4AL21EC053	Nagabhushan H K
50	4AL21EC054	Naveen Kumar H S
51	4AL21EC062	Prajwal S Das
52	4AL21EC068	Ramya R
53	4AL21EC104	Vaishnavi S
54	4AL22EC400	Abhishek P T
55	4AL22EC401	Chethana A B
56	4AL22EC402	Chetan G Kur Gouda
57	4AL22EC403	Lakshmi P B
58	4AL22EC405	Pallavi B
59	4AL22EC406	Shamshuddin
60	4AL22EC407	Suhani R J
61	4AL22EC408	Veeresh S V

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Academic Year 2023-24

5th Semester 'B' Section

#	USN	Student Name
1	4AL21EC056	Nivedita T Patil ✓
2	4AL21EC057	Prajyot Rajgonda Patil
3	4AL21EC058	Pavan
4	4AL21EC059	Pooja Venkatesh Naik
5	4AL21EC060	Prajwal L R
6	4AL21EC061	Prajwal Malabagi
7	4AL21EC063	Prakruthi K P
8	4AL21EC064	Prasanna Kumar B I ✓
9	4AL21EC065	Rakesh
10	4AL21EC066	Raksha
11	4AL21EC067	Rakshith ✓
12	4AL21EC069	Ravi Kovi
13	4AL21EC070	Sahana
14	4AL21EC071	Saikumar
15	4AL21EC073	Sanjana Shrikant Havanoor ✓
16	4AL21EC074	Santhosha A S
17	4AL21EC076	Shashank C Soppannavar
18	4AL21EC077	Shashank Swami
19	4AL21EC078	Shashank Viresh Shetti
20	4AL21EC079	Shivakumar K V
21	4AL21EC080	Shravya Shetty
22	4AL21EC081	Shreya Chandrahasa Shetty ✓
23	4AL21EC082	Shreya K R
24	4AL21EC083	Shreyas S Naik
25	4AL21EC084	Shruthi
26	4AL21EC085	Siddharoodh B Durgipujeri
27	4AL21EC086	Sinchana C K
28	4AL21EC087	Sinchana R
29	4AL21EC088	Sinchana RD
30	4AL21EC089	Sinchana.S.D
31	4AL21EC090	Sindhu KS
32	4AL21EC091	Sindhu S Patil
33	4AL21EC092	Sonali

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Year 2023-24

34	4AL21EC093	Srishti S Shetty
35	4AL21EC094	Suma K G
36	4AL21EC095	Sumith N
37	4AL21EC096	Sushrutha N
38	4AL21EC097	Tanishka
39	4AL21EC098	Tej Ashok
40	4AL21EC099	Thejas J Kotian
41	4AL21EC100	Thejashwi P Acharya
42	4AL21EC101	Thrisha P Hegde
43	4AL21EC102	Usha Rani.N
44	4AL21EC103	V Venkta Sainihith Mullapudi
45	4AL21EC105	Vaishnavi Vithal Naik
46	4AL21EC106	Varshini Shetty
47	4AL21EC107	Varun Kumar R
48	4AL21EC108	Varun Devaramani
49	4AL21EC109	Veena Basavaraj
50	4AL21EC110	Videesh D Shetty
51	4AL21EC111	Vishal
52	4AL21EC112	Vishwanath HB
53	4AL21EC113	Yashaswini T R
54	4AL21EC114	Yashwanth GT
55	4AL21EC115	Yogeshwar M
56	4AL20EC009	C. Navajeevan
57	4AL22EC404	Navaneeth ✓

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

V Semester

Digital Communication			
Course Code	21EC51	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
- Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Understand the principles of spread spectrum communications.
- Understand the basic principles of information theory and various source coding techniques.
- Build a comprehensive knowledge about various Source and Channel Coding techniques.
- Discuss the different types of errors and error detection and controlling codes used in the communication channel.
- Understand the concepts of convolution codes and analyze the code words using time domain and transform domain approach.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby PSUs such as BHEL, BEL, ISRO, etc., and small-scale communication industries.
3. Show Video/animation films to explain the functioning of various modulation techniques, Channel, and source coding.
4. Encourage collaborative (Group) Learning in the class
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize & analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-ary PSK, M-ary QAM. Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability. Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation).

Teaching-Learning Process	Chalk and talk method, Simulation of modulation techniques, Power Point Presentation, YouTube videos Animation of BPSK, QPSK, BFSK and DPSK. Problems on Generation and detection of DPSK, QPSK. **Self-study topic**: Minimum shift keying and Non-coherent BFSK **RBT Level:** L1, L2, L3

Module-2	
Signalling Communication through Band Limited AWGN Channels: **Signalling over AWGN Channels**- Introduction, Geometric representation of signals, Gram- Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel (without statistical characterization), Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver. **Signal design for Band limited Channels**: Design of band limited signals for zero ISI-The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Symbol-by-Symbol detection of data with controlled ISI.	
Teaching-Learning Process	Chalk & talk method, PowerPoint Presentation, YouTube videos **Self-study topics**: Maximum Likelihood detection, Channel equalization **RBT Level:** L1, L2, L3
Module-3	
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95.	
Teaching-Learning Process	Chalk & talk method, Seminar about security issues in communication systems **RBT Level:** L1, L2, L3
Module-4	
Introduction to Information Theory: Measure of information, Average information content of symbols in long independent sequences. **Source Coding:** Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon-Fano Encoding Algorithm, Huffman coding. **Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes.	
Teaching-Learning Process	Chalk and talk method, Problems on source coding, error control codes **RBT Level:** L1, L2, L3
Module-5	
Linear Block Codes: Matrix description of Linear Block Codes, Error Detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array. **Convolution codes:** Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram.	
Teaching-Learning Process	Chalk and talk method, Animation of convolution encoders **RBT Level:** L1, L2, L3
Course outcomes (Course Skill Set) At the end of the course the student will be able to: 1. Analyze different digital modulation techniques and choose the appropriate modulation technique for the given specifications. 2. Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels. 3. Differentiate various spread spectrum schemes and compute the performance parameters of communication system. 4. Apply the fundamentals of information theory and perform source coding for given message 5. Apply different encoding and decoding techniques with error Detection and Correction.	
Assessment Details (both CIE and SEE)	

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
3. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
4. Hari Bhat, Ganesh Rao, "Information Theory and Coding", Cengage, 2017.
5. Todd K Moon, "Error Correction Coding", Wiley Std. Edition, 2006.

Reference Books:

1. Bernard Sklar, "Digital Communications – Fundamentals and Applications", Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
2. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/108102096

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic year : 2023-24

SEMESTER – 5TH 'A' & 'B' | **Scheme - 2021**

Course Code: 21EC51 | **Course Name: DIGITAL COMMUNICATION**

Course Teacher: PROF.VIJETHA T S

Course Outcomes: After studying this course, students will be able to,

CO Numbers	Course Outcomes	Blooms Level	Target Level
21EC51.1	Explain different digital modulation schemes, and compare advantages/ Disadvantages of each as applied to baseband signal. Ability to simulate modulation techniques in communication systems using modern tool.	3,4	2
21EC51.2	Analyze receivers such as Correlation and matched filters and also Make use of adaptive equalization techniques in band limited channels to control the Inter Symbol Interference (ISI),	3,4	2
21EC51.3	Analyze and Simulate Performance of different spread spectrum techniques in communication system.	3,4	2
21EC51.4	Apply the fundamentals of information theory and perform source coding for given message.	3,4	2
21EC51.5	Apply different encoding and decoding techniques with error Detection and correction	3,4	2

CO/PSO Mapping Matrix:

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
21EC51.1	2	2	2	2	2								2	2	2
21EC51.2	2	3	2	2									2	2	
21EC51.3	2	3	2	2	2	2							2	2	2
21EC51.4	2	2	2	2		2							2	2	
21EC51.5	2	2	2	2	2	2							2	2	2
SUM	10	10	10	10	6	6							10	10	6
Average	2	2	2	2	2	2							2	2	2

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

tification of Course Outcome and Program Outcome mapping:

CO	POs	Level	Justification
EC51.1	1,PSO1	2	Digital communications main modulations and demodulations are the basic engineering knowledge.
	2,PSO2	2	The modulation problems are analysing based on the BER
	3	2	The receiver circuit is designed based on the transmitter.
	4	2	The Applications of the modulation techniques to solve some complex problems.
	5,PSO3	2	Some modulation techniques are implemented using as Mat lab
EC51.2	1,PSO1	2	The basic mathematic equations and its application parts are used for design the receiver.
	2,PSO2	3	Receiver analysis is full of derivations and the problems
	3	2	The receiver design is done.
	4	2	Designing a communication receiver part and its analysis which include solving the complex problems
1EC51.3	1,PSO1	2	Different spread spectrum techniques analysis require the mathematical knowledge
	2,PSO2	3	Different spread spectrum techniques analysis and comparisons
	3	2	Using PN codes spread spectrum design can be done
	4	2	Spreading the signal can analyze which include solving the complex problems
	5, PSO3	2	By using this students can design the spread spectrum model using Mat lab
	6	2	Spread spectrum technique protect the signal from unwanted noises
1EC51.4	1,PSO1	2	To do the coding basic engineering knowledge is required
	2,PSO2	2	Error control coding requires the problem analysis
	3	2	Through different coding techniques the problems can be solved
	4	2	Complex problems can be solved using different coding techniques.
	6	2	The signal protection can be done by coding
1EC51.5	1,PSO1	2	To do the coding basic engineering knowledge is required
	2,PSO2	2	Error control coding requires the problem analysis
	3	2	Through different coding techniques the problems can be solved
	4	2	Complex problems can be solved using different coding techniques.
	5,PSO3	2	By using this students can design the encoding and decoding model using Mat lab
	6	2	The signal protection can be done by coding

Course Teacher Signature

Siddesh

IQAC Member Signature

Dept. of Electronics & Communication
Alva's Institute of Engg. & Technology
Mijar MOODBIDRI 574 225

USN

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Department of Electronics & Communication Engineering

Continuous Internal Evaluation Test-I

Academic Year 2023-24

Course Title: Digital Communication		**Course Code:21EC51**
Date: 02/01/2024	**Time: 3.00PM to 4.30 PM**	**Semester: 5th 'A' & 'B' Sec**
Faculty Incharge: Prof. Vijetha T.S & Prof. Bhagyashree K		**Max. Marks: 20**

Note: Answer ONE complete question from each Part.

Q. No.		Questions	Marks	COs	BTL
		MODULE - 1			
1	a)	Derive the probability of error of BFSK technique	5	1	L2
	b)	Explain the generation and detection of DPSK	5	1	L2
		OR			
2	a)	Explain the generation and detection of QPSK	5	1	L2
	b)	Derive the probability of error of BPSK technique	5	1	L2
		MODULE - 4			
3	a)	Derive the expression for average information contents of symbols in long independent sequence.	5	4	L2
	b)	A zero memory source has a source alphabet $S = \{S_1, S_2, S_3\}$ with the probabilities of $P = \{1/2, 1/4 \text{ and } 1/4\}$. Find the entropy of the source. List all the elements for the 2nd extension of this source. Hence show $H(S^2) = 2H(S)$.	5	4	L2
		OR			
4	a)	Prove that entropy of Zero memory extension source is given by $H(S^n) = nH(S)$.	5	4	L2
	b)	In a facsimile transmission of picture, there are about 2.25×10^6 pixels frame. For a good reproduction 12 brightness levels are necessary. Assume all these levels are equally likely to occur. Find the rate of information if one picture is to be transmitted every 3 minutes. What is the source efficiency of this facsimile transmitter?	5	4	L2

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY, MOODBIDRI

Department of Electronics and Communication Engineering

Semester	5th	Internal Assessment	1

SCEHEME OF EVALUATION

26th December 2020

DIGITAL COMMUNICATION – 21EC51

Note: Answer any TWO full questions.

Q. NO.	Scheme of Evaluation	Marks	CO's
1a	Block Diagram of Coherent Receiver of BFSK	2	3
	* Let $x(t)$ be the received BFSK signal given by: $x(t) = s(t) + w(t)$ $x = \begin{cases} s_1(t) + w(t) & \text{if Symbol '1'} \\ s_2(t) + w(t) & \text{if Symbol '0'} \end{cases}$ Where $w(t)$ is Gaussian random variable with mean $(\mu) = 0$ & variance $(\sigma^2) = \frac{N_0}{2}$	2+2	
	* Let us consider the transmission of Symbol '1' then the received signal is $x(t) = s_1(t) + w(t)$ * The o/p of the top correlator is $x_1 = \int_0^{T_b} x(t)\,\phi_1(t)\,dt$ $x_1 = \int_0^{T_b} [s_1(t) + w(t)]\,\phi_1(t)\,dt$ $= \int_0^{T_b} s_1(t)\,\phi_1(t)\,dt + \int_0^{T_b} w(t)\,\phi_1(t)\,dt$ $x_1 = s_{11} + w_1$ $x_1 = \sqrt{E_b} + w_1 \rightarrow (1)$ * Mean is given by $E[x_1] = E[\sqrt{E_b} + w_1] = \sqrt{E_b} + 0$ $E[x_1] = \sqrt{E_b}$ * Variance of x_1 is $\text{var}[x_1] = \text{var}[\sqrt{E_b} + w_1] = 0 + \frac{N_0}{2}$ $\text{var}[x_1] = \frac{N_0}{2}$ * The o/p of the bottom correlator is $x_2 = \int_0^{T_b} x(t)\,\phi_2(t)\,dt$ $x_2 = \int_0^{T_b} [s_2(t) + w(t)]\,\phi_2(t)\,dt$ $x_2 = \int_0^{T_b} s_2(t)\,\phi_2(t)\,dt + \int_0^{T_b} w(t)\,\phi_2(t)\,dt$ $x_2 = s_{21} + w_2$ $x_2 = \sqrt{E_b} + w_2 \rightarrow (2)$ * The mean of x_2 is $E[x_2] = \sqrt{E_b}$ * The variance of x_2 is $\text{var}[x_2] = \frac{N_0}{2}$ * Let us find the mean & variance of random variable $z = x_1 - x_2$ in the question. Mean $E[z] = E[x_1] - E[x_2]$ $E[z] = \sqrt{E_b} - \sqrt{E_b}$ $E[z] = 0$ (* The variance of the random variable 'z' is independent of which binary Symbol was transmitted. Since the random variables x_1 & x_2 are Statistically independent their variance values equal to $N_0/2$.) * $\text{var}[z] = \text{var}[x_1] + \text{var}[x_2]$ $= \frac{N_0}{2} + \frac{N_0}{2}$ $\text{var}[z] = N_0$ * Conditional PDF when Symbol '0' transmitted is given by $f_z(z|0) = \frac{1}{\sqrt{2\pi\sigma^2}}\, e^{\frac{-(z-\mu)^2}{2\sigma^2}}$ $f_z(z|0) = \frac{1}{\sqrt{2\pi N_0}}\, e^{\frac{-(z+\sqrt{E_b})^2}{2N_0}}$ $f_z(z|0) = \frac{1}{\sqrt{2\pi N_0}}\, e^{\left[\frac{-(z+\sqrt{E_b})^2}{2N_0}\right]} \rightarrow (3)$ $\mu = -\sqrt{E_b}$ & $\sigma^2 = N_0$	2	

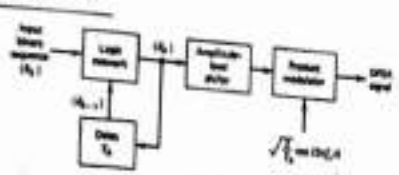
1b

Differential phase Shift Keying (DPSK) :-

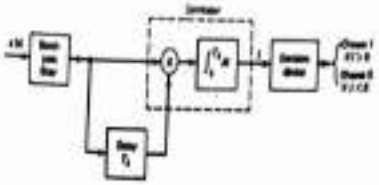
* DPSK eliminates the need for a coherent reference signal at the receiver by combining two basic operations at the transmitter :
  1) Differential encoding of the i/p binary wave &
  2) phase - Shift Keying
  hence the name DPSK.

* To Symbol '1', a cosine signal with 0° phase Shift is transmitted.
* To Symbol '0', a cosine signal with 180° phase Shift is transmitted.

DPSK Transmitter :-



DPSK Receiver :-



* The differential encoding process at the transmitter starts with an arbitrary bit, serving as reference, & thereafter the differential encoded sequence $\{d_k\}$ is generated by using the logic equation:

$$d_k = b_k \, d_{k-1} + \bar{b}_k \, \bar{d}_{k-1}$$

where b_k = the i/p binary digit at time kT_b &
d_{k-1} = the previous value of the differentially encoded digit.

(truth table)

a	b	y = a⊕b
0	0	1
0	1	0
1	0	0
1	1	1

* At the instant $t = T_b$, the received DPSK signal is passed through a BPF centered at the carrier frequency f_c.
* The BPF o/p is a delayed version of it ($t - T_b$) are applied to the Correlator.
* The o/p of the Correlator 'y' is proportional to the cosine of the difference between the carrier angle in the two Correlator i/p's.
* If $y > 0 \rightarrow$ receiver decides in favour of Symbol '1' i.e phase change lies between $-\pi/2$ & $+\pi/2$.
* If $y < 0 \rightarrow$ receiver decides in favour of Symbol '0' i.e phase change

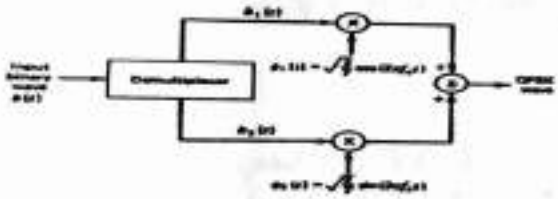
2

2

3

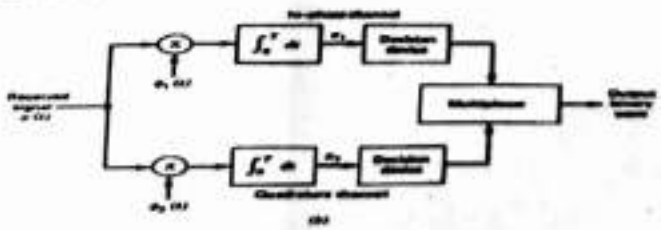
3a

BPSK Transmitter :-



* The i/p binary sequence b(t) represented in polar form is divided into odd $[b_1(t)]$ & even $[b_2(t)]$ numbered bits by using demultiplexer. They are denoted as $b_1(t)$ & $b_2(t)$.
* These two sequences, phase modulate two carrier signal of same frequency but quadrature in phase.
* Since each Symbol carries two bits, the signalling rate decreased. ∴ Bw required is half the bandwidth required compared to BPSK

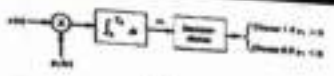
BPSK Receiver :-



4+4

3b

2+2+3



* Let $x(t)$ be the received signal

$$x(t) = s(t) + \omega(t) \longrightarrow (1)$$

$$x(t) = \begin{cases} s_1(t) = \sqrt{E_b}\,\phi_1(t) + \omega(t) & \text{, to Symbol '1'} \\ s_2(t) = -\sqrt{E_b}\,\phi_1(t) + \omega(t) & \text{, to Symbol '0'} \end{cases}$$

* Let us assume that the Symbol '0' is transmitted. Then the output of the correlator is

$$x_1 = \int_0^{T_b} x(t)\,\phi_1(t)\,dt = \int_0^{T_b} [s_2(t) + \omega(t)]\,\phi_1(t)\,dt$$

$$= \int_0^{T_b} s_2(t)\,\phi_1(t)\,dt + \int_0^{T_b} \omega(t)\,\phi_1(t)\,dt$$

$$\boxed{x_1 = -\sqrt{E_b} + w_1}$$

* Mean of the random variable x_1 is

$$E[x_1] = E\left[-\sqrt{E_b} + w_1\right] = E\left[-\sqrt{E_b}\right] + E[w_1] = -\sqrt{E_b} + 0$$

$$\boxed{E[x_1] = -\sqrt{E_b}}$$

* Variance of x_1 is

$$\mathrm{var}[x_1] = \mathrm{var}\left[-\sqrt{E_b} + w_1\right] = \mathrm{var}\left[-\sqrt{E_b}\right] + \mathrm{var}[w_1] = 0 + N_0/2$$

$$\boxed{\mathrm{var}[x_1] = N_0/2}$$

* Conditional PDF when Symbol '0' is transmitted is given by:

$$f_{x_1}(x_1/0) = \frac{1}{\sqrt{\pi N_0}} \cdot e^{-\left(\frac{x_1 + \sqrt{E_b}}{\sqrt{N_0}}\right)^2} \longrightarrow (2)$$

WKT Complementary error function

$$\mathrm{erfc}(u) = \frac{2}{\sqrt{\pi}} \int_u^{\infty} e^{-z^2}\,dz \longrightarrow (4)$$

From eq (4), we can write eq (3) as

$$\boxed{P_e(0) = \frac{1}{2}\,\mathrm{erfc}\left(\sqrt{\frac{E_b}{N_0}}\right)}$$

where $a = \sqrt{\frac{E_b}{N_0}}$

* Similarly we can calculate probability of error for 1st kind:

$$\boxed{P_e(1) = \frac{1}{2}\,\mathrm{erfc}\left(\sqrt{\frac{E_b}{N_0}}\right)}$$

Let probability of transmitting Symbol '0' is $P(0) = \frac{1}{2}$

Let probability of transmitting Symbol '1' is $P(1) = \frac{1}{2}$

* Then average probability of error

$$P_e = P(0)\,P_e(0) + P(1)\,P_e(1)$$

$$P_e = \frac{1}{2}\left[\frac{1}{2}\,\mathrm{erfc}\left(\sqrt{\frac{E_b}{N_0}}\right)\right] + \frac{1}{2}\left[\frac{1}{2}\,\mathrm{erfc}\left(\sqrt{\frac{E_b}{N_0}}\right)\right]$$

$$\boxed{P_e = \frac{1}{2}\,\mathrm{erfc}\left(\sqrt{\frac{E_b}{N_0}}\right)}$$

$$f_{x_1}(x_1/1) = \frac{1}{\sqrt{\pi N_0}} \cdot e^{-\frac{(x_1 - \sqrt{E_b})^2}{N_0}} \quad (e^2)$$

$$\boxed{f_{x_1}(x_1/1) = \frac{1}{\sqrt{\pi N_0}} \cdot e^{-\left[\frac{x_1 - \sqrt{E_b}}{\sqrt{N_0}}\right]^2}} \longrightarrow (3)$$

* Let $p_1(0)$ denote the conditional probability of deciding in favour of Symbol '1' when '0' is transmitted.

Region Z_2: $0 \le x_1 < +\infty$

$$\therefore p_1(0) = \int_0^{\infty} f_{x_1}(x_1/0)\,dx_1$$

$$p_1(0) = \frac{1}{\sqrt{\pi N_0}} \int_0^{\infty} e^{-\left[\frac{x_1 + \sqrt{E_b}}{\sqrt{N_0}}\right]^2} \cdot dx_1$$

Let $z = \frac{x_1 + \sqrt{E_b}}{\sqrt{N_0}}$

$$dz = \frac{dx_1}{\sqrt{N_0}} + 0$$

$$dx_1 = \sqrt{N_0}\,dz$$

Limits:

when $x_1 = 0$	when $x_1 = \infty$
$z = \frac{x_1 + \sqrt{E_b}}{\sqrt{N_0}}$	$z = \infty$
$z = \frac{0 + \sqrt{E_b}}{\sqrt{N_0}}$	
$z = \sqrt{\frac{E_b}{N_0}}$	

$$\therefore p_1(0) = \int_{\sqrt{E_b/N_0}}^{\infty} \frac{\sqrt{N_0}}{\sqrt{\pi N_0}}\,e^{-z^2}\,dz\,\sqrt{N_0} \longrightarrow (4)$$

$$= \frac{\sqrt{N_0}}{\sqrt{\pi}} \int_{\sqrt{E_b/N_0}}^{\infty} e^{-z^2} \cdot dz$$

$$p_1(0) = \frac{1}{\sqrt{\pi}} \cdot \frac{2}{2} \int_{\sqrt{E_b/N_0}}^{\infty} e^{-z^2}\,dz \longrightarrow (5)$$

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ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

(Unit of Alva's Education Foundation (R), Moodbidri)
Affiliated to Visvesvaraya Technological University, Belagavi & Approved by AICTE, New Delhi.
Recognized by Government of Karnataka.
A+, Accredited by NAAC & NBA (ECE & CSE)
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Department of Electronics & Communication Engineering

Continuous Internal Evaluation Test-I
Academic Year 2023-24

Course Title: Digital Communication		**Course Code:21EC51**
Date: 02/01/2024	**Time: 3.00PM to 4.30 PM**	**Semester: 5th 'A' & 'B' Sec**
Faculty Incharge: Prof. Vijetha T.S & Prof. Bhagyashree K		**Max. Marks: 20**

Note: Answer ONE complete question from each Part.

Q. No.		Questions	Marks	COs	BTL
		MODULE - 1			
1	a)	Derive the probability of error of BFSK technique	5	1	L2
	b)	Explain the generation and detection of DPSK	5	1	L2
		OR			
2	a)	Explain the generation and detection of QPSK	5	1	L2
	b)	Derive the probability of error of BPSK technique	5	1	L2
		MODULE - 4			
3	a)	Derive the expression for average information contents of symbols in long independent sequence.	5	4	L2
	b)	A zero memory source has a source alphabet $S = \{S_1, S_2, S_3\}$ with the probabilities of $P = \{1/2, 1/4 \text{ and } 1/4\}$. Find the entropy of the source. List all the elements for the 2nd extension of this source. Hence show $H(S^2) = 2H(S)$.	5	4	L2
		OR			
4	a)	Prove that entropy of Zero memory extension source is given by $H(S^n) = nH(S)$.	5	4	L2
	b)	In a facsimile transmission of picture, there are about 2.25×10^6 pixels frame. For a good reproduction 12 brightness levels are necessary. Assume all these levels are equally likely to occur. Find the rate of information if one picture is to be transmitted every 3 minutes. What is the source efficiency of this facsimile transmitter?	5	4	L2

evels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

CO	Course Outcomes
1	Explain different digital modulation schemes, and compare advantages/ Disadvantages of each as applied to baseband signal. Ability to simulate modulation techniques in communication systems using modern tool.
2	Analyze receivers such as Correlation and matched filters and also Make use of adaptive equalization techniques in band limited channels to control the Inter Symbol Interference (ISI),
3	Analyze and Simulate Performance of different spread spectrum techniques in communication system.
4	Apply the fundamentals of information theory and perform source coding for given message.
5	Apply different encoding and decoding techniques with error Detection and correction

Course Teacher
. Vijetha T S & Prof. Bhagyashree K

[Vijetha-TS]

(Bhagyashree K)

IQAC
Mr. Sudhakara

Siddesh

HOD
Dr. Siddesh G K
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Module - 4

1) → Considering a long source alphabet $S = \{s_1, s_2, \dots, s_q\}$ with probabilities $P = \{p_1, p_2, \dots, p_q\}$ respectively. 1M

→ Considering a long independent sequence of length L symbols

$p_1 L$ no of messages of type s_1,

$p_2 L$ " " " " " " s_2 1M

⋮

& $p_q L$ no of messages of type s_q

→ The self info of $s_1 = \log \frac{1}{p_1}$ bits.

∴ $p_1 L$ no of msgs of type s_1, contain $p_1 L \log \frac{1}{p_1}$ of information.

$p_2 L$ " " " " " " s_2, " $p_2 L \log \frac{1}{p_2}$ " "

⋮

$p_q L$ " " " " " " s_q, " $p_q L \log \frac{1}{p_q}$ " " 1M

→ Total self. info content of all these msg symbols is,

$$I_{total} = p_1 L \log \frac{1}{p_1} + p_2 L \log \frac{1}{p_2} + \dots + p_q L \log \frac{1}{p_q}$$

$$I_{total} = L\left[p_1 \log \frac{1}{p_1} + p_2 \log \frac{1}{p_2} + \dots + p_q \log \frac{1}{p_q}\right] \quad 1M$$

$$I_{total} = L \sum_{i=1}^{q} p_i \log \frac{1}{p_i}$$

∴ $$I_{total} = L \sum_{i=1}^{q} p_i \log \frac{1}{p_i}$$

$\therefore$ Average self information $= \frac{I_{total}}{L}$

$\therefore$ Avg self information $= \sum_{i=1}^{q} p_i \log \frac{1}{p_i}$ bits/msg Symbol

$\therefore$ Avg self information or Entropy $= \sum_{i=1}^{q} p_i \log \frac{1}{p_i}$ bits/msg Symbol

$\therefore H(S) = \sum_{i=1}^{q} p_i \log \frac{1}{p_i}$ bits/msg Symbol.

(3b) Basic Source with 3 Symbols. $P = \{1/2, 1/4, 1/4\}$

$$H(S) = \sum_{i=1}^{3} p_i \log 1/p_i$$

$$H(S) = \frac{1}{2}\log 2 + 2\left[\frac{1}{4}\log 4\right]$$

1M

$H(S) = 1.5$ bits/msg Symbol

2nd Extension.

$3^2 = 9$ Symbols.

$S_1S_2 = 1/2\,1/2 = 1/4$	$S_2S_1 = 1/8$	$S_3S_1 = 1/8$
$S_1S_2 = 1/8$	$S_2S_2 = 1/16$	$S_3S_2 = 1/16$
$S_1S_3 = 1/8$	$S_2S_3 = 1/16$	$S_3S_3 = 1/16$

2M

$$H(S^2) = \sum_{i=1}^{9} p_i \log \frac{1}{p_i}$$

$$H(S^2) = \frac{1}{4}\log 4 + 4\left[\frac{1}{8}\log 8\right] + 4\left[\frac{1}{16}\log 16\right]$$

1M

$H(S^2) = 0.5 + 0.5 + 1$

$H(S^2) = 3$ bits/msg Symbol

$H(S^2) = 2H(S) = 2(1.5) \Rightarrow H(S^2) = 3$ bits/msg symbol

1/2

$$p_1 + p_2 = 1 \rightarrow (1)$$

2nd Extension $2^2 = 4$

$S_1S_1 = p_1p_1 = p_1^2$; $S_2S_1 = p_2p_1$

$S_1S_2 = p_1p_2$; $S_2S_2 = p_2^2$

IM

Sum of all probabilities of 2nd Extension.

$$p_1^2 + p_1p_2 + p_1p_2 + p_2^2 = 1$$

$$p_1^2 + 2p_1p_2 + p_2^2 = 1$$

$$(p_1 + p_2)^2 = 1.$$

Entropy of basic binary source.

$$H(S) = \sum_{i=1}^{2} p_i \log \frac{1}{p_i}$$

IM

$$H(S) = p_1 \log \frac{1}{p_1} + p_2 \log \frac{1}{p_2} \rightarrow (2)$$

Entropy of 2nd Extension,

$$H(S^2) = \sum_{j=1}^{4} p_j \log \frac{1}{p_j}$$

$$\log \frac{1}{x^2} = 2 \log \frac{1}{x}$$

$$H(S^2) = p_1^2 \log \frac{1}{p_1^2} + p_1p_2 \log \frac{1}{p_1p_2} + p_1p_2 \log \frac{1}{p_1p_2} + p_2^2 \log \frac{1}{p_2^2}$$

$$= 2p_1^2 \log \frac{1}{p_1} + 2p_1p_2 \log \frac{1}{p_1p_2} + 2p_2^2 \log \frac{1}{p_2}$$

$$= 2p_1^2 \log \frac{1}{p_1} + 2p_1p_2 \log \frac{1}{p_1} + 2p_1p_2 \log \frac{1}{p_2} + 2p_2^2 \log \frac{1}{p_2}$$

$$= 2p_1(p_1 + p_2) \log \frac{1}{p_1} + 2p_2(p_1 + p_2) \log \frac{1}{p_2}$$

($p_1 + p_2 = 1$)

$H(S^2) = 2\left[p_1 \log\frac{1}{p_1} + p_2 \log\frac{1}{p_2}\right]$ (4)

$\boxed{H(S^2) = 2H(S)}$ 1M

2nd extension

$2^3 = 8$

$S_1S_1S_1 = p_1^3$	$S_2S_1S_1 = p_2p_1^2$
$S_1S_1S_2 = p_1^2p_2$	$S_2S_1S_2 = p_2p_2^2$
$S_1S_2S_1 = p_1^2p_2$	$S_2S_2S_1 = p_1p_2^2$
$S_1S_2S_2 = p_1p_2^2$	$S_2S_2S_2 = p_2^3$

Sum of all probabilities of 3rd Extension of the

$p_1^3 + 3p_1^2p_2 + 3p_1p_2^2 + p_2^3$

$= (p_1+p_2)^3 = (1)^3 = 1$

Entropy of the 3rd Extended source 1M

$\boxed{H(S^3) = 3H(S)}$

Generalizing 5M

$\boxed{H(S^n) = nH(S)}$

(4b) Total no of pixels in one frame $= 2.25\times10^6$ p

No of brightness levels $= 12$, $q = (12)^{2.25\times10^6}$ fo

$\Sigma = H(S)_{max} = \log_2 q = \log_2(12)^{2.25\times10^6} = 2.25\times$

$\Sigma = 8.066\times10^6$ bits/picture

Given, one picture is to be

Rate of transmission,

$$r_s = \frac{1}{3\ min} = \frac{1}{3 \times 60} = \frac{1}{180}\ \text{pictures/sec}$$ 1M

Average rate of information

$$R_s = r_s I$$

$$R_s = \frac{1}{3 \times 60} \times 8.066 \times 10^6$$ 1M

$$R_s = 44812\ \text{bits/sec}$$

Since the information transmitted is maximum,

$$\eta_s = \frac{H(s)}{H(s)_{max}} = \frac{H(s)_{max}}{H(s)_{max}} = 1 = 100\%$$ 1M

5M

(Bhagyashree.K)
(Faculty Incharge)

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ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

(Accredited by NAAC with A+ Grade)

Department of Electronics & Communication Engineering(Accredited by NBA)

Continuous Internal Evaluation Test –II..... AY 2023-24

urse Title : Digital Communication		Course Code: 21EC51
te: 09/02/2024	Time: 9.30 AM- 11.00 AM	Semester/Section: 5th A & B
culty: Prof. Vijetha T S & Prof. Bhagyashree K		Max. Marks: 30

te: Answer ONE FULL question from each Module.

No.	Questions	Marks	COs	BTL
	Module 3			
a)	Explain the Properties of PN sequences with example.	5	CO3	L2
b)	Explain the Fast FH-SS.	5	CO3	L2
	OR			
a)	Explain the DS-SS-BPSK.	5	CO3	L2
b)	Explain the CDMA-IS 95.	5	CO3	L2
	Module 4			
a)	Construct binary code for the following source using Shannon's binary encoding procedure. $S = \{ s_1, s_2, s_3, s_4, s_5\}$ $P = (0.4, 0.25, 0.15, 0.12, 0.08\}$	10	CO4	L2
	OR			
a)	Given the messages x1, x2, x3, x4, x5 and x6 with respective of probabilities of 0.4, 0.2, 0.2, 0.1, 0.07 and 0.03, construct a binary code by applying Huffman encoding procedure. Determine the efficiency and redundancy of the code so formed.	10	CO4	L2

ls of Bloom's Taxonomy

.	L1	L2	L3	L4	L5	L6
el	Remember	Understand	Apply	Analyze	Evaluate	Create

rse Outcomes

Explain different digital modulation schemes, and compare advantages/ Disadvantages of each as applied to baseband signal. Ability to simulate modulation techniques in communication systems using modern tool.
Analyze receivers such as Correlation and matched filters and also Make use of adaptive equalization techniques in band limited channels to control the Inter Symbol Interference (ISI),
Analyze and Simulate Performance of different spread spectrum techniques in communication system.
Apply the fundamentals of information theory and perform source coding for given message.
Apply different encoding and decoding techniques with error Detection and correction

. Vijetha T S/Mrs. Bhagyashree K

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Q.No	Scheme	Marks	CO's
3	Module – 4 Step 1 S_1 S_2 S_3 S_4 S_5 0.4 0.25 0.15 0.12 0.08 p_1 p_2 p_3 p_4 p_5 Step 2 $\alpha_1 = 0$; $\alpha_2 = 0.4$ $\alpha_3 = 0.4 + 0.25 = 0.65$ $\alpha_4 = 0.4 + 0.25 + 0.15 = 0.8$ $\alpha_5 = 0.4 + 0.25 + 0.15 + 0.12 = 0.92$ $\alpha_6 = 0.4 + 0.25 + 0.15 + 0.12 + 0.08 = 1$ Step 3 $2^{l_i} \geq \frac{1}{p_i}$ $\forall$ $i = 1, 2, 3, 4, 5$ $i = 1$; $2^{l_1} \geq \frac{1}{p_1}$ $l_1 = 2$ $i = 2$; $2^{l_2} \geq \frac{1}{p_2}$ $l_2 = 2$ $i = 3$; $2^{l_3} \geq \frac{1}{p_3}$ $l_3 = 3$ $i = 4$; $2^{l_4} \geq \frac{1}{p_4}$ $l_4 = 4$ $i = 5$; $2^{l_5} \geq \frac{1}{p_5}$ $l_5 = 4$.		

Step 4

$\alpha_1 = 0$

$\alpha_2 = (0.4)_{10}$

$0.4 \times 2 = 0.8$ with carry 0
$0.8 \times 2 = 0.6$ with carry 1
$0.6 \times 2 = 0.2$ with carry 1

$\alpha_2 = (0.011)_2$

$\alpha_3 = (0.65)_{10}$

$0.65 \times 2 = 0.3$ with carry 1
$0.3 \times 2 = 0.6$ with carry 0
$0.6 \times 2 = 0.2$ with carry 1

$\alpha_3 = (0.101)_2$

$\alpha_4 = (0.8)_{10}$

$0.8 \times 2 = 0.6$ with carry 1
$0.6 \times 2 = 0.2$ with carry 1
$0.2 \times 2 = 0.4$ with carry 0
$0.4 \times 2 = 0.8$ with carry 0

$\alpha_4 = (0.1100)_2$

$\alpha_5 = (0.92)_{10}$

$0.92 \times 2 = 0.84$ with carry
$0.84 \times 2 = 0.68$ with carry
$0.68 \times 2 = 0.36$ with carry
$0.36 \times 2 = 0.72$ with carry

$\alpha_5 = (0.1110)_2$

Step 5

SS	f_i	Code	l_i (bits)
S_1	0.4	00	2
S_2	0.25	01	2
S_3	0.15	101	3
S_4	0.12	1100	4
S_5	0.08	1110	4

4.

S.S	p_i	Code	Source s_a		Source s_b		Source s_c		Source s_d	
			p_i	Code	p_i	Code	p_i	Code	p_i	Code
x_1	0.4	1	0.4	1	0.4	1	0.4	1	0.6	0
x_2	0.2	01	0.2	01	0.2	01	0.4	00	0.4	1
x_3	0.2	000	0.2	000	0.2	000	0.2	01		
x_4	0.1	0010	0.1	0010	0.2	001				
x_5	0.07	00110	0.1	0011						
x_6	0.03	00111								

$$L = \sum_{i=1}^{6} p_i l_i = 2.3 \text{ bits/msg Symbol}$$

$$H(S) = \sum_{i=1}^{6} p_i \log \frac{1}{p_i} = 2.209 \text{ bits/msg Symbol}$$

$$\eta_c = \frac{H(S)}{L} = 96.04\%$$

$$L\eta_c = 2.96\%$$

Course Title: Electromagnetic Waves		
Date: 28/09/2024	Time: 9.30AM to 11.00AM	Semester: 5th SEM A & B Section
Faculty: Mrs. VIJETHA T S		Max. Marks: 20

Note: Answer ONE complete question from each Part.

Q.No.		Questions	Marks	COs	B
		PART-A			
1	a)	Derive the equation for potential at a point due to a Q charge, when the charge is at the Origin.	5	2	
	b)	Derive the point form of continuity equation.	5	2	
		OR			
2	a)	Define the Electric potential and electric field intensity. Obtain the relationship between them.	5	2	
	b)	Infinite number of charges each of QnC are placed along X axis at X= 1,2,4,8,..... ∞. Find the Electric potential and electric field intensity at a point X=0 due to all charges.	5	2	
		PART-B			
3	a)	Sate and Explain Ampere's Circuital Law differential form	5	3	
	b)	Explain the Magnetic Potential	5	3	
		OR			
4	a)	State and Prove Stokes' Theorem.	5	3	
	b)	State and Explain the Biot – Savarts law.	5	3	

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L
Level	Remember	Understand	Apply	Analyze	Evaluate	Cre

Course Outcomes

CO	Course Outcomes	T L
CO1	Apply differential equations, vector algebra, Integral multivariate calculus and complex calculus to solve for basics electrostatic, magneto static and electromagnetic field problems.	
CO2	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law	
CO3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Poisson's equations	
CO4	Calculate magnetic field, force, and potential energy with respect to magnetic materials	
CO5	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors and also Evaluate power associated with EM waves using Pointing theorem	

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Department of Electronics and Communication Engineering

Semester	5th	Internal Assessment	2

SCEHEME OF EVALUATION

09th February 2024

DIGITAL COMMUNICATION – 21EC51

Note: Answer any TWO full questions.

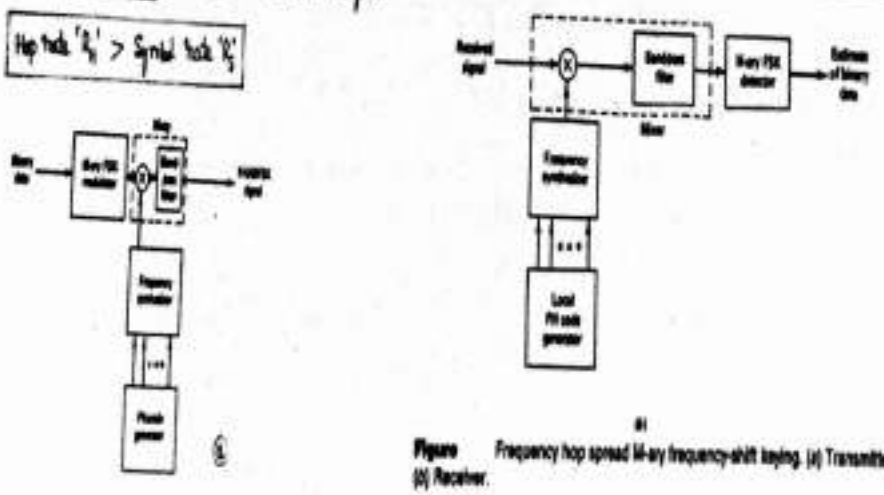
Q. NO.	Scheme of Evaluation	Marks	CO's
1a	Three Properties of PN sequence 1.Run 2.Balanced 3.Auto correlation with example	1+1+2+1	1
1b		2+2+1	

Figure Frequency hop spread M-ary frequency-shift keying. (a) Transmitter. (b) Receiver.

Model for analysis :-

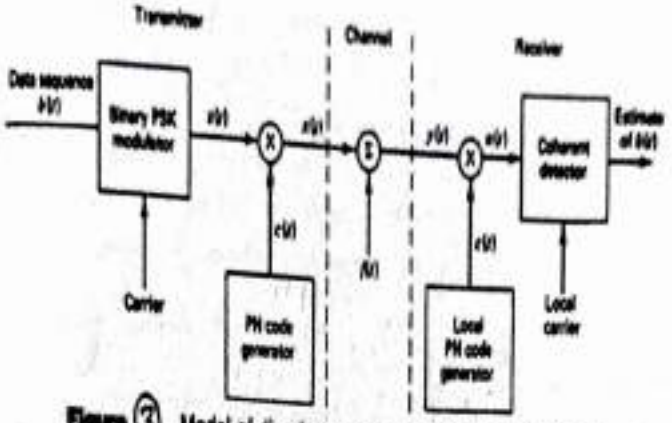


Figure ③ Model of direct-sequence spread binary PSK system.

Where,

$S(t)$ is the binary PSK signal &

$c(t)$ is the PN sequence.

* In the receiver, the received signal $y(t)$ is 1st multiplied by the PN sequence $c(t)$.

Thus $$u(t) = y(t).c(t) \longrightarrow ②$$

Substituting eq① in eq②, we get

$$u(t) = [c(t).S(t) + j(t)]\, c(t)$$

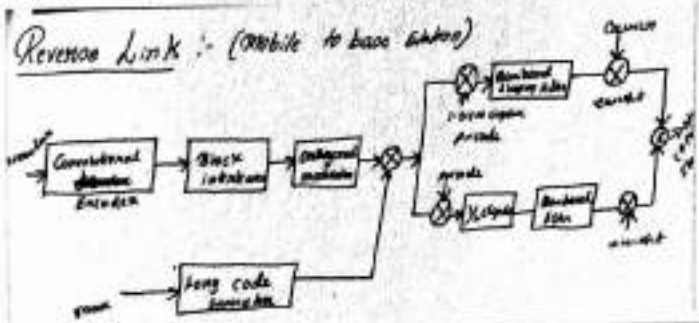
$$u(t) = c^2(t)\, S(t) + j(t).c(t) \qquad \because c^2(t) = 1$$

$$\boxed{u(t) = S(t) + c(t)\, j(t)}$$

2+2+1

b CDMA IS 95 BLOCK DIAGRAM AND EXPLANATION 2+2+1

Reverse Link :- (Mobile to base station)

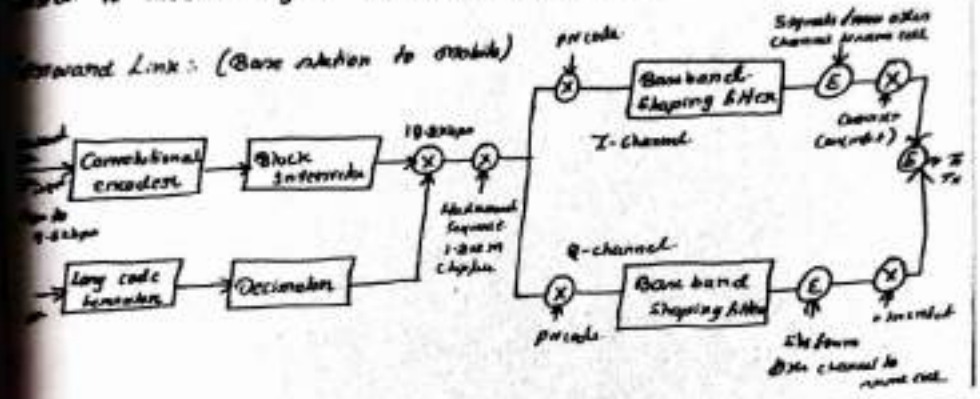


CDMA based on IS-95 (mobile Communication)

With the help of CDMA it is possible to transmit many IS-95 sig so that they can occupy same channel bandwidth. Each channel has its own PN sequence.

CDMA is used widely for voice communication. It is standardized as IS-95. It uses frequency band of 800MHz to 900MHz. The BW of 1.25MHz is used for transmission from base station to mobile. Again 1.25MHz is used on reverse link. R_c = 1.2288 Mcps

Forward Link: (Base station to mobile)



Step 4

$\alpha_1 = 0$

$\alpha_2 = (0.4)_{10}$

$0.4 \times 2 = 0.8$ with carry 0
$0.8 \times 2 = 0.6$ with carry 1
$0.6 \times 2 = 0.2$ with carry 1

$\alpha_2 = (0.011)_2$

$\alpha_3 = (0.65)_{10}$

$0.65 \times 2 = 0.3$ with carry 1
$0.3 \times 2 = 0.6$ with carry 0
$0.6 \times 2 = 0.2$ with carry 1

$\alpha_3 = (0.101)_2$

$\alpha_4 = (0.8)_{10}$

$0.8 \times 2 = 0.6$ with Carry 1
$0.6 \times 2 = 0.2$ with Carry 1
$0.2 \times 2 = 0.4$ with Carry 0
$0.4 \times 2 = 0.8$ with Carry 0

$\alpha_4 = (0.1100)_2$

$\alpha_5 = (0.92)_{10}$

$0.92 \times 2 = 0.84$ with Carry 1
$0.84 \times 2 = 0.68$ with Carry 1
$0.68 \times 2 = 0.36$ with Carry 1
$0.36 \times 2 = 0.72$ with Carry 0

$\alpha_5 = (0.1110)_2$

03

Step 5

S.S	p_i	Code	l_i (length)
S_1	0.4	00	2
S_2	0.25	01	2
S_3	0.15	101	3
S_4	0.12	1100	4
S_5	0.08	1110	4

01

(or)

S.S	p_i	Code	Source S_a p_i	Code	Source S_b p_i	Code	Source S_c p_i	Code	Source S_d p_i	Code
x_1	0.4	1	0.4	1	0.4	1	0.4	1	0.6	0
x_2	0.2	01	0.2	01	0.2	01	0.4	00	0.4	1
x_3	0.2	000	0.2	000	0.2	000	0.2	01		
x_4	0.1	0010	0.1	0010	0.2	001				
x_5	0.07	00110	0.1	0011						
x_6	0.03	00111								

$$L = \sum_{i=1}^{6} p_i l_i = 2.3 \text{ bits/msg Symbol}$$

$$H(S) = \sum_{i=1}^{6} p_i \log \frac{1}{p_i} = 2.209 \text{ bits/msg Symbol}$$

$$\eta_c = \frac{H(S)}{L} = 96.04\%$$

$$R_{\eta_c} = 2.96\%$$

USN | | | | | | | | | | |

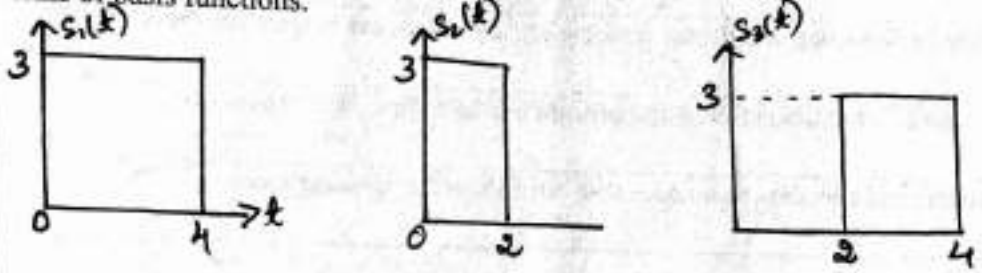
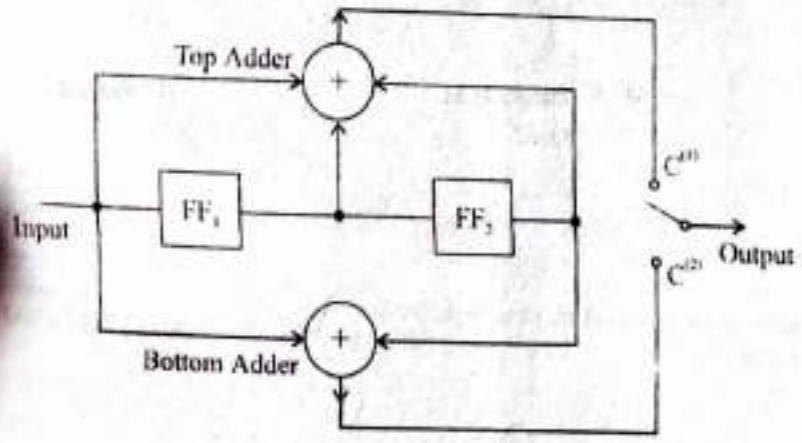
ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

(Accredited by NAAC with A+ Grade)

Department of Electronics & Communication Engineering(Accredited by NBA)

Continuous Internal Evaluation Test –III..... AY 2023-24

Title : **Digital Communication**		
2/03/2024	Time: 9.30 AM- 11.00 AM	Course Code: 21EC51
: Prof. Vijetha T S & Prof. Bhagyashree K		Semester/Section: 5th A & B section
Answer ONE FULL question from each Module.		Max. Marks: 30

	Questions	Marks	COs	BTL
	Module 2			
a)	State and prove the Properties of Matched filter	5	CO2	L2
b)	The binary data 011100101 is applied to the input of a matched duo binary system. **(i)** Construct the modified duo binary coder output and receiver output with Precoder. **(ii)** Due to error in transmission, the level produced by the 3rd digit is zero construct the new receiver output.	5 5	CO2	L2
	OR			
a)	Three signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ are shown in the below figure. Find the orthonormal basis functions for these signals and also express the signals in terms of basis functions. 	5	CO2	L2
b)	Explain the four techniques of Duo binary signalling	5	CO2	L2
	Module 5			
a)	Consider the binary convolutional encoder shown in figure.  **A (2, 1, 2) convolutional encoder** Draw the state table, state transition table, state diagram and the corresponding code tree. Using the code tree, find the sequence for the message 10111.	10	CO5	L2

OR

4	a)	For a systematic (7,4) Linear Block Code, the parity matrix P is given by, $[P] = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$ (i) Find all the possible code vectors. (ii) Draw the corresponding encoding circuit. (iii) A single error has occurred in each of these received vectors. Detect and correct those errors. (a) $R_A = [0111110]$ (b) $R_B = [1011100]$

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5
Level	Remember	Understand	Apply	Analyze	Evaluate

Course Outcomes

CO1	Explain different digital modulation schemes, and compare advantages/ Disadvantages of each baseband signal. Ability to simulate modulation techniques in communication systems using modern
CO2	Analyze receivers such as Correlation and matched filters and also Make use of adaptive equalizat in band limited channels to control the Inter Symbol Interference (ISI),
CO3	Analyze and Simulate Performance of different spread spectrum techniques in communication system.
CO4	Apply the fundamentals of information theory and perform source coding for given message.
CO5	Apply different encoding and decoding techniques with error Detection and correction

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY, MOODBIDRI

Department of Electronics and Communication Engineering

Semester	5th	Internal Assessment	3

SCEHEME OF EVALUATION

12th March 2024

DIGITAL COMMUNICATION – 21EC51

Note: Answer any TWO full questions.

Q. NO.	Scheme of Evaluation	Marks	CO's
1 (a)	Three properties of matched filter.		
	Property 1 :- $(SNR)_{max} = \frac{2E}{N_0}$		
	$\int_{-\infty}^{\infty} \lvert X(f)\rvert^2 . df = \int_{-\infty}^{\infty} x^2(t) . dt$	1M	
	Property 2 :- max sig component at $t = T$		
	$x_0(f) = X(f) H(f)$		2
	$H(f) = \frac{2x}{N_0} \lvert X(f)\rvert^* e^{-j2\pi fT}$		
	$x_0(t) = \int_{-\infty}^{\infty} \frac{2x}{N_0} \lvert X(f)\rvert^2 e^{j2\pi f(t-T)} . df$	2M	
	$x_0(T) = \frac{2x}{N_0} E$		
	Property 3:-		
	$x_0(t) = \frac{2x}{N_0} \int_{-\infty}^{\infty} y(f) e^{j2\pi f(t-T)} . df$	1M	

1 (b)

$b_x \rightarrow$ 0 1 1 1 0 0 1 0 1

$d_{x-1} \rightarrow$ 1 1 1 0 0 1 0 1 1

$d_x = b_x \oplus d_{x-1} \rightarrow$ 1 0 0 1 0 1 1 1 0 — 2m

$a_x \rightarrow$ +1 −1 −1 +1 −1 +1 +1 +1 −1

$c_x \rightarrow$ 0 −2 −2 +2 0 0 +2 0 −2

$b_x = 1$ if $|c_x| > 1$ — 1m

$b_x = 0$ if $|c_x| < 1$

with error

$c_x \rightarrow$ 0 2 0 2 0 0 2 0 2 — 2m

0 1 ⓪ 1 0 0 1 0 1 — 2

2 (a)

$E_{g_1} = 36$ $\quad \phi_1(t) = \begin{cases} 1/2 & 0 \le t \le 4 \\ 0 & t > 4 \end{cases}$ — 2m

$S_{21} = 3$

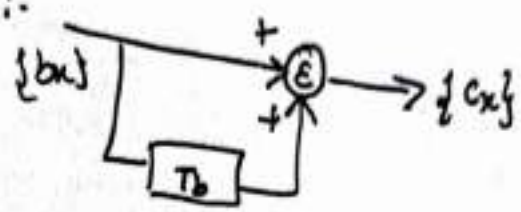
$g_2(t) = 3/2 \quad 0 \le t \le 2$ $\quad \phi_2(t) = \begin{cases} \frac{1}{\sqrt{2}} & \text{for } 0 \le t \le 2 \\ 0 & t > 2 \end{cases}$ — 2m

$S_1(i) = \phi_1(t) S_{11}$ $\quad S_2(t) = 3\phi_1(t) + \frac{3}{\sqrt{2}}\phi_2(t)$

$= 6\phi_1(t)$

$S_3(t) = 3\phi_1(t) - \frac{3}{\sqrt{2}}\phi_2(t)$ — 1M

(5) Duobinary Encoder :-



$$C_k = b_k + b_{k-1}$$

$$\hat{b_k} = c_k - b_{k-1}$$

1 M

Duobinary Encoder with Precoder

$$a_k = b_k + a_{k-1}$$

$$c_k = \begin{cases} \pm 2V & \text{if } b_k = 0 \\ 0 & \text{if } b_k = 1. \end{cases}$$

1 M

Modified Duobinary Encoder.

$$c_k = a_k - a_{k-2}$$

2 M

$$\hat{a_k} = c_k + \hat{a}_{k-2}$$

Modified Duobinary Encoder with Precoder

$b_k = 1$ if $|c_k| > 1$

$b_k = 0$ if $|c_k| < 1$

1 M

Siddesh
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ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY, MOODBIDRI

Department of Electronics and Communication Engineering

Semester | 5th Semester 'A' & 'B' Section | 12/03/2024

Continuous Internal Evaluation Test - III

SCEHEME OF EVALUATION

Digital Communication (21EC51)/ Module 5

Q. NO	Scheme of Evaluation	Marks	CO's

Module - 5

Step 1: State Table

State	S_0	S_1	S_2	S_3
Binary Description	00	10	01	11

01

Step 2: State Transition Table

$C^{(1)} = d_l + d_{l-1} + d_{l-2}$ for the top-adder

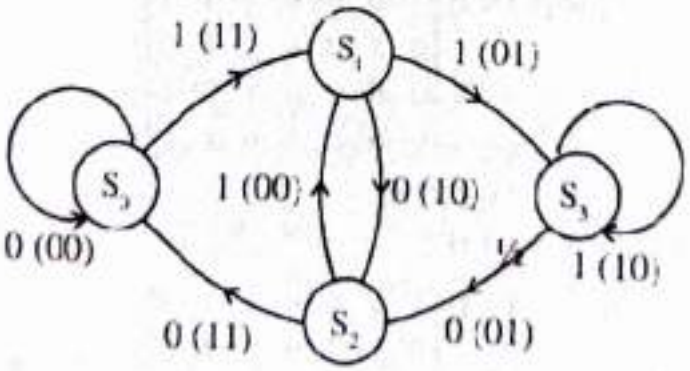
$C^{(2)} = d_l + d_{l-2}$ for the bottom-adder.

02

PRESENT STATE	BINARY DESCRIPTION	INPUT	NEXT STATE	BINARY DESCRIPTION	d_l	d_{l-1}	d_{l-2}	OUTPUT $C^{(1)}$	OUTPUT $C^{(2)}$
S_0	00	0	S_0	00	0	0	0	0	0
		1	S_1	10	1	0	0	1	1
S_1	10	0	S_2	01	0	1	0	1	0
		1	S_3	11	1	1	0	0	1
S_2	01	0	S_0	00	0	0	1	1	1
		1	S_1	10	1	0	1	0	0
S_3	11	0	S_2	01	0	1	1	0	1
		1	S_3	11	1	1	1	1	0

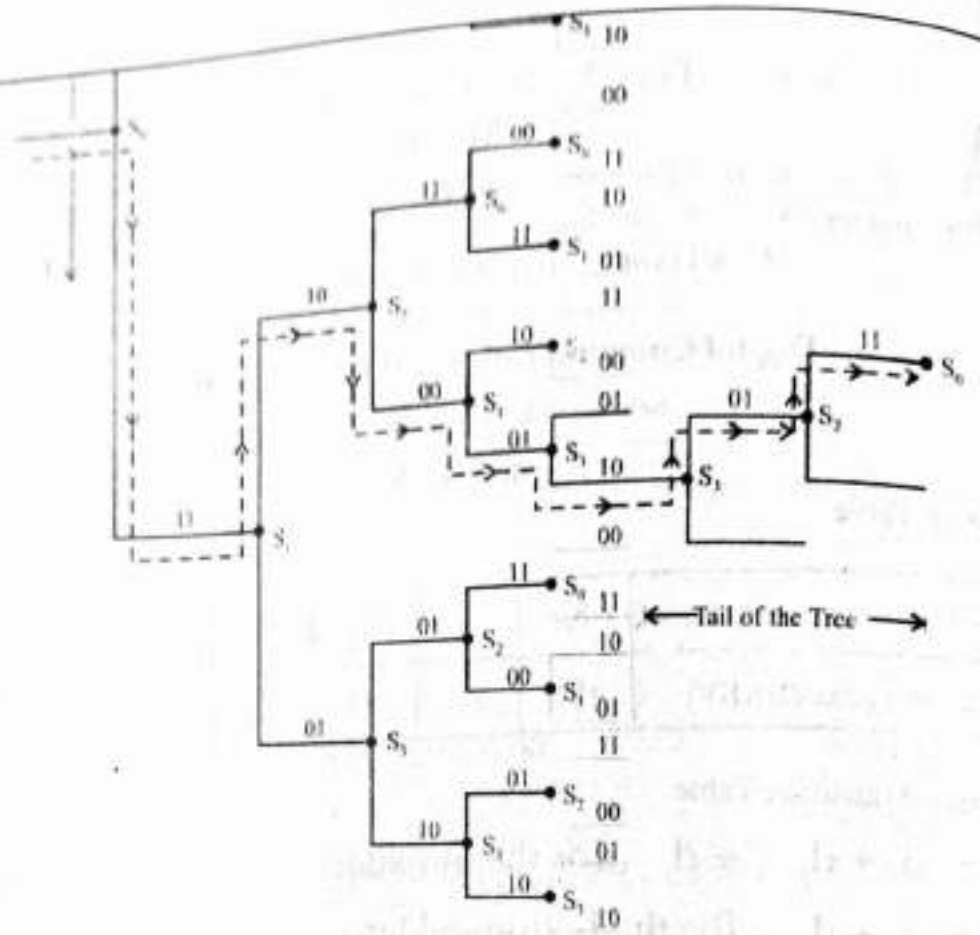
03

1



02

Code word = [11 10 00 01 10 01 11]



(i) The generator matrix [G] is given by equation (5.11) as

$$[G] = [I_4 \vdots P] = [I_4 \vdots P]$$

$$= \left[\begin{array}{cccc:ccc} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

Using equation (5.10), the code-vectors can be found as

$$[C] = [D][G]$$

As an example, let $D = [1\ 1\ 0\ 1]$

$$\therefore\ [C] = [1\ 1\ 0\ 1]\left[\begin{array}{ccccccc} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

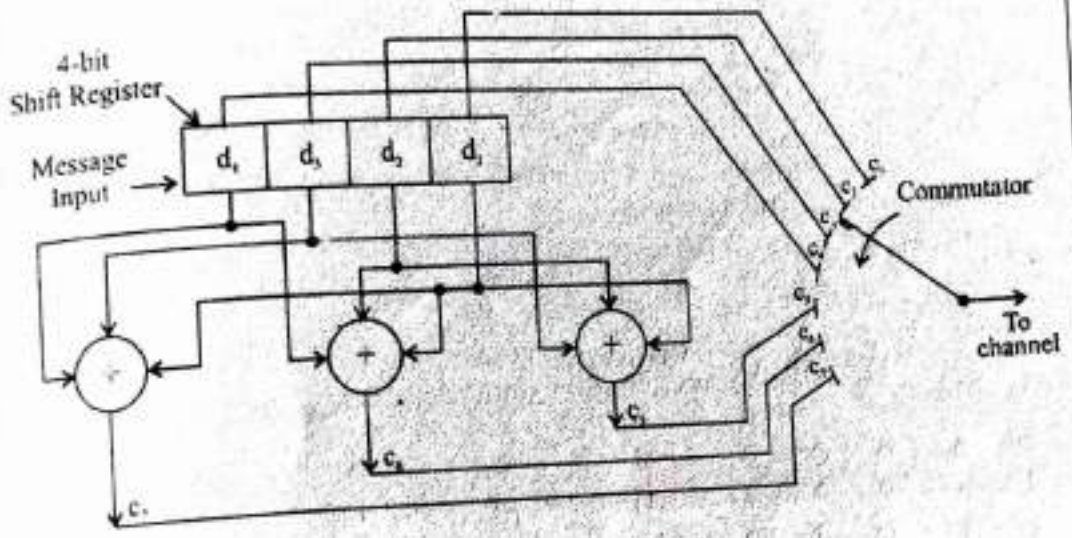
$$= [1\ 1\ 0\ 1\ 0\ 1\ 0]$$

For $D = [0\ 1\ 1\ 1]$

$$[C] = [0\ 1\ 1\ 1]\left[\begin{array}{ccccccc} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

$$= [0\ 1\ 1\ 1\ 0\ 0\ 0]$$

Message Vector (D)	Code-Vectors (C)	Message Vector (D)	Code-Vector (C)
0000	0000000	1000	1000111
0001	0001011	1001	1001100
0010	0010101	1010	1010010
0011	0011110	1011	1011001
0100	0100110	1100	1100001
0101	0101101	1101	1101010
0110	0110011	1110	1110100
0111	0111000	1111	1111111



$$[C] = [D][G] = [d_1\ d_2\ d_3\ d_4]\begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

$$\therefore \quad [C] = [d_1, d_2, d_3, d_4, (d_1+d_2+d_3), (d_1+d_2+d_4), (d_1+d_3+d_4)]$$

(a) Given $R_A = [0\,1\,1\,1\,1\,1\,0]$

The parity check matrix H is given by equation (5.14) as

$$H = \left[P^T \mid I_{n-k}\right] = \left[P^T \mid I_3\right]$$

$$= \left[\begin{array}{cccc|ccc} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{array}\right]$$

∴ The syndrome S_A is given by equation (5.22) as

$$S_A = R_A H^T$$

$$= [0\ 1\ 1\ 1\ 1\ 1\ 0] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = [1\ 1\ 0]$$

The syndrome is located in the second row of H^T matrix. Hence the 2nd bit counting from left is in error. The corresponding error-vector is then given by

$$E_A = [0\ 1\ 0\ 0\ 0\ 0\ 0]$$

The corrected code-vector which is the transmitted vector is given by

$$C_A = R_A + E_A = [0\ 1\ 1\ 1\ 1\ 1\ 0] + [0\ 1\ 0\ 0\ 0\ 0\ 0]$$

$= [0\ 0\ 1\ 1\ 1\ 1\ 0]$ which is the valid code-vector corresponding to the message vector 0011 as seen from table 5.4.

(b) Given $R_B = [1\ 0\ 1\ 1\ 1\ 0\ 0]$

$$\therefore S_B = R_B H$$

$$= [1\ 0\ 1\ 1\ 1\ 0\ 0] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$= [1\ 0\ 1]$ which is located in the 3rd row of H^T.

∴ The error vector $E_B = [0\ 0\ 1\ 0\ 0\ 0\ 0]$

The corrected code-vector $= C_B = R_B + E_B$

$= [1\ 0\ 1\ 1\ 1\ 0\ 0] + [0\ 0\ 1\ 0\ 0\ 0\ 0]$

$= [1\ 0\ 0\ 1\ 1\ 0\ 0]$

Prof. Vijetha T S/ Prof. Bhagyashree K
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ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY, MOODBIDRI

Department of Electronics and Communication Engineering

Semester	5th	Internal Assessment	3

SCEHEME OF EVALUATION

12th March 2024

DIGITAL COMMUNICATION – 21EC51

Note: *Answer any TWO full questions.*

Q. NO.	Scheme of Evaluation	Marks	CO's
1 (a)	Three properties of matched filter.		
	Property 1:- $(SNR)_{max} = \frac{2E}{N_0}$		
	$\int_{-\infty}^{\infty} \lvert X(f)\rvert^2 . df = \int_{-\infty}^{\infty} x^2(t) . dt$	1M	
	Property 2:- max sig component at $t = T$		
	$x_0(f) = X(f) H(f)$		2
	$H(f) = \frac{2k}{N_0} \lvert X(f)\rvert^* e^{-j2\pi fT}$		
	$x_0(t) = \int_{-\infty}^{\infty} \frac{2k}{N_0} \lvert X(f)\rvert^2 e^{j2\pi f(t-T)} . df$	2M	
	$x_0(T) = \frac{2k}{N_0} E$		
	Property 3:-		
	$x_0(t) = \frac{2k}{N_0} \int_{-\infty}^{\infty} \psi(f) e^{j2\pi f(t-T)} . df$	1M	

Alva's Institute of Engineering &Technology, Moodbidri

Department of Electronics & Communication Engineering

ASSIGNMENT - ODD Semester 2023-24

Course Title: **DIGITAL COOMUNICATION**

Semester: 5th SEM 'A' & B Section	Course Code: 21EC51
	Faculty: Mrs. VIJETHA T S

Module		Assignment 1	Marks	COs
	1.	Define the modulation technique. Explain the types of digital modulations scheme.		
	2.	Explain the transmitter and receiver of BFSK		
	3.	Explain the transmitter and receiver of BPSK.		
	4.	Explain the transmitter and receiver of DPSK		
	5.	Explain the transmitter and receiver of QPSK.		1
	6.	Obtain the Expression for probability of error in BFSK		
	7.	Obtain the Expression for probability of error in QPSK.		
	8.	Obtain the Expression for probability of error in BPSK.		
	9.	Explain the M-ary QAM		
	10.	Explain the M-ary BPSK		

Module		Assignment	Marks	CO
2	1	Write a note on AWGN	10	
	2	Explain the gram schimid orthogonalization procedure		
	3	Obtain the expression for signal energy and norm of a vector		
	4	Explain the optimum receiver using coherent detection		
	5	Explain the correlation receiver		
	6	Define the matched filter. State and prove the properties of matched filter		
	7	Derive the probability error equation for matched filter		
	8	Derive the Impulse response of matched filter		
	9	Explain the model analysis of ISI		
	10	Explain the four techniques of duo binary encoding		

Module		Assignment 3 MODULE 3	Marks
3	1	What is a spread spectrum	10
	2	What is the PN sequence? Explain its generation with example.	

3	Explain the properties of PN sequence		
4	Explain with block diagram the model of base band spread spectrum		
5	Explain with block diagram the model of DS-SS BPSK system		
6	What is Frequency hop SS? difference between Slow and fast FH-SS.		
7	Explain the slow FH-SS with Example.		
8	Explain the CDMA based on Is-95.		

SIGNMENT RUBICS

GRADE	MARKS
A	5
B	4
C	2
D	1
NOT SUBMITTED	0

Mat lab based assignment

Mini- project on digital modulation techniques	10	5

ASSIGNMENT RUBICS

RUBICS	MARKS
Submitted on time and answered all the questions	10
Submitted on time and not answered the questions	6
Submitted late	4
NOT SUBMITTED	0

Course Outcomes

CO	Course Outcomes	Target Level
CO1	Explain different digital modulation schemes, and compare advantages/ Disadvantages of each as applied to baseband signal. Ability to simulate modulation techniques in communication systems using modern tool.	2
CO2	Analyze receivers such as Correlation and matched filters and also Make use of adaptive equalization techniques in band limited channels to control the Inter Symbol Interference (ISI),	2
CO3	Analyze and Simulate Performance of different spread spectrum techniques in communication system.	2
CO4	Apply the fundamentals of information theory and perform source coding for given message.	2
CO5	Apply different encoding and decoding techniques with error Detection and correction	2

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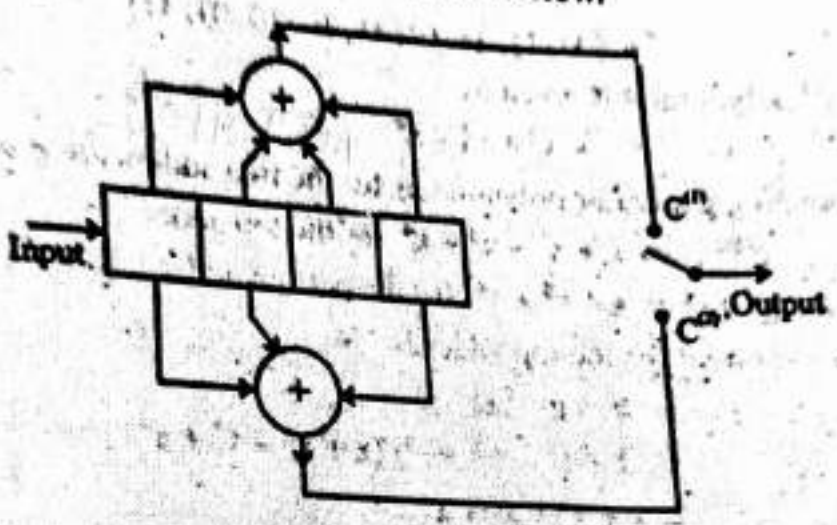
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ASSIGNMENT -1

Course Title: Digital Communication	Course Title: 21EC51
Date of Announcement: 04/02/2024	Semester: 5th 'A' & 'B'
Date of Submission: 28/02/2024	
Faculty Incharge: Mrs. Bhagyashree K	Max Marks: 10

#	Questions	COs
1	Consider a source with 8 alphabets A to H with respective probabilities of 0.22, 0.20, 0.18, 0.15, 0.10, 0.08, 0.05, 0.02. (a) Construct a binary compact (Huffman) code and determine the code efficiency. (b) Construct a ternary compact code and determine the code efficiency. (c) Construct a quaternary compact code and determine the code efficiency. Draw code trees for all the 3 cases.	4
2	For a systematic (7,4) Linear Block Code (LBC), the parity matrix P is given by $[P]=\begin{pmatrix}1&1&1\\1&1&0\\1&0&1\\0&1&1\end{pmatrix}$ (i) Find all possible valid code vectors. (ii) Draw the corresponding encoding circuit. (iii) A single error has occurred in each of these received vectors. Detect and correct those errors. (iv) Draw the syndrome calculation circuit. (a) R_A=[0111110] (b) R_B=[1011100] (c) R_C = [1010000]	5
3.	Consider the (3,1,2) convolutional code with $g^{(1)} = (1\,1\,0), g^{(2)} = (1\,0\,1)$ *and* $g^{(3)} = (1\,1\,1)$. (I) Draw the encoder block diagram. (ii) Find the generator matrix. (iii)Find the code – word corresponding to the information sequence (11101) using time domain and transform domain approach.	5

For the convolutional encoder shown in figure below.

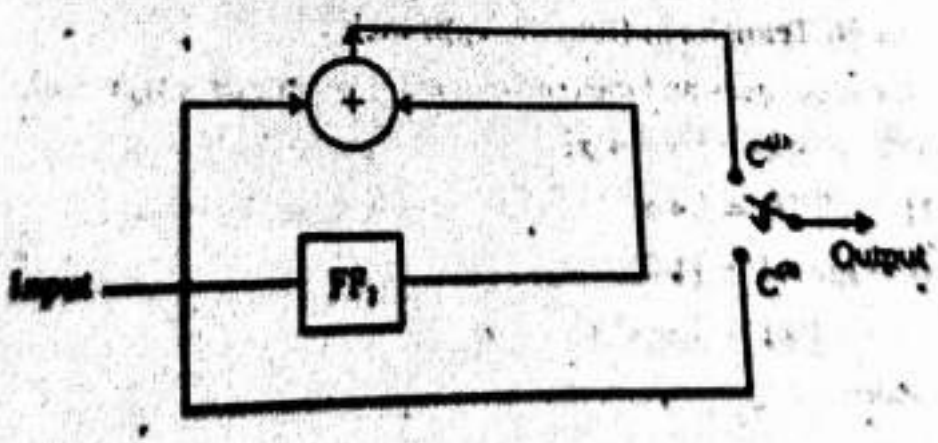


5

(i) Find the impulse response and hence calculate the output produced by the information sequence 10111.

(ii) Write the generator polynomials of the encoder and recomputed the output for the input of (i) and compare with that of (i).

Consider the convolutional encoder shown in figure below. The code is systematic.



5

(i) Draw the state diagram.

(ii) Draw the code tree.

(iii) Find the encoder output produced by the message sequence 10111.

(iv) Verify the output using time domain approach (matrix method).

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Department of Electronics and Communication Engineering

DC MINI-PROJECT 5th SEM B SECTION -2023-24

BATCH.No	USN	NAME	TOPIC
B1	4AL21EC066	Raksha	Encryption and Decryption technology
	4AL21EC063	Prakruthi K P	
	4AL21EC070	Sahana	
	4AL21EC091	Sindhu S Patil	
B2	4AL22EC404	Navaneeth	QPSK Modulation and Demodulation
	4AL21EC099	Thejas J Kotian	
	4AL21EC067	Rakshith	
B3	4AL21EC074	Santhosha A S	Simulation of FSK using Mat lab
	4AL21EC098	Tej Ashok	
	4AL21EC083	Shreyas S Naik	
	4AL21EC069	Ravi Kovi	
B4	4AL21EC059	Pooja Venkatesh Naik	Orthogonal frequency division multiplexing
	4AL21EC092	Sonali	
	4AL21EC093	Srishti S Shetty	
	4AL21EC106	Varshini Shetty	
B5	4AL21EC061	Prajwal Malabagi	Frequency hopping spread spectrum in wireless network
	4AL21EC079	Shivakumar K V	
	4AL21EC095	Sumith N	
B6	4AL21EC061	Prajwal Malabagi	FH-SS in Wireless Networks
	4AL21EC079	Shivakumar K V	

DC MINI-PROJECT 5th SEM B SECTION -2023-24

	4AL21EC095	Sanjana N	
B7	4AL21EC084	Shruthi	Physical layer security in wireless network
	4AL21EC088	Sinchana RD	
	4AL21EC090	Sindhu KS	
	4AL21EC102	Usha Rani.N	
B8	4AL21EC082	Shreya K R	Gram schmit orthogonalization procedure
	4AL21EC086	Sinchana C K	
	4AL21EC109	Veena Basavaraj Rachappanavar	
	4AL21EC113	Yashaswini T R	
B9	4AL20EC009	C. Navajeevan	Line code techniques
	4AL21EC071	Saikumar	
	4AL21EC085	Siddharoodh B Durgipujeri	
	4AL21EC103	V Venkta Sainihith Mullapudi	
B10	4AL21EC101	Thrisha P Hegde	Hilbert transformation
	4AL21EC081	Shreya Chandrahasa Shetty	
	4AL21EC097	Tanishka	
	4AL21EC089	Sinchana.S.D	
B11	4AL21EC056	Nivedita T Patil	Quadrature channel modulation in the presence of channel
	4AL21EC073	Sanjana Shrikant Havanoor	
	4AL21EC087	Sinchana R	
	4AL21EC096	Sushrutha N	

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Department of Electronics and Communication Engineering

DC MINI-PROJECT 5th SEM B SECTION -2023-24

	4AL21EC080	Shravan Shetty	
B12	4AL21EC094	Suma K G	Code division multiple access
	4AL21EC100	Thejashwi P Acharya	
	4AL21EC105	Vaishnavi Vithal Naik	
B13	4AL21EC065	Rakesh	Matched filter
	4AL21EC058	Pavan	
	4AL21EC110	Videesh D Shetty	
	4AL21EC111	Vishal	
B14	4AL21EC057	Prajyot Rajgonda Patil	Noisy Channel Coding Theorem
	4AL21EC112	Vishwanath HB	
B15	4AL21EC076	Shashank C Soppannavar	Duo binary encoding
	4AL21EC077	Shashank Swami	
	4AL21EC078	Shashank Viresh Shetti	
	4AL21EC108	Varun Devaramani	

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DC MINI-PROJECT 5th SEM A SECTION -2023-24

BATCH.No	USN	NAME	TOPIC
A1	4AL21EC031	Hemanth R	Simulation of AWGN using Matlab
	4AL21EC039	Keerthan S	
	4AL21EC046	Mahantesh ShidarayTanvashi	
A 2	4AL21EC015	Bhavana.B	Discrete time FS
	4AL21EC025	Deeksha S	
	4AL21EC030	Harshitha B S	
	4AL21EC033	HuriyaSanadi	
A 3	4AL21EC007	Anchita	Gaussian Minimum Shift Keying
	4AL21EC024	Darshana Basavaraj Bandi.	
	4AL21EC034	Inchara S Shetty	
	4AL21EC043	Lakshmi Keerthana B	
A 4	4AL21EC002	Abhishek S	Simulation on TDMA using mat lab
	4AL21EC003	Akash A H	
	4AL21EC036	Jeevan V	
	4AL21EC053	Nagabhushan H K	
A 5	4AL21EC032	Hemashri H N	64-PSK using Mat lab
	4AL21EC049	Manupriya Y	
	4AL21EC068	Ramya R	

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DC MINI-PROJECT 5thSEM A SECTION -2023-24

A 6	4AL21EC014	Bhaskar T	Generation of PN sequence using python
	4AL21EC018	Charan Raj R V	
	4AL21EC045	Madugonde Sandeep	
	4AL21EC054	Naveen Kumar H S	
A 7	4AL21EC026	Deekshith D Shetty	M-ary ASK Modulation & demodulation
	4AL21EC029	Gowtham M A	
	4AL21EC040	Kiran Kashyap M	
	4AL21EC042	Lakshan	
A 8	4AL21EC001	A. S. Pavithra	Differencial pulse code modulation
	4AL21EC009	B.Vennela	
	4AL21EC050	Meghana L	
	4AL21EC104	Vaishnavi S	
A 9	4AL22EC400	Abhishek P T	Pulse Amplitude Modulation
	4AL21EC013	Bharath N	
	4AL22EC402	Chetan G Kur Gouda	
	4AL22EC406	Shamshuddin	
A 10	4AL22EC401	Chethana A B	M-Ary QAM modulation & Demodulation
	4AL22EC405	Pallavi B	
	4AL22EC407	Suhani R J	
A 11	4AL21EC016	ChakravarthyJaipalTeredal	BPSK using Mat lab

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Department of Electronics and Communication Engineering

DC MINI-PROJECT 5thSEM A SECTION -2023-24

	4AL21EC023	Darshan T S	
	4AL21EC019	Chethan M	
	4AL22EC408	Veeresh S V	
	4AL21EC028	Gagan H S	**Pulse code modulation**
	4AL21EC020	Chethan K.M	
A 12	4AL21EC035	Jeevan K G	
	4AL21EC062	Prajwal S Das	
	4AL21EC005	Akshay Kumar H	**DPSK using Mat lab**
	4AL21EC021	Chiranjeevi U B	
A 13	4AL21EC041	Kishor U	
	4AL21EC044	Lekhan T	
	4AL21EC037	Kalmesh G Galigoudra	**FDMA using Mat lab**
	4AL21EC038	KaluvaChandrashekar	
A 14	4AL21EC047	Mailaragouda N P	
	4AL21EC006	Amaresha M	

5TH SEM A section

DIGITAL COMMUNICATION - CIE FINALIZED MARKS(23-24)

#	USN	Student Name	CIE -1 (20M)	CIE -2 (20M)	CIE -3 (20M)	CIE TOTAL (60M)	ASSIGN (40M)	TOTAL (100M)	FINAL AVG (50)
1	4AL21EC001	A. S. Pavithra	15	19	20	54	38	92	46
2	4AL21EC002	Abhishek S	15	19	16	50	38	88	44
3	4AL21EC003	Akash A H	0	5	16	21	35	56	28
4	4AL21EC005	Akshay Kumar H	15	20	20	55	40	95	48
5	4AL21EC006	Amaresha M	14	20	20	54	39	93	47
6	4AL21EC007	Anchita	10	20	20	50	38	88	44
7	4AL21EC008	Anush S Amargol	7	18	13	38	34	72	36
8	4AL21EC009	B.Vennela	19	20	20	59	37	96	48
9	4AL21EC010	Basangouda Patil	6	15	16	37	33	70	35
10	4AL21EC011	Basavakiran	6	5	18	29	38	67	34
11	4AL21EC013	Bharath N	8	0	9	17	27	44	22
12	4AL21EC014	Bhaskar T	8	19	18	45	35	80	40
13	4AL21EC015	Bhavana.B	18	19	20	57	38	95	48
14	4AL21EC016	Chakravarty Jaipal Terad	13	20	19	52	35	87	44
15	4AL21EC018	Charan Raj Rv	2	18	17	37	24	61	31
16	4AL21EC019	Chetan M	AB	20	20	40	40	80	40
17	4AL21EC020	Chethan K.M	5	15	13	33	38	71	36
18	4AL21EC021	Chiranjeevi U B	10	20	20	50	40	90	45
19	4AL21EC022	Chithra L	7	19	18	44	38	82	41
20	4AL21EC023	Darshan T S	7	20	15	42	40	82	41
21	4AL21EC024	Darshana Basavaraj Band	5	1	13	19	33	52	26
22	4AL21EC025	Deeksha S	20	20	20	60	40	100	50
23	4AL21EC026	Deekshith D Shetty	8	19	3	30	31	61	31
24	4AL21EC027	Diya	13	5	18	36	31	67	34
25	4AL21EC028	Gagan H S	15	20	18	53	28	81	41
26	4AL21EC029	Gowthama M A	14	16	20	50	18	68	34
27	4AL21EC030	Harshitha B.S	16	20	20	56	36	92	46
28	4AL21EC031	Hemanth R	3	13	0	16	32	48	24
29	4AL21EC032	Hemashri H N	12	20	20	52	36	88	44
30	4AL21EC033	Huriya Sanadi	14	20	18	52	38	90	45
31	4AL21EC034	Inchara S Shetty	15	20	20	55	37	92	46

5TH SEM A section

DIGITAL COMMUNICATION - CIE FINALIZED MARKS(23-24)

32	4AL21EC035	Jeevan K G	10	19	16	45	40	85	43
33	4AL21EC036	Jeevan V	11	19	18	48	38	86	43
34	4AL21EC037	Kalmesh G Galigoudra	10	19	16	45	40	85	43
35	4AL21EC038	Kaluva Chandrashekar	9	20	18	47	40	87	44
36	4AL21EC039	Keerthan S	3	3	16	22	31	53	27
37	4AL21EC040	Kiran Kashyap M	12	19	18	49	37	86	43
38	4AL21EC041	Kishor U	10	15	17	42	37	79	40
39	4AL21EC042	Lakshan	20	20	20	60	40	100	50
40	4AL21EC043	Lakshmi Keerthana B	15	20	20	55	35	90	45
41	4AL21EC044	Lekhan T	17	20	20	57	37	94	47
42	4AL21EC045	Madugonde Sandeep	4	19	16	39	35	74	37
43	4AL21EC046	Mahantesh Shidaray T	3	13	10	26	37	63	32
44	4AL21EC047	Mailaragouda N P	14	20	20	54	40	94	47
45	4AL21EC049	Manupriya Y	19	19	19	57	38	95	48
46	4AL21EC050	Meghana L	12	19	AB	31	34	65	33
47	4AL21EC051	Mohammed Iqbal	AB	1	15	16	26	42	21
48	4AL21EC052	Muhammad Razi	AB	1	15	16	26	42	21
49	4AL21EC053	Nagabhushan H K	11	18	15	44	32	76	38
50	4AL21EC054	Naveen Kumar H S	8	18	20	46	35	81	41
51	4AL21EC062	Prajwal S Das	3	15	17	35	40	75	38
52	4AL21EC068	Ramya .R	20	20	20	60	39	99	50
53	4AL21EC104	Vaishnavi S	12	20	AB	32	34	66	33
54	4AL22EC400	Abhishek P Tatuskar	12	19	20	51	36	87	44
55	4AL22EC401	Chetana A Burud	20	20	17	57	40	97	49
56	4AL22EC402	G Chethan Kumar Gowda	10	19	20	49	35	84	42
57	4AL22EC403	Lakshmi Balakkanavar	8	10	16	34	30	64	32
58	4AL22EC405	Pallavi A Bhoomanagoud	13	14	20	47	40	87	44
59	4AL22EC406	Shamshuddin	9	19	12	40	37	77	39
60	4AL22EC407	Suhani R Jadhav	8	6	16	30	36	66	33
61	4AL22EC408	Veeresh S V	15	20	18	53	37	90	45

Electronics & Communication Engineering

5TH SEM A section

DIGITAL COMMUNICATION - ASSIGNMENT MARKS(23-24)

#	USN	Student Name	ITC As (10M)	ITC R (10M)	ITC Avg (20M)	DC As(15M)	DC R (5M)	DC Avg (20M)	Total (40M)
1	4AL21EC001	A. S. Pavithra	9	10	19	14	5	19	38
2	4AL21EC002	Abhishek S	10	10	20	13	5	18	38
3	4AL21EC003	Akash A H	5	10	15	15	5	20	35
4	4AL21EC005	Akshay Kumar H	10	10	20	15	5	20	40
5	4AL21EC006	Amaresha M	10	10	20	14	5	19	39
6	4AL21EC007	Anchita	10	10	20	13	5	18	38
7	4AL21EC008	Anush S Amargol	9	10	19	15	0	15	34
8	4AL21EC009	B.Vennela	10	10	20	12	5	17	37
9	4AL21EC010	Basangouda Patil	9	10	19	14	0	14	33
10	4AL21EC011	Basavakiran	10	10	20	13	5	18	38
11	4AL21EC013	Bharath N	10	10	20	4	3	7	27
12	4AL21EC014	Bhaskar T	5	10	15	15	5	20	35
13	4AL21EC015	Bhavana.B	10	10	20	13	5	18	38
14	4AL21EC016	Chakravarty Jaipal	5	10	15	15	5	20	35
15	4AL21EC018	Charan Raj Rv	9	10	19	0	5	5	24
16	4AL21EC019	Chetan M	10	10	20	15	5	20	40
17	4AL21EC020	Chethan K.M	10	10	20	13	5	18	38
18	4AL21EC021	Chiranjeevi U B	10	10	20	15	5	20	40
19	4AL21EC022	Chithra L	10	10	20	13	5	18	38
20	4AL21EC023	Darshan T S	10	10	20	15	5	20	40
21	4AL21EC024	Darshana Basavaraj	10	10	20	8	5	13	33
22	4AL21EC025	Deeksha S	10	10	20	15	5	20	40
23	4AL21EC026	Deekshith D Shetty	6	10	16	12	3	15	31
24	4AL21EC027	Diya	10	10	20	11	0	11	31
25	4AL21EC028	Gagan H S	7	6	13	10	5	15	28
26	4AL21EC029	Gowthama M A	7	6	13	0	5	5	18
27	4AL21EC030	Harshitha B.S	10	6	16	15	5	20	36
28	4AL21EC031	Hemanth R	9	6	15	12	5	17	32
29	4AL21EC032	Hemashri H N	10	10	20	11	5	16	36
30	4AL21EC033	Huriya Sanadi	10	10	20	13	5	18	38

31	4AL21EC034	Inchara S Shetty	10	10	20	12	5	17	37
32	4AL21EC035	Jeevan K G	10	10	20	15	5	20	40
33	4AL21EC036	Jeevan V	10	10	20	13	5	18	38
34	4AL21EC037	Kalmesh G Galigouc	10	10	20	15	5	20	40
35	4AL21EC038	Kaluva Chandrashe	10	10	20	15	5	20	40
36	4AL21EC039	Keerthan S	10	10	20	8	3	11	31
37	4AL21EC040	Kiran Kashyap M	10	10	20	12	5	17	37
38	4AL21EC041	Kishor U	10	10	20	12	5	17	37
39	4AL21EC042	Lakshan	10	10	20	15	5	20	40
40	4AL21EC043	Lakshmi Keerthana	10	10	20	12	3	15	35
41	4AL21EC044	Lekhan T	7	10	17	15	5	20	37
42	4AL21EC045	Madugonde Sandeep	10	10	20	10	5	15	35
43	4AL21EC046	Mahantesh Shidara	10	10	20	12	5	17	37
44	4AL21EC047	Mailaragouda N P	10	10	20	15	5	20	40
45	4AL21EC049	Manupriya Y	10	10	20	13	5	18	38
46	4AL21EC050	Meghana L	9	10	19	10	5	15	34
47	4AL21EC051	Mohammed Iqbal	5	10	15	10	1	11	26
48	4AL21EC052	Muhammad Razi	5	10	15	10	1	11	26
49	4AL21EC053	Nagabhushan H K	7	10	17	10	5	15	32
50	4AL21EC054	Naveen Kumar H S	10	10	20	10	5	15	35
51	4AL21EC062	Prajwal S Das	10	10	20	15	5	20	40
52	4AL21EC068	Ramya .R	10	10	20	14	5	19	39
53	4AL21EC104	Vaishnavi S	9	10	19	12	3	15	34
54	4AL22EC400	Abhishek P Tatuska	10	10	20	11	5	16	36
55	4AL22EC401	Chetana A Burud	10	10	20	15	5	20	40
56	4AL22EC402	G Chethan Kumar G	10	10	20	10	5	15	35
57	4AL22EC403	Lakshmi Balakkana	10	10	20	10	0	10	30
58	4AL22EC405	Pallavi A B	10	10	20	15	5	20	40
59	4AL22EC406	Shamshuddin	10	10	20	12	5	17	37
60	4AL22EC407	Suhani R Jadhav	10	10	20	11	5	16	36
61	4AL22EC408	Veeresh S V	10	10	20	12	5	17	37

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5TH SEM B section

DIGITAL COMMUNICATION - CIE FINALIZED MARKS(23-24)

#	USN	Student Name	CIE -1 (20M)	CIE -2 (20M	CIE -3 (20M)	CIE TOTAL (60M	ASSIGN (40M)	TOTAL (100M)	FINAL AVG (50M)
1	4AL20EC009	C. Navajeevan	AB	2	20	22	34	56	28
2	4AL21EC056	Nivedita T Patil	19	20	20	59	40	99	50
3	4AL21EC057	Prajyot Rajgonda Patil	10	20	17	47	32	79	40
4	4AL21EC058	Pavan	AB	AB	5	5	36	41	21
5	4AL21EC059	Pooja Venkatesh Naik	19	19	20	58	39	97	49
6	4AL21EC060	Prajwal L R	13	11	16	40	30	70	35
7	4AL21EC061	Prajwal Malabagi	20	16	20	56	35	91	46
8	4AL21EC063	Prakruthi K P	11	15	0	26	35	61	31
9	4AL21EC064	Prasanna Kumar B I	6	14	15	35	29	64	32
10	4AL21EC065	Rakesh	2	AB	10	12	30	42	21
11	4AL21EC066	Raksha	19	20	20	59	39	98	49
12	4AL21EC067	Rakshith	6	19	15	40	34	74	37
13	4AL21EC069	Ravi Kovi	9	13	5	27	29	56	28
14	4AL21EC070	Sahana	8	7	14	29	38	67	34
15	4AL21EC071	Saikumar	15	20	20	55	40	95	48
16	4AL21EC073	Sanjana Shrikant Havanoo	20	20	20	60	40	100	50
17	4AL21EC074	Santhosha A S	14	20	18	52	40	92	46
18	4AL21EC076	Shashank C Soppannavar	10	19	19	48	22	70	35
19	4AL21EC077	Shashank Swami	10	17	15	42	35	77	39
20	4AL21EC078	Shashank Viresh Shetti	15	18	10	43	32	75	38
21	4AL21EC079	Shivakumar K V	13	14	18	45	32	77	39
22	4AL21EC080	Shravya Shetty	17	19	20	56	38	94	47
23	4AL21EC081	Shreya Chandrahasa Shetty	14	20	20	54	38	92	46
24	4AL21EC082	Shreya K R	19	20	18	57	40	97	49
25	4AL21EC083	Shreyas S Naik	5	20	12	37	34	71	36
26	4AL21EC084	Shruthi	12	20	20	52	39	91	46
27	4AL21EC085	Siddharoodh B Durgipujer	13	20	20	53	33	86	43
28	4AL21EC086	Sinchana C K	19	20	20	59	40	99	50
29	4AL21EC087	Sinchana R	12	20	20	52	37	89	45
30	4AL21EC088	Sinchana RD	15	16	20	51	40	91	46

5TH SEM B section

DIGITAL COMMUNICATION - CIE FINALIZED MARKS(23-24)

31	4AL21EC089	Sinchana.S.D	15	20	20	55	39	94	47
32	4AL21EC090	Sindhu KS	15	16	20	51	39	90	45
33	4AL21EC091	Sindhu S Patil	13	19	14	46	38	84	42
34	4AL21EC092	Sonali	12	18	18	48	34	82	41
35	4AL21EC093	Srishti S Shetty	12	20	20	52	34	86	43
36	4AL21EC094	Suma K G	1	13	3	17	32	49	25
37	4AL21EC095	Sumith N	6	19	16	41	20	61	31
38	4AL21EC096	Sushrutha N	5	19	18	42	35	77	39
39	4AL21EC097	Tanishka	10	20	13	43	37	80	40
40	4AL21EC098	Tej Ashok	8	20	20	48	28	76	38
41	4AL21EC099	Thejas J Kotian	9	20	20	49	35	84	42
42	4AL21EC100	Thejashwi P Acharya	18	19	20	57	34	91	46
43	4AL21EC101	Thrisha P Hegde	19	20	20	59	38	97	49
44	4AL21EC102	Usha Rani.N	19	20	19	58	37	95	48
45	4AL21EC103	V Venkta Sainihith M	16	20	18	54	36	90	45
46	4AL21EC105	Vaishnavi Vithal Naik	8	19	20	47	37	84	42
47	4AL21EC106	Varshini Shetty	19	20	20	59	37	96	48
48	4AL21EC107	Varun Kumar R	4	20	13	37	31	68	34
49	4AL21EC108	Varun Devaramani	9	19	18	46	37	83	42
50	4AL21EC109	Veena Basavaraj R	19	20	20	59	38	97	49
51	4AL21EC110	Videesh D Shetty	0	2	12	14	28	42	21
52	4AL21EC111	Vishal	0	AB	13	13	29	42	21
53	4AL21EC112	Vishwanath HB	2	13	3	18	25	43	22
54	4AL21EC113	Yashaswini T R	14	20	20	54	40	94	47
55	4AL21EC114	Yashwanth GT	12	20	20	52	32	84	42
56	4AL21EC115	Yogeshwar M	12	19	18	49	20	69	35
57	4AL22EC404	Navaneeth	12	18	18	48	38	86	43

Department of Electronics Communication Engineering

5TH SEM B section

DIGITAL COMMUNICATION - ASSIGNMENT MARKS(23-24)

#	USN	Student Name	ITC As (10M)	ITC R (10M)	ITC (20M)	DC As (15M)	DC R (5M)	DC A (20M)	Total (40M)
1	4AL20EC009	C. Navajeevan	9	10	19	10	5	15	34
2	4AL21EC056	Nivedita T Patil	10	10	20	15	5	20	40
3	4AL21EC057	Prajyot Rajgonda Patil	9	10	19	13	0	13	32
4	4AL21EC058	Pavan	10	10	20	11	5	16	36
5	4AL21EC059	Pooja Venkatesh Naik	10	10	20	14	5	19	39
6	4AL21EC060	Prajwal L R	10	7	17	13	0	13	30
7	4AL21EC061	Prajwal Malabagi	10	7	17	13	5	18	35
8	4AL21EC063	Prakruthi K P	10	7	17	13	5	18	35
9	4AL21EC064	Prasanna Kumar B I	9	7	16	13	0	13	29
10	4AL21EC065	Rakesh	9	7	16	10	4	14	30
11	4AL21EC066	Raksha	10	9	19	15	5	20	39
12	4AL21EC067	Rakshith	10	7	17	12	5	17	34
13	4AL21EC069	Ravi Kovi	9	7	16	8	5	13	29
14	4AL21EC070	Sahana	10	10	20	13	5	18	38
15	4AL21EC071	Saikumar	10	10	20	15	5	20	40
16	4AL21EC073	Sanjana Shrikant Hava	10	10	20	15	5	20	40
17	4AL21EC074	Santhosha A S	10	10	20	15	5	20	40
18	4AL21EC076	Shashank C Soppannav	10	7	17	0	5	5	22
19	4AL21EC077	Shashank Swami	10	7	17	13	5	18	35
20	4AL21EC078	Shashank Viresh Shetti	10	7	17	10	5	15	32
21	4AL21EC079	Shivakumar K V	10	7	17	10	5	15	32
22	4AL21EC080	Shravya Shetty	10	10	20	13	5	18	38
23	4AL21EC081	Shreya Chandrahasa Sh	10	10	20	13	5	18	38
24	4AL21EC082	Shreya K R	10	10	20	15	5	20	40
25	4AL21EC083	Shreyas S Naik	9	10	19	10	5	15	34
26	4AL21EC084	Shruthi	10	10	20	14	5	19	39
27	4AL21EC085	Siddharoodh B Durgipu	10	10	20	10	3	13	33
28	4AL21EC086	Sinchana C K	10	10	20	15	5	20	40
29	4AL21EC087	Sinchana R	10	10	20	12	5	17	37
30	4AL21EC088	Sinchana RD	10	10	20	15	5	20	40

5TH SEM B section

DIGITAL COMMUNICATION - ASSIGNMENT MARKS(23-24)

31	4AL21EC089	Sinchana.S.D	9	10	19	15	5	20	39
32	4AL21EC090	Sindhu KS	10	10	20	14	5	19	39
33	4AL21EC091	Sindhu S Patil	10	10	20	13	5	18	38
34	4AL21EC092	Sonali	10	7	17	12	5	17	34
35	4AL21EC093	Srishti S Shetty	10	7	17	12	5	17	34
36	4AL21EC094	Suma K G	9	7	16	13	3	16	32
37	4AL21EC095	Sumith N	10	7	17	0	3	3	20
38	4AL21EC096	Sushrutha N	10	8	18	12	5	17	35
39	4AL21EC097	Tanishka	10	8	18	14	5	19	37
40	4AL21EC098	Tej Ashok	9	8	17	8	3	11	28
41	4AL21EC099	Thejas J Kotian	10	8	18	12	5	17	35
42	4AL21EC100	Thejashwi P Acharya	10	10	20	11	3	14	34
43	4AL21EC101	Thrisha P Hegde	10	10	20	13	5	18	38
44	4AL21EC102	Usha Rani.N	10	10	20	14	3	17	37
45	4AL21EC103	V Venkta Sainihith Mul	10	10	20	13	3	16	36
46	4AL21EC105	Vaishnavi Vithal Naik	10	10	20	12	5	17	37
47	4AL21EC106	Varshini Shetty	10	10	20	12	5	17	37
48	4AL21EC107	Varun Kumar R	10	10	20	11	0	11	31
49	4AL21EC108	Varun Devaramani	10	10	20	12	5	17	37
50	4AL21EC109	Veena Basavaraj Racha	10	8	18	15	5	20	38
51	4AL21EC110	Videesh D Shetty	9	8	17	9	2	11	28
52	4AL21EC111	Vishal	10	8	18	9	2	11	29
53	4AL21EC112	Vishwanath HB	6	8	14	8	3	11	25
54	4AL21EC113	Yashaswini T R	10	10	20	15	5	20	40
55	4AL21EC114	Yashwanth GT	10	10	20	12	0	12	32
56	4AL21EC115	Yogeshwar M	10	10	20	0	0	0	20
57	4AL22EC404	Navaneeth	10	10	20	13	5	18	38

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Branch : EC Semester : 5

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1	4AL20EC009	28
2	4AL21EC001	46
3	4AL21EC002	44
4	4AL21EC003	28
5	4AL21EC005	48
6	4AL21EC006	47
7	4AL21EC007	44
8	4AL21EC008	36
9	4AL21EC009	48
10	4AL21EC010	35
11	4AL21EC011	34
12	4AL21EC013	22
13	4AL21EC014	40
14	4AL21EC015	48
15	4AL21EC016	44
16	4AL21EC018	31
17	4AL21EC019	40
18	4AL21EC020	36
19	4AL21EC021	45
20	4AL21EC022	41
21	4AL21EC023	41
22	4AL21EC024	26
23	4AL21EC025	50
24	4AL21EC026	31
25	4AL21EC027	34
26	4AL21EC028	41
27	4AL21EC029	34
28	4AL21EC030	46
29	4AL21EC031	24
30	4AL21EC032	44
31	4AL21EC033	45
32	4AL21EC034	46
33	4AL21EC035	43
34	4AL21EC036	43
35	4AL21EC037	43
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	4AL21EC052	21
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	4AL21EC077	39
	4AL21EC078	38
	4AL21EC079	39
	4AL21EC080	47
	4AL21EC081	46

NO.	USN	21EC51
6	4AL21EC082	49
7	4AL21EC083	36
8	4AL21EC084	46
9	4AL21EC085	43
80	4AL21EC086	50
81	4AL21EC087	45
82	4AL21EC088	46
83	4AL21EC089	47
84	4AL21EC090	45
85	4AL21EC091	42
86	4AL21EC092	41
87	4AL21EC093	43
88	4AL21EC094	25
89	4AL21EC095	31
90	4AL21EC096	39
91	4AL21EC097	40
92	4AL21EC098	38
93	4AL21EC099	42
94	4AL21EC100	46
95	4AL21EC101	49
96	4AL21EC102	48
97	4AL21EC103	45
98	4AL21EC104	33
99	4AL21EC105	42
100	4AL21EC106	48
101	4AL21EC107	34
102	4AL21EC108	42
103	4AL21EC109	49
104	4AL21EC110	21
105	4AL21EC111	21
106	4AL21EC112	22
107	4AL21EC113	47
108	4AL21EC114	42
109	4AL21EC115	35
110	4AL22EC400	44
111	4AL22EC401	49
112	4AL22EC402	42
113	4AL22EC403	32
114	4AL22EC404	43

NO.	USN	21EC51
15	4AL22EC405	44
16	4AL22EC406	39
17	4AL22EC407	33
18	4AL22EC408	45

USN | | | | | | | | | | |

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

(Accredited by NAAC with A+ Grade)

Department of Electronics & Communication Engineering(Accredited by NBA)

Continuous Internal Evaluation Test –II..... AY 2023-24

Course Title : Digital Communication		Course Code: 21EC51
Date: 09/02/2024	Time: 9.30 AM- 11.00 AM	Semester/Section: 5th A & B
Faculty: Prof. Vijetha T S & Prof. Bhagyashree K		Max. Marks: 30

Note: Answer ONE FULL question from each Module.

Q. No.		Questions	Marks	COs	BTL
		Module 3			
1	a)	Explain the Properties of PN sequences with example.	5	CO3	L2
	b)	Explain the Fast FH-SS.	5	CO3	L2
		OR			
2	a)	Explain the DS-SS-BPSK.	5	CO3	L2
	b)	Explain the CDMA-IS 95.	5	CO3	L2
		Module 4			
3	a)	Construct binary code for the following source using Shannon's binary encoding procedure. $S = \{ s_1, s_2, s_3, s_4, s_5\}$ $P = (0.4, 0.25, 0.15, 0.12, 0.08)$	10	CO4	L2
		OR			
4	a)	Given the messages x1, x2, x3, x4, x5 and x6 with respective of probabilities of 0.4, 0.2, 0.2, 0.1, 0.07 and 0.03, construct a binary code by applying Huffman encoding procedure. Determine the efficiency and redundancy of the code so formed.	10	CO4	L2

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

CO1	Explain different digital modulation schemes, and compare advantages/ Disadvantages of each as applied to baseband signal. Ability to simulate modulation techniques in communication systems using modern tool.
CO2	Analyze receivers such as Correlation and matched filters and also Make use of adaptive equalization techniques in band limited channels to control the Inter Symbol Interference (ISI),
CO3	Analyze and Simulate Performance of different spread spectrum techniques in communication system.
CO4	Apply the fundamentals of information theory and perform source coding for given message.
CO5	Apply different encoding and decoding techniques with error Detection and correction

Mrs. Vijetha T S/Mrs. Bhagyashree K

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