



Department of Electronics and Communication Engineering

4th BoS Meeting on 9th January 2026

AGENDA

Item No.	Agenda Item																													
1.0	Review and Confirmation of Items																													
1.1	Review and Confirmation of the Minutes of the 3 rd BOS Meeting held on 01-11-2025.																													
2.0	Approval Items																													
	VR25																													
2.1	Approval of VR25-II B. Tech I & II Semester Course Structure.																													
2.2	Approval of Syllabus for VR25-II B. Tech I Semester.																													
2.3	Approval of Syllabus for VR25-II B. Tech II Semester.																													
2.4	Approval of B. Tech Syllabi of other departments for VR25.																													
	<table><tr><th>S.No.</th><th>Regulation</th><th>Year & Sem</th><th>Subject Name</th><th>Department</th></tr><tr><td>1</td><td>VR25</td><td>II-I</td><td>Computer Organization and Architecture</td><td>CSE, CSE(AI&ML), CSE(DS)</td></tr><tr><td>2</td><td>VR25</td><td>II-I</td><td>Computer Organization and Microprocessor</td><td>IT</td></tr><tr><td>3</td><td>VR25</td><td>II-I</td><td>Introduction to IoT</td><td>IT</td></tr><tr><td>4</td><td>VR25</td><td>II-I</td><td>Introduction to IoT Lab</td><td>IT</td></tr></table>					S.No.	Regulation	Year & Sem	Subject Name	Department	1	VR25	II-I	Computer Organization and Architecture	CSE, CSE(AI&ML), CSE(DS)	2	VR25	II-I	Computer Organization and Microprocessor	IT	3	VR25	II-I	Introduction to IoT	IT	4	VR25	II-I	Introduction to IoT Lab	IT
S.No.	Regulation	Year & Sem	Subject Name	Department																										
1	VR25	II-I	Computer Organization and Architecture	CSE, CSE(AI&ML), CSE(DS)																										
2	VR25	II-I	Computer Organization and Microprocessor	IT																										
3	VR25	II-I	Introduction to IoT	IT																										
4	VR25	II-I	Introduction to IoT Lab	IT																										
	VR24																													
2.5	Approval of VR24-III B. Tech I & II Semester Course Structure																													
2.6	Approval of VR24-IV B. Tech I & II Semester Course Structure.																													
2.7	Approval of Syllabus for VR24-III B. Tech I & II Semester.																													
2.8	Approval of Syllabus for VR24-IV B. Tech I & II Semester																													



**VIGNAN'S INSTITUTE OF MANAGEMENT AND
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2.9	Approval of B. Tech Syllabi of other departments for VR24.				
	S.No.	Regulation	Year & Sem	Subject Name	Department
	1	VR24	III-I	Image Processing	CSE, CSE (AI & ML), CSE (DS), IT
	2	VR24	III-II	Internet of Things	CSE
	3	VR24	IV-I	Internet of Things	CSE (AI&ML), CSE(DS)
	4	VR24	III-I	Embedded Systems	CSE
	5	VR24	III-II	Embedded Systems	IT
	6	VR24	III-II	Embedded Systems Lab	IT
	7	VR24	IV-II	Speech and Video Processing	CSE(AI & ML)
3.0	Any other items with permission of Chair				


Chairman-BOS



VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN

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Department of Electronics and Communication Engineering

4th BoS Meeting held on 09th January 2026

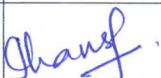
Members Present:

S. No.	Name	Designation	Organization	Position in BoS	Signature
1	Dr. T. Pullaiah	Associate Professor & HOD	VMTW, Hyderabad.	BOS Chairman	
2	Dr. T. Satya Savithri	Professor	JNTUH, Hyderabad	Member (JNTUH Nominee)	
3	Mr. D. Srinivasa Rao	Project Director	RAILTEL Corporation of India Limited, Secunderabad	Member (Industry)	
4	Dr. D. Narendar Singh	Associate Professor	Anurag University, Hyderabad.	Member (Academician)	
5	Dr. Vadthiya Narendar	Assistant Professor	NIT, Warangal.	Member (Academician)	
6	Ms. A. Sri Lasya	Sr. System Engineer	Cognizant, Hyderabad.	Member (Alumni)	
7	Mr. P. Harikrishna	Associate Professor	VMTW, Hyderabad.	Member	
8	Dr. SK. Masthan Basha	Associate Professor	VMTW, Hyderabad.	Member	
9	Dr. G. Jhansi Reddy	Associate Professor	VMTW, Hyderabad.	Member	
10	Dr. K. Padmaleela	Assistant Professor	VMTW, Hyderabad.	Member	
11	Mr. J. Sunil Kumar	Associate Professor	VMTW, Hyderabad.	Member	
12	Mrs. G. Indira Priyadarshini	Associate Professor	VMTW, Hyderabad.	Member	

Vignan's Institute of Management & Technology for Women
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Department of Electronics and Communication Engineering

**Minutes of the 4th Board of Studies (BoS) meeting held on 9th January 2026., 11.30 AM
at Department of ECE, VMTW**

S. No	Name	Designation	Organization	Position in BoS	Signature
1	Dr. T. Pullaiah	Associate Professor & HOD	VMTW, Hyderabad.	BOS Chairman	
2	Dr. T. Satya Savithri	Professor	JNTUH, Hyderabad	Member (JNTUH Nominee)	
3	Mr. D. Srinivasa Rao	Project Director	RAILTEL Corporation of India Limited, Secunderabad	Member (Industry)	
4	Dr. D. Narendar Singh	Associate Professor	Anurag University, Hyderabad.	Member (Academician)	
5	Dr. Vadthiya Narendar	Assistant Professor	NIT, Warangal.	Member (Academician)	
6	Ms. A. Sri Lasya	Sr. System Engineer	Cognizant, Hyderabad.	Member (Alumni)	
7	Mr. P. Harikrishna	Associate Professor	VMTW, Hyderabad.	Member	
8	Dr. SK. Masthan Basha	Associate Professor	VMTW, Hyderabad.	Member	
9	Dr. G. Jhansi Reddy	Associate Professor	VMTW, Hyderabad.	Member	
10	Dr. K. Padmaleela	Assistant Professor	VMTW, Hyderabad.	Member	
11	Mr. J. Sunil Kumar	Associate Professor	VMTW, Hyderabad.	Member	
12	Mrs. G. Indira Priyadarshini	Associate Professor	VMTW, Hyderabad.	Member	

MINUTES BOOK

Vignan's Institute of Management & Technology for Women (An Autonomous Institutions & Accredited by NBA & NAAC)

Department of Electronics and Communication Engineering

**Minutes of the 4th Board of Studies (BoS) meeting held on 9th January 2026, 11.30 AM
at Department of ECE, VMTW**

The Quorum (Minimum 40%) was satisfied.

The Chairman-BoS Dr. T. Pullaiah introduced the following members in the Board.

S. No.	Name	Designation	Organization	Position in BoS
1	Dr. T. Pullaiah	Associate Professor & HOD	VMTW, Hyderabad.	BoS Chairman
2	Dr. T. Satya Savithri	Professor	JNTUH, Hyderabad	Member (JNTUH Nominee)
3	Mr. D. Srinivasa Rao	Project Director	RAILTEL Corporation of India Limited, Secunderabad	Member (Industry)
4	Dr. D. Narendar Singh	Associate Professor	Anurag University, Hyderabad.	Member (Academician)
5	Dr. Vadthiya Narendar	Assistant Professor	NIT, Warangal.	Member (Academician)
6	Ms. A. Sri Lasya	Sr. System Engineer	Cognizant, Hyderabad.	Member (Alumni)
7	Mr. P. Harikrishna	Associate Professor	VMTW, Hyderabad.	Member
8	Dr.SK. Masthan Basha	Associate Professor	VMTW, Hyderabad.	Member
9	Dr. G. Jhansi Reddy	Associate Professor	VMTW, Hyderabad.	Member
10	Dr. K. Padmaleela	Assistant Professor	VMTW, Hyderabad.	Member
11	Mr. J. Sunil Kumar	Associate Professor	VMTW, Hyderabad.	Member
12	Mrs. G. Indira Priyadarshini	Associate Professor	VMTW, Hyderabad.	Member

Minutes of the Board of Studies (BoS) meeting held on Friday, 9th January 2026

The following members were present:

1. Dr. T. Pullaiah
2. Dr. T. Satya Savithri
3. Mr.D.Srinivasa Rao
4. Dr. D. Narendar Singh
5. Dr. Vadthiya Narendar
6. Ms. A. Sri Lasya
7. Mr. P. Harikrishna
8. Dr. SK. Masthan Basha
9. Dr. G. Jhansi Reddy
10. Dr. K. Padmaleela
11. Mr. J. Sunil Kumar
12. Mrs. G. Indira Priyadarshini

The Chairman-BoS welcomed all the members to the meeting of the Board of Studies.

Proceedings of the meeting of the Board of Studies

1.0 Review and Confirmation of items

1.1 Review and Confirmation of the Minutes of Meeting of the 3rd BoS held on 1st November 2025.

The Chairman-BoS presented the minutes of the meeting 3rd BoS held on 1st November 2025.

The Board has reviewed and confirmed the Minutes. (attached here with Annexure –I)

2.0 Approval Items.

2.1 Approval of syllabus for VR25-II B. Tech I & II Semester Course Structure

The Chairman BOS presented the Course Structure of VR25-II B. Tech I & II Semester (attached here with Annexure –II) to the members.

The Board has approved the Course Structure as per JNTUH.

2.2 Approval of Syllabus for VR25-II B. Tech I Semester

The Chairman BOS presented the Syllabus of VR25-II B. Tech I Semester (attached here with Annexure –III) to the members.

The Board has approved the Syllabus as per JNTUH.

2.3 Approval of Syllabus for VR25-II B. Tech II Semester

The Chairman BOS presented the Syllabus of VR25-II B. Tech II Semester (attached here with Annexure –IV) to the members.

The Board has approved the Syllabus as per JNTUH.

2.4 Approval of B. Tech Syllabi of other departments for VR25.

The Chairman BOS presented the Syllabus of other departments offered by ECE as follows

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR25	II-I	Computer Organization and Architecture	CSE, CSE(AI&ML), CSE(DS)
2	VR25	II-I	Computer Organization and Microprocessor	IT
3	VR25	II-I	Introduction to IoT	IT
4	VR25	II-I	Introduction to IoT Lab	IT

The Board has approved the Syllabus as per JNTUH.

2.5 Approval of VR24-III B. Tech I & II Semester Course Structure

The Chairman BOS presented the Course Structure of VR24-III B. Tech I & II Semester (attached here with Annexure –V) to the members.

The Board has approved the Course Structure as per JNTUH.

2.6 Approval of VR24-IV B. Tech I & II Semester Course Structure.

The Chairman BOS presented the Course Structure of VR24-IV B. Tech I & II Semester (attached here with Annexure –VI) to the members.

The Board has approved the Course Structure as per JNTUH.

2.7 Approval of Syllabus for VR24-III B. Tech I & II Semester.

The Chairman BOS presented the Syllabus of VR24-III B. Tech I & II Semester (attached here with Annexure –VII) to the members.

The Board has approved the Syllabus as per JNTUH.

2.8 Approval of Syllabus for VR24-IV B. Tech I & II Semester

The Chairman BOS presented the Syllabus of VR24-IV B. Tech I & II Semester (attached here with Annexure –VIII) to the members.

The Board has approved the Syllabus as per JNTUH.

2.9 Approval of B. Tech Syllabi of other departments for VR24.

The Chairman BOS presented the Syllabus of other departments offered by ECE as follows

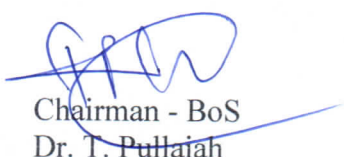
S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR24	III-I	Image Processing	CSE, CSE (AI & ML), CSE (DS), IT
2	VR24	III-II	Internet of Things	CSE
3	VR24	IV-I	Internet of Things	CSE (AI&ML), CSE(DS)
4	VR24	III-I	Embedded Systems	CSE
5	VR24	III-II	Embedded Systems	IT
6	VR24	III-II	Embedded Systems Lab	IT
7	VR24	IV-II	Speech and Video Processing	CSE(AI & ML)

The Board has approved the Syllabus as per JNTUH.

3.0 Any other points with the permission of the Chair

1. Mr. D. Srinivasa Rao, Project Director, RAILTEL Corporation of India Limited, Secunderabad suggested to introduce LEO antenna as one of content in Syllabus.
2. Dr. T. Satya Savithri, Professor, JNTUH, Hyderabad observed additions in VR24 Course Structure for III B. Tech I Semester, and accepted addition of new subject in professional elective-1 for VR24. Agreed with Mr. D. Srinivasa Rao Project Director, RAILTEL Corporation of India Limited also suggested to put LEO antenna in V unit of Satellite Communication (PE-IV).

The Board suggested the Chairman_BoS to maintain the Academic Quality, Update the syllabus to uphold the institution's standards.



Chairman - BoS
Dr. T. Pullaiah

Annexure

I

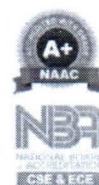


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Department of Electronics and Communication Engineering

BOARD OF STUDIES

S. No	Name of the Member	Designation	Organization	Role
1	Dr. T. Pullaiah	Associate Professor & HOD	VMTW, Hyderabad.	BoS Chairman
2	Dr. T. Satya Savithri	Professor	JNTUH, Hyderabad	Member (JNTUH Nominee)
3	Mr. D. Srinivasa Rao	Project Director	RAILTEL Corporation of India Limited, Secunderabad	Member (Industry)
4	Dr. D. Narendar Singh	Associate Professor	Anurag University, Hyderabad.	Member (Academician)
5	Dr. Vadthiya Narendar	Assistant Professor	NIT, Warangal.	Member (Academician)
6	Ms. A. Sri Lasya	Sr. System Engineer	Cognizant, Hyderabad.	Member (Alumni)
7	Mr. P. Harikrishna	Associate Professor	VMTW, Hyderabad.	Member
8	Dr. SK. Masthan Basha	Associate Professor	VMTW, Hyderabad.	Member
9	Dr. G. Jhansi Reddy	Associate Professor	VMTW, Hyderabad.	Member
10	Dr. K. Padmaleela	Assistant Professor	VMTW, Hyderabad.	Member
11	Mr. J. Sunil Kumar	Associate Professor	VMTW, Hyderabad.	Member
12	Mrs. G. Indira Priyadarshini	Associate Professor	VMTW, Hyderabad.	Member

PRINCIPAL

Vignans Institute of Management & Technology For Women
Kondapur (V), Ghatkesar (M), Medchal-Malkajgiri (Dt)-501 301
Telangana State



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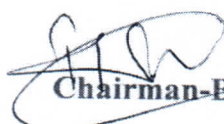


Department of Electronics and Communication Engineering

3rd BoS Meeting on 1st November 2025

AGENDA

Item No.	Agenda Item
1.0	Review and Confirmation of Items
1.1	Review and confirmation of the Minutes of Meeting of the 2nd BoS held on 19 th August 2025.
1.2	Review and Confirmation of M. Tech Academic Regulations (VR25) from the Academic Year: 2025-26.
1.3	Review and Confirmation of M. Tech Academic Calendar (VR25) from the Academic Year: 2025-26.
1.4	Review and Confirmation of M. Tech VLSI System Design Course Structure (VR25) from the Academic Year: 2025-26.
2.0	Approval Items
2.1	Ratification of Syllabus for I M.Tech I Semester.
2.2	Approval of Syllabus for M.Tech II, III & IV Semesters.
3.0	Any other items with permission of Chair


Chairman-BoS



VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN

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Department of Electronics and Communication Engineering 3rd BoS Meeting on 1st November 2025

Members Present:

S.No.	Name	Designation	Organization	Position in BoS	Signature
1	Dr.T. Pullaiah	Associate Professor & HOD	VMTW, Hyderabad.	BOS Chairman	
2	Dr.T. Satya Savithri	Professor	JNTUH, Hyderabad	Member (JNTUH Nominee)	
3	Mr. D. Srinivasa Rao	Project Director	RAILTEL Corporation of India Limited, Secunderabad	Member (Industry)	
4	Dr.D. Narendar Singh	Associate Professor	Anurag University, Hyderabad.	Member (Academician)	
5	Dr. Vadthiya Narendar	Assistant Professor	NIT, Warangal.	Member (Academician)	
6	Ms. A. Sri Lasya	Sr. System Engineer	Cognizant, Hyderabad.	Member (Alumni)	
7	Mr. P. Harikrishna	Associate Professor	VMTW, Hyderabad.	Member	
8	Dr.SK.Masthan Basha	Associate Professor	VMTW, Hyderabad.	Member	
9	Dr. G. Jhansi Reddy	Associate Professor	VMTW, Hyderabad.	Member	
10	Dr. K. Padma Leela	Associate Professor	VMTW, Hyderabad.	Member	
11	Mr. J. Sunil Kumar	Associate Professor	VMTW, Hyderabad.	Member	
12	Mrs. G. Indira Priyadarshini	Associate Professor	VMTW, Hyderabad.	Member	

MINUTES BOOK

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Department of Electronics and Communication Engineering

Minutes of the 3rd Board of Studies (BoS) meeting held on 1st November 2025, 02.00 PM

at Department of ECE, VMTW

The Quorum (minimum 40%) was satisfied.

The Chairman-BoS Dr. T. Pullaiah introduced the following members in the Board.

S. No.	Name	Designation	Organization	Position in BoS
1	Dr. T. Pullaiah	Associate Professor & HOD	VMTW, Hyderabad.	BoS Chairman
2	Dr. T. Satya Savithri	Professor	JNTUH, Hyderabad	Member (JNTUH Nominee)
3	Mr. D. Srinivasa Rao	Project Director	RAILTEL Corporation of India Limited, Secunderabad	Member (Industry)
4	Dr. D. Narendar Singh	Associate Professor	Anurag University, Hyderabad.	Member (Academician)
5	Dr. Vadthiya Narendar	Assistant Professor	NIT, Warangal.	Member (Academician)
6	Ms. A. Sri Lasya	Sr. System Engineer	Cognizant, Hyderabad.	Member (Alumni)
7	Mr. P. Harikrishna	Associate Professor	VMTW, Hyderabad.	Member
8	Dr. SK. Masthan Basha	Associate Professor	VMTW, Hyderabad.	Member
9	Dr. G. Jhansi Reddy	Associate Professor	VMTW, Hyderabad.	Member
10	Dr. K. Padma Leela	Assistant Professor	VMTW, Hyderabad.	Member
11	Mr. J. Sunil Kumar	Associate Professor	VMTW, Hyderabad.	Member
12	Mrs. G. Indira Priyadarshini	Associate Professor	VMTW, Hyderabad.	Member

Minutes of the Board of Studies (BoS) meeting held on Tuesday, 1st November 2025

The following members were present:

1. Dr. T. Pullaiah
2. Dr. T. Satya Savithri
3. Mr. D. Srinivasa Rao
4. Dr. D. Narendar Singh
5. Dr. Vadthiya Narendar
6. Ms. A. Sri Lasya
7. Mr. P. Harikrishna
8. Dr. SK. Masthan Basha
9. Dr. G. Jhansi Reddy
10. Dr. K. Padma Leela
11. Mr. J. Sunil Kumar
12. Mrs. G. Indira Priyadarshini

The Chairman-BoS welcomed all the members to the meeting of the Board of Studies.

Proceedings of the meeting of the Board of Studies

1.0 Review and Confirmation of items

1.1 Review and Confirmation of the Minutes of Meeting of the 2nd BoS held on 19th August 2025.

The Board has reviewed the Minutes of meeting of the 2nd BOS held on 19th August 2025.

1.2 Review and Confirmation of M. Tech Academic Regulations (VR25) from the Academic Year: 2025-26.

The Board has reviewed and confirmed the M. Tech Academic Regulations (VR25) from the Academic Year:2025-26. (Annexure-I).

1.3 Review and Confirmation of M. Tech Academic Calendar (VR25) from the Academic Year: 2025-26.

The Board has reviewed and confirmed the M. Tech Academic Calendar for the A.Y. 2025-26. (Annexure-II).

1.4 Review and Confirmation of M. Tech VLSI System Design Course Structure (VR25) from the Academic Year: 2025-26.

The Board has reviewed and confirmed the M. Tech VLSI System Design Course Structure (VR25) from the Academic year :2025-26. (Annexure-III).

2.0 Approval Items.

2.1 Ratification of Syllabus for I M. Tech I Semester.

The BoS chairman presented the syllabus of I M. Tech VLSI System Design to the members and stated that the syllabus is adopted from JNTUH. (Annexure-IV).

The Board has Approved the Syllabus as per JNTUH.

2.2 Approval of Syllabus for M. Tech II, III & IV Semesters.

The BoS chairman presented the syllabus of M. Tech VLSI System Design II,III & IV semesters to the members and stated that the syllabus is adopted from JNTUH. (Annexure-V).

The Board has Approved the Syllabus as per JNTUH.

3.0 Any other items with permission of Chair

1. Dr. T. Satya Savithri, Professor, JNTUH, Hyderabad observed changes in VR25 with previous syllabus and accepted chosen professional electives.
2. Mr. D. Srinivasa Rao, Project Director, RAILTEL Corporation of India Limited, Secunderabad agreed with Dr. T. Satya Savithri, Professor, JNTUH, Hyderabad
3. Dr. SK. Masthan Basha, Associate Professor, VMTW agreed with Dr. T. Satya Savithri madam,

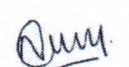
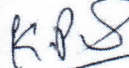
The Board suggested the Chairman_BoS to maintain the Academic Quality, Update the syllabus to uphold the institution's standards.


Chairman - BoS
Dr. T. Pullaiah

Vignan's Institute of Management & Technology for Women
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Minutes of the 3rd Board of Studies (BoS) meeting held on 1st November 2025, 02.00 PM
at Department of ECE, VMTW

S. No	Name	Designation	Organization	Position in BoS	Signature
1	Dr. T. Pullaiah	Associate Professor & HOD	VMTW, Hyderabad.	BOS Chairman	
2	Dr. T. Satya Savithri	Professor	JNTUH, Hyderabad	Member (JNTUH Nominee)	
3	Mr. D. Srinivasa Rao	Project Director	RAILTEL Corporation of India Limited, Secunderabad	Member (Industry)	
4	Dr. D. Narendar Singh	Associate Professor	Anurag University, Hyderabad.	Member (Academician)	
5	Dr. Vadthiya Narendar	Assistant Professor	NIT, Warangal.	Member (Academician)	
6	Ms. A. Sri Lasya	Sr. System Engineer	Cognizant, Hyderabad.	Member (Alumni)	
7	Mr. P. Harikrishna	Associate Professor	VMTW, Hyderabad.	Member	
8	Dr. SK. Masthan Basha	Associate Professor	VMTW, Hyderabad.	Member	
9	Dr. G. Jhansi Reddy	Associate Professor	VMTW, Hyderabad.	Member	
10	Dr. K. Padmaleela	Assistant Professor	VMTW, Hyderabad.	Member	
11	Mr. J. Sunil Kumar	Associate Professor	VMTW, Hyderabad.	Member	
12	Mrs. G. Indira Priyadarshini	Associate Professor	VMTW, Hyderabad.	Member	

Minutes of the Board of Studies (BoS) meeting held on Tuesday, 1st November 2025

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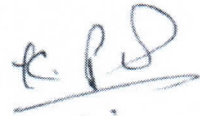
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Annexure

II

Approval Syllabus for VR 25-II B.Tech I Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 25	II-I	Probability Theory and Stochastic Processes	ECE
2	VR 25	II-I	Signals and Systems	ECE
3	VR 25	II-I	Electronic Devices and Circuits	ECE
4	VR 25	II-I	Digital Logic Design	ECE
5	VR 25	II-I	Control Systems Engineering	ECE
6	VR 25	II-I	Modelling & Simulation Lab	ECE
7	VR 25	II-I	Electronic Devices and Circuits Lab	ECE
8	VR 25	II-I	Digital Logic Design Lab	ECE

Approval Syllabus for VR 25-II B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 25	II-II	Electromagnetic Fields And Transmission Lines	ECE
2	VR 25	II-II	Analog and Digital Communications	ECE
3	VR 25	II-II	Electronic Circuit Analysis	ECE
4	VR 25	II-II	Linear And Digital IC Applications	ECE
5	VR 25	II-II	Analog and Digital Communications Lab	ECE
6	VR 25	II-II	Electronic Circuit Analysis Lab	ECE
7	VR 25	II-II	Linear and Digital IC Applications Lab	ECE

VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN
B. Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE – VR25

II B. Tech. – I Semester

S.No.	Course Code	Course	L	T	P	Credits
1	25EC301PC	Probability Theory and Stochastic Processes	3	0	0	3
2	25EC302PC	Signals and Systems	3	0	0	3
3	25EC303PC	Electronic Devices and Circuits	3	0	0	3
4	25EC304PC	Digital Logic Design	3	0	0	3
5	25EC305PC	Control Systems	2	0	0	2
6	25MS306BS	Innovation and Entrepreneurship	2	0	0	2
7	25EC307PC	Modelling and Simulation Lab	0	0	2	1
8	25EC308PC	Electronic Devices and Circuits Lab	0	0	2	1
9	25EC309PC	Digital Logic Design Lab	0	0	2	1
10	25CS310SD	Linux and Shell Scripting	0	0	2	1
11	25VA311BS	Environmental Science	1	0	0	1
Total			17	0	08	21

II B. Tech. - II Semester

S.No.	Course Code	Course	L	T	P	Credits
1	25MA401BS	Numerical Methods and Complex Variables	3	0	0	3
2	25EC402PC	Electromagnetic Fields and Transmission Lines	3	0	0	3
3	25EC403PC	Analog and Digital Communications	3	0	0	3
4	25EC404PC	Electronic Circuit Analysis	3	0	0	3
5	25EC405PC	Linear and Digital IC Applications	3	0	0	3
6	25MA406BS	Computational Mathematics Lab	0	0	2	1
7	25EC407PC	Analog and Digital Communications Lab	0	0	2	1
8	25EC408PC	Electronic Circuit Analysis Lab	0	0	2	1
9	25EC409PC	Linear and Digital IC Applications Lab	0	0	2	1
10	25IT410SD	Web and Mobile Applications	0	0	2	1
Total			15	0	10	20

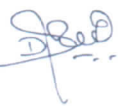
Note: L - Theory

T - Tutorial

P - Practical

C - Credits

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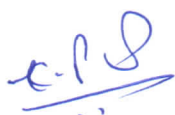
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Annexure

III

B.Tech.ECE

L T P C

II Year-I Semester

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PROBABILITY THEORY AND STOCHASTIC PROCESSES

Prerequisite: Mathematics

Course Objectives:

- This gives basic understanding of random variables and operations that can be performed on them.
- To know the Spectral and temporal characteristics of Random Process.
- To Learn the Basic concepts of Information theory Noise sources and its representation for understanding its characteristics.

Course Outcomes: Upon completing this course, the student will be able to

- Perform operations on single and multiple Random variables.
- Determine the Spectral and temporal characteristics of Random Signals.
- Characterize LTI systems driven by stationary random process by using ACFs and PSDs.
- Understand the concepts of Noise and Information theory in Communication systems..
- Analyze the properties of stochastic processes, such as correlation, covariance, and spectral density

UNIT-I: Probability

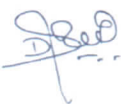
Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events. Random Variables- Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties..

UNIT-II: Operations on single Random Variable

Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable - Monotonic and Non-monotonic Transformations of Continuous and Discrete Random Variable, Computer generation of a Random Variable of a given PDF/CDF.

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UNIT-III: Multiple random variables and Operations on Multiple random variables

Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density– Point and Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem, Equal and Unequal Distribution (Proof not expected). Expected Value of a Function of Random Variables- Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT-IV: Random processes – Temporal characteristics

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean- Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross- Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT-V: Random processes – Spectral characteristics

The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

Noise sources: Resistive / Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.

Text Books:

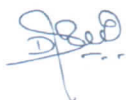
1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles - TMH, 4th Edition
2. Murray R Spiegel, John Schiller, R Alu Srinivasan. – Probability and Statistics – Schaum's Outlines, 2nd Edition, TMH

Reference Books:

1. P Ramesh Babu - Probability Theory and Random Processes – McGraw Hill Education
2. Athanasios Papoulis and S. Unnikrishnan Pillai - Probability, Random Variables and Stochastic Processes – McGraw Hill Education, 4th Edition
3. K. N. Hari Bhat, K. Anitha Sheela and Jayant Ganguly - Probability Theory and Stochastic Processes for Engineers - Pearson, 1st Edition, 2011
4. Taub and Schilling - Principles of Communication systems by (TMH), 2008
Y Mallikarjuna Reddy - Probability Theory and Stochastic Processes, 4th Edition, University Press.

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B.Tech.ECE	L	T	P	C
II Year-I Semester	3	0	0	3

SIGNALS AND SYSTEMS

Prerequisite: Mathematics

Course Objectives: This subject gives the basics of Signals and Systems required for all Electrical Engineering related courses. The objectives of this subject are to:

- Classify signals and systems and their analysis in time and frequency domains.
- Study the concepts of distortion less transmission through LTI Systems, convolution and correlation properties.
- Understand Laplace and Z-transforms their properties for analysis of signals and systems.
- Identify the need for sampling of CT signals, types and merits and demerits of each type

Course Outcomes: Upon completing this course, the student will be able to:

- Characterize various signals, systems and their time and frequency domain analysis, using transform techniques.
- Identify the conditions for transmission of signals through systems and conditions for physical realization of systems
- Understand the significance of sampling theorem for baseband and band-pass signals for various types of sampling and for different duty cycles
- Understand the concept of correlation and PSD functions and their applications.
- Use sampling theorem for baseband and band-pass signals for various types of sampling and for different duty cycles

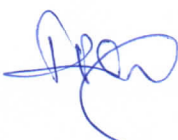
UNIT-I: Signal Analysis

Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

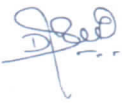
UNIT-II: Fourier series

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

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UNIT-III: Signal Transmission through Linear Systems

Linear System, Impulse response, Response of a Linear System, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. Extraction of Signal from Noise by Filtering. Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and risetime. Extraction of Signal from Noise by Filtering.

UNIT-IV: Laplace Transforms

Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

Correlation: Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Parseval's Theorem, Detection of Periodic Signals in the presence of Noise by Correlation.

UNIT-V: Sampling theorem

Graphical and analytical proof of Sampling Theorem for Base band/Band Limited and Band Pass Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing

Z-Transforms: Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

Text Books:

1. Signals, Systems & Communications -B.P. Lathi, BS Publications.
2. Signals and Systems – Allan. V. Oppenheim, Allan. S. Willsky with S. Hamid. Nawab, 2nd Ed. Pearson.

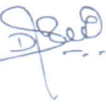
Reference Books:

1. Signals and Systems–Simon Haykin, Barry Van Veen, 2nd Ed., Wiley.
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH.
3. Fundamentals of Signals and Systems – Michel J. Roberts, Govind Sharma, 2nd Ed., MGH.
4. Signals, Systems and Transforms - Charles. L. Philips, John M. Parr and Eve A. Riskin, 4th Ed., 2004, Pearson, Prentice Hall.



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B.Tech.ECE

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II Year-I Semester

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ELECTRONIC DEVICES AND CIRCUITS

Prerequisite: Mathematics

Course Overview:

This course introduces fundamental semiconductor devices and their behavior, including diodes, BJTs, and FETs. It covers their characteristics, applications, and the analysis of basic electronic circuits. The course also explores rectifiers, voltage regulation, amplifier design, and advanced semiconductor technologies like Fin FETs and CNTFETs. Emphasis is placed on developing a strong foundation for analog circuit design and understanding modern device technologies in electronics.

Course Outcomes: By the end of this course, students will be able to:

CO1: Analyze the electrical characteristics and models of semiconductor diodes and apply them in rectifier and clipping circuits.

CO2: Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) and analyze their input and output characteristics.

CO3: Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications.

CO4: Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations.

CO5: Analyze the structure, working, and characteristics of JFETs, MOSFETs, and advanced devices like Fin FETs and CNTFETs, and compare modern device technologies.

UNIT-I: Diode Characteristics and Applications

PN junction diode – I-V characteristics, Diode resistance and capacitance, Diode models (Ideal, Simplified, Piecewise Linear), Rectifiers – Half-wave, Full wave (Center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Zener diode – I-V characteristics and voltage regulation..

UNIT-II: Bipolar Junction Transistor (BJT)

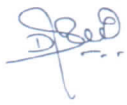
Structure and working principle of BJT, Current components and transistor action, Configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input and output characteristics, Determination of h-parameters from transistor characteristics.

UNIT-III: BJT Biasing

Need for biasing and stabilization, Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway

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UNIT-IV: Transistor Amplifiers

Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor., Detection of Periodic Signals in the presence of Noise by Correlation

UNIT-V: Special Purpose Diodes

Principle of Operation of – SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode

Field Effect Transistors and Advanced Devices: JFET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion modes – Structure, operation, and characteristics, Advanced Devices: Fin FETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. Fin FET vs. CNTFET..

Text Books:

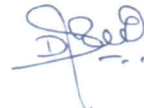
1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. Tata McGraw-Hill, 1991.
2. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. Pearson, 11th ed., 2013.
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. Oxford University Press, 7th ed., 2014.

Reference Books:

1. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 5th ed., 2008.
2. Neamen, Donald A. Electronic Circuit Analysis and Design. McGraw-Hill, 2nd ed., 2001.
3. Salivahanan, S., and N. Suresh Kumar. Electronic Devices and Circuits. McGraw-Hill Education, 4th ed., 2017
4. Razavi, Behzad. Fundamentals of Microelectronics. Wiley, 2nd ed., 2013.
5. Taur, Yuan, and Tak H. Ning. Fundamentals of Modern VLSI Devices. Cambridge University Press, 2nd ed., 2009

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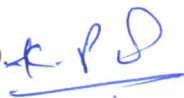
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B.Tech.ECE

L T P C

II Year-I Semester

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DIGITAL LOGIC DESIGN

Course Overview:

This course introduces students to the fundamental principles of digital logic design. Starting from Boolean algebra and its simplification techniques, it covers the formal analysis and design of combinational and sequential circuits. Additionally, the course addresses memory elements and programmable logic devices, which are essential building blocks for complex digital systems

Course Outcomes: Upon completion, students will be able to:

- Apply Boolean algebra and minimization techniques to simplify Boolean functions.
- Design combinational circuits using logic gates.
- Analyze latches and flip-flops to design sequential logic circuits.
- Construct synchronous sequential circuits combining flip-flops and logic gates. CO5: Utilize programmable logic devices in digital system design
- Basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems

UNIT-I: Number Systems

Binary, Octal, Decimal, Hexadecimal, Fixed-point and Floating-point Number Representations, Complements of Numbers: 1's and 2's Complement, Error Detection and Correction Codes: Parity Check, Hamming Code.

Boolean Algebra and Logic Gates: Axiomatic definitions, basic theorems and properties, Boolean Functions: Canonical and standard forms, Digital Logic Gates Overview.

UNIT-II: Gate-Level Minimization Techniques

Karnaugh maps: 2, 3, and 4 variables, Sum-of-products (SOP) and product-of-sums (POS) simplification, Don't care conditions, Implementation using NAND and NOR gates..

UNIT-III: Combinational Logic Circuits

Analysis and design procedures, Binary adder-subtractor and BCD adder, magnitude comparator, decoders, encoders, multiplexers and demultiplexers.

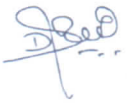
UNIT-IV: Sequential Logic Circuits

Gated latches, Flip-flops: Clocked S-R, D, T, JK, Master-Slave JK, Design of synchronous and asynchronous counters, Shift registers: types and applications.

UNIT-V: Synchronous Sequential Logic

Moore and Mealy state machines, State diagrams, state tables, and state reduction, Case studies: sequence detector, traffic light controller, vending machine.

Programmable Logic Devices: Memory devices - RAM, ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

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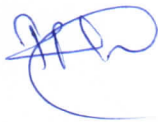
Text Books:

1. M. Morris Mano, Michael D. Ciletti, Digital Design with an Introduction to the Verilog HDL, 6th Edition, Pearson Education/PHI, 2017.

Reference Books:

1. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital Systems: Principles and Applications, 10th Edition, Pearson Education.
2. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, 6th Edition, Cengage Learning.

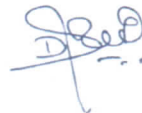
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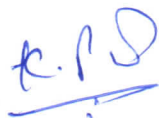
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B.Tech.ECE

L T P C

II Year-I Semester

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CONTROL SYSTEMS

Pre-Requisites: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

Course Objectives:

- To introduce the fundamental concepts, classifications, and mathematical modeling of control systems for mechanical and electrical domains.
- To analyze control system behavior in time and frequency domains and stability criteria using root locus, Bode plot, Nyquist plot, etc.
- Design and evaluate compensators and controllers to improve system performance.
- Explain state-space representation, solution of state equations, and assess system controllability and observability.

Course Outcomes: Upon completion of this Course, the students will be able to:

- Describe open- and closed-loop systems and develop mathematical models using block diagrams and signal flow graphs.
- Analyze time response of second-order systems using time-domain specifications and assess stability using Routh-Hurwitz criterion and root locus techniques.
- Analyze frequency response plots including Bode, Polar, and Nyquist plots, and investigate system stability.
- Design compensators and controllers to meet specific performance criteria in control systems.
- Apply the state-variable approach and analyze controllability and observability.

UNIT-I: Control System fundamentals

Classification of control systems, Open and Closed loop systems. Mathematical modelling of mechanical systems and their conversion into electrical systems. Block diagram reduction and Signal flow graphs.

UNIT-II: Time response Analysis

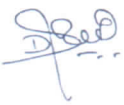
Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability. Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

UNIT-III: Frequency response Analysis

Frequency domain specifications, bode plots, Gain margin and Phase Margin. Polar plot, Nyquist plot, and Nyquist criterion for stability.

UNIT-IV: Compensators and controllers

Introduction to compensators, Lag compensator, Lead. compensator, Lag- Lead compensator, Design of compensators using bode plot. Introduction to controllers, P, I, D, PI, PD, PID controllers.

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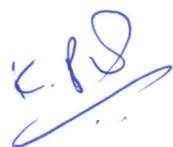
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UNIT-V: State space representation

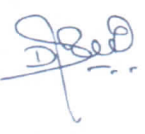
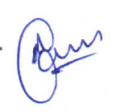
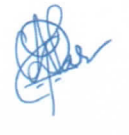
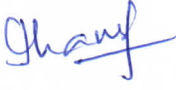
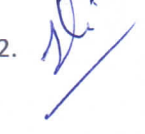
Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and observability.

Text Books:

1. I.J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009.
2. Benjamin C. Kuo, Automatic Control Systems, 7ed., PHI, 2010.

Reference Books:

1. K. Ogata, Modern Control Engineering, 2ed., Prentice Hall, 2010.
2. M. Gopal, Control Systems: Principles and Design, Tata McGraw-Hill, 1997.
3. Norman S. Nise, Control Systems Engineering, 5ed., John Wiley & Sons, 2007.
4. A.K. Jairath, Solutions and Problems of Control Systems, CBS Publishers, 2013.
5. A. Nagoor Kani, Control Systems, 2ed., RBA Publications, 2007.

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B.Tech. CSE & ECE

L T P C

II Year - I Semester

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INNOVATION AND ENTREPRENEURSHIP
(Common for CSE & ECE)**Course Objectives:**

- To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
- To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
- To initiate prototype development and understand minimum viable products.
- To develop initial Business and financial planning and Go-to-Market strategies.
- To impart knowledge on establishing startups, venture pitching and IPR.

Course Outcomes: The student will learn

- Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
- Assess the problem from an industry perspective and generate solutions using the design thinking principles.
- Assess market competition, estimate market size, and develop a prototype.
- Analyze Business and financial planning models and Go-to-Market strategies.
- Able to build a start-up, register IP and identify funding opportunities.

UNIT - I: Fundamentals of Innovation and Entrepreneurship

Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation. Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus. Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity.

UNIT - II: Problem and Customer Identification:

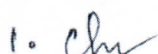
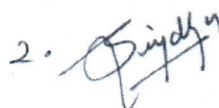
Identification of gap, problem, analyzing the problem from an industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model. Idea generation, Ideation techniques: Brainstorming, Brain writing, round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem. Core Teaching Tool: Several types of activities including Class, game, Gen AI, Get out of the building' and Venture Activity.

UNIT - III: Opportunity assessment and Prototype development:

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity. Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation. Core Teaching Tool: Venture Activity, No-code Innovation Tools, Class activity

UNIT - IV: Business & Financial Models:

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach –

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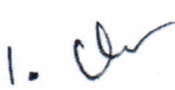
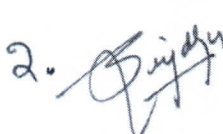
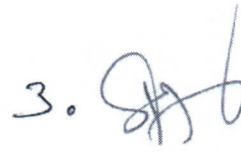
Selecting the Right Channel, creating digital presence, and building customer acquisition strategy. Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

UNIT - V: Startups and IPR:

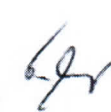
Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features. Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology. Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities

Reference Books:

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Startup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
6. NISP -Brochure inside pages - startup_policy_2019.pdf

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5. Sridhar 6. Sridhar 7. Limala 8. Niru

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B.Tech.ECE

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II Year-I Semester

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MODELLING & SIMULATION LAB

Note:

- Minimum of 12 experiments are to be completed / simulated.
- All the experiments are to be simulated using MATLAB or equivalent software

Course outcomes:

- Will be able to use a simulation tool for generating, analyzing and performing various operations on Signals / Sequences both in time and Frequency domain
- Will be able to use a simulation tool for Analyzing and Characterizing Continuous and Discrete Time Systems both in Time and Frequency domain along with the concept of Sampling
- Will be able to use a simulation tool for generating different Random Signals; analyzing their Characteristics by finding different higher order Moments and noise removal applications
- Will be able to use a Simulink for Control System applications

List of Experiments:

Signals and Systems (Minimum 7 Experiments)

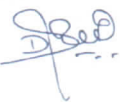
1. Write the code / script for generating various standard viz: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using Waveform synthesis. Also, for perform different operations viz: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them.
2. Write the code / script for finding the Even and Odd parts of Signal / Sequence and Real and Imaginary parts of Signal.
3. Write the code / script for finding the output of a System for a given input and Impulse Response and finding Auto Correlation and Cross Correlation of Signals / sequences
4. Write the code / script for Verifying whether a given Continuous/Discrete System is Linear, Time Invariant, Stable and Physically Realizable
5. Write the code / script for obtaining Sinusoidal response and Impulse response of a given Continuous / Discrete LTI System.
 - a) Plot the Real and Imaginary part and
 - b) Magnitude and Phase Plot of the response
6. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Fourier Transform by using the properties wherever required.
7. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Laplace Transform by using the properties where ever required. Also plot pole-zero diagram in S-plane

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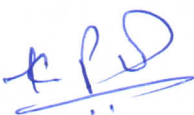
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8. Write the code/ script for finding and plotting the Magnitude and Phase Spectrum of any given Sequence by finding its Z-Transform by using the properties wherever required. Also plot pole – zero diagram in Z-plane
9. Design a Simulink or equivalent model for
 - a) Solving Differential Equations
 - b) Finding the response of any RLC Circuit with different initial Conditions for AC and DC inputs and plot the corresponding responses.
10. Gibbs Phenomenon and waveform synthesis

Probability Theory and Stochastic Processes (Minimum 3 Experiments)

11. Write the code / script for generating various Random Variables with different CDFs/ PDFs
12. Write the code / script for generating Gaussian noise and for finding its mean, Skewness, Kurtosis, PDF and PSD.
13. Write the code / script for Verifying Sampling theorem for different sampling rates, Sampling types and Duty Cycles and for plotting the sampled and reconstructed Signals.
14. Write the code / script for Removal of noise from the signal using Cross correlation.
15. Write the code / script for Extraction of Periodic Signal masked by noise using Auto Correlation

Control Systems (Minimum 2 Experiments)

16. Build and Simulate a DC Motor using Simulink
17. Implementation of a PID Controller from equations using Simulink
18. Controllability and Observability

Note: For the experiments with code/scripts written in MATLAB or equivalent (1-8, 11-15), the student can design a user interface or app using MATLAB App Designer or equivalent.

Application on Real Time signals

1. Application of Autocorrelation: GPS Synchronization Satellite communication toolbox is required for this experiment.

Generate the GPS signal. Visualize the GPS signal. Plot of autocorrelation of C/A code and visualize the spectrum of GPS signals. For exact steps, go through the following page:

<https://www.mathworks.com/help/satcom/ug/gps-waveform-generation.html>

2. Sampling of Speech Signals

Record and play speech in MATLAB. For steps, go through the following page:
https://in.mathworks.com/help/matlab/import_export/record-and-play-audio.html

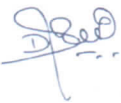
Change the sampling rate of the recorded speech signal and play back to see the effect of aliasing. For steps, go through the following page:

<https://in.mathworks.com/help/signal/ug/changing-signal-sample-rate.html>

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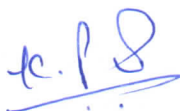
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B.Tech.ECE

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II Year I Semester

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ELECTRONIC DEVICES AND CIRCUITS LAB**Course overview:**

This laboratory course aims to provide hands-on experience and simulation-based learning of semiconductor devices and basic electronic circuits. Students will analyze the characteristics and applications of diodes, BJTs, and FETs, design rectifiers and amplifiers, and simulate modern electronic circuits using software tools. The course bridges theoretical concepts with practical implementation, developing foundational skills essential for analog electronics and circuit analysis.

Course Outcomes (COs): By the end of this course, students will be able to:

CO1: Analyze the I–V characteristics of semiconductor devices such as diodes, BJTs, and FETs.

CO2: Design and evaluate basic rectifier, clipper, clamper, and voltage regulation circuits.

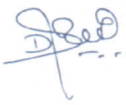
CO3: Demonstrate biasing techniques for BJTs and determine their operating point using DC load line analysis.

CO4: Design and analyze transistor amplifier circuits in various configurations using h-parameter models.

CO5: Simulate and interpret electronic circuits using appropriate simulation tools.

List of Experiments**A. Hardware-Based Experiments (7):**

1. Study the I–V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
2. Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.
3. Design and analyze half-wave and full-wave rectifiers (center-tap and bridge) with and without capacitor filters to evaluate ripple factor and output voltage.
4. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
5. Plot the input and output characteristics of a BJT in common emitter configuration to determine input/output resistance and current gain.
6. Design and test fixed bias and voltage divider bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior.
7. Construct and analyze a Common Base (CB) configuration of a BJT to study input-output characteristics and determine current gain (α) and input/output resistance.

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B. Software-Based Simulation Experiments (7):

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.
3. Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on voltage gain and signal amplification.
4. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.
5. Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and trans conductance.
6. Simulate the characteristics of a MOSFET and design a CMOS inverter to study digital switching behavior and low-power logic design.
7. Simulate the transfer and output characteristics of an enhancement-mode NMOS transistor to analyze threshold voltage, drain current, and switching behavior.

Hardware Requirements:

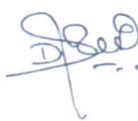
1. Regulated DC Power Supply (0–30V)
2. Function Generator
3. Digital Multimeter
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Resistors, Capacitors, Diodes (1N4007, Zener Diodes)
7. BJTs (e.g., BC107, 2N2222), JFETs (e.g., J201), MOSFETs (e.g., IRF540N)
8. Trainer Kits (optional but preferred for ease)

Software Requirements (Any one of the listed tools or equivalent):

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Proteus Design Suite (Simulation and PCB Design)
4. TINA-TI (Free from Texas Instruments)
5. PSPICE for TI or OrCAD Lite
6. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

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II Year I Semester

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DIGITAL LOGIC DESIGN LABARATORY

Course Overview:

This laboratory course provides hands-on experience with the design, analysis, and simulation of digital circuits. Students begin by constructing and testing basic digital components using logic gate ICs, covering Boolean minimization, arithmetic circuits, code converters, and combinational building blocks. The second part focuses on implementing equivalent and advanced designs using Verilog HDL, exploring various modeling styles—dataflow, behavioral, and structural—along with simulation tools. The course emphasizes both foundational logic principles and modern digital system development practices.

Course Outcomes (COs): After completing this course, students will be able to:

CO1: Analyze and simplify Boolean expressions and implement them using logic gates and ICs.

CO2: Design and realize combinational and sequential logic circuits using logic gate hardware.

CO3: Model digital systems in Verilog HDL using dataflow, behavioral, and structural styles.

CO4: Simulate and verify digital designs using industry-standard EDA tools and test benches.

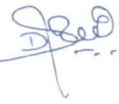
CO5: Build modular and hierarchical designs such as counters, FSMs, and shift registers.

List of Experiments:

A. Realization in Hardware Laboratory (Using Logic ICs)

These are fundamental hands-on experiments conducted using logic ICs such as AND, OR, NOT, NAND, NOR XOR gates, flip-flops, multiplexers, and decoders.

1. Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.
2. Design and implement Half Adder, Full Adder, Half Subtractor, and Full Subtractor using logic gates.
3. Construct and analyze basic logic gates (AND, OR, NOT, XOR, XNOR) using only NAND and NOR gates.
4. Design and implement parity bit generators (even and odd) and a 4-input majority logic circuit.
5. Design and implement code converters such as Binary to Gray, Gray to Binary, and BCD to Excess-3 using gates
6. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and 7segment decoder logic

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B. Verilog HDL-Based Digital Design Experiments (Simulation-Based)

These experiments are implemented using **Verilog HDL** with different modeling styles (dataflow, behavioral, structural) and simulated using tools like **Vivado**, **ModelSim**, or **Xilinx ISE**.

1. Design and simulate a 2-bit comparator using dataflow modeling; extend it to 4-bit using structural modeling.
2. Implement a 2:1 multiplexer using dataflow modeling and design an 8:1 multiplexer using structural modeling.
3. Design a 2-to-4 decoder using dataflow modeling and realize a 3-to-8 decoder using structural modeling.
4. Implement a given Boolean function using a decoder-based approach in behavioral modeling.
5. Design and simulate a universal n-bit shift register (left, right, hold, parallel load) using behavioural modeling.
6. Design a synchronous MOD-n counter using behavioral modeling with D or JK flip-flops.
7. Design and simulate an asynchronous (ripple) counter for a custom sequence using structural modeling.
8. Implement a sequence detector for a given binary pattern using FSM (Moore/Mealy) in behavioral modeling.

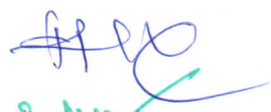
Required Hardware (for Hardware Lab Experiments)

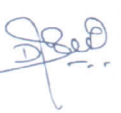
Component	Description
Digital Trainer Kit	Breadboard with power supply and clock generator
Logic ICs	7400 (NAND), 7402 (NOR), 7408 (AND), 7432 (OR), 7486 (XOR), 7404 (NOT), etc.
Flip-Flop ICs	7474 (D Flip-Flop), 7476 (JK Flip-Flop)
MUX/Decoder ICs	74153, 74138, 74139
LEDs, switches, connecting wires	For I/O interface and testing

Required Software Tools (for Verilog HDL Experiments) (Any one of the tool below)

Software Purpose	Description
Xilinx Vivado	HDL simulation and synthesis (preferred tool)
ModelSim	Verilog simulation and waveform analysis
Xilinx ISE	Legacy support for simulation and FPGA design



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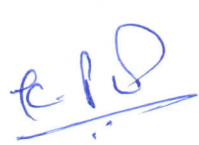
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B.Tech. ECE

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II Year-I Semester

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LINUX AND SHELL SCRIPTING**Course Outcomes:** By the end of the course, students will be able to:

- **CO1:** Understand Linux system structure, OS architecture, and command-line environment.
- **CO2:** Perform Linux installation and basic administration including file, user, and permission management.
- **CO3:** Develop shell scripts to automate tasks such as backups, monitoring, and data processing.
- **CO4:** Use Linux tools for software management, networking, and service configuration.
- **CO5:** Implement backup, recovery, and basic troubleshooting techniques through practical labs.

Week 1: Introduction to OS Concepts

Lab Activity: Linux History, Open source software basics & Licenses, Why Linux vs windows Identify system and application software on your PC. Differentiate their roles and explain basic OS functions.

Week 2: Linux Architecture & Kernel Types

Lab Activity: Compare Monolithic and Microkernel architectures using diagrams. Discuss how Linux's structure supports device-level control.

Week 3: Installing Linux (Ubuntu/CentOS)

Lab Activity: Install Linux using Virtual Box or WSL. Document each installation step and trouble shoot any permission or hardware issues.

Week 4: Linux Filesystem & Navigation

Lab Activity: Navigate key directories like /home, /etc, and /var. Create folder structures for a team project.

Week 5: File Permissions & Ownership

Lab Activity: Set permissions on project folders so only group members can access/edit them. Verify permissions using multiple users.

Week 6: User and Group Management

Lab Activity: Create users and groups for a coding team. Set up shared access using group permissions and configure hidden config files.

Week 7: Process Management

Lab Activity: Identify and terminate frozen or unresponsive processes during compilation using commands like ps and top.

Week 8: Process Priorities & Memory Tools

Lab Activity: Adjust priority of background jobs using nice and monitor system memory usage with vmstat and free. Display information about the processes using top and kill the applications/processes with the task id

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Week 9: Shell Scripting Basics

Use Case: System Info Script for Lab Login

Lab Activity:

Create a shell script that automatically displays system uptime, current date/time, available disk space, and active users each time a lab user logs in. Use variables and echo statements to present the information in a readable format.

Week 10: Loops, Functions, and Cron Jobs

Use Case: Automated Backup Scheduler for Project Folders

Lab Activity:

Write a shell script that loops through all user folders in /home and backs them up to a predefined backup location. Add functions for logging success/failure. Schedule it to run daily at 2 AM using cron. Handle missing folders gracefully.

Week 11: Package Management & Archiving

Use Case: Setting Up Developer Environment + Archiving a Project

Lab Activity:

Use apt (Ubuntu) or yum (CentOS) to install essential tools like vim, curl, or git. Archive a project directory using tar or zip. Use sha256sum to verify archive integrity before transferring it to another system.

Installation of applications using apt, apt-get, yum, dnf, snap, or brew commands. Setup python virtual environment

Week 12: Text Processing & Networking Utilities

Use Case: Security Log Analysis & Network Check After Intrusion Alert

Lab Activity:

Analyze /var/log/auth.log or /var/log/secure to detect failed login attempts using grep, awk, cut, and sort. Use ping, traceroute, netstat, nbtstat, arp and scp to check remote system connectivity and transfer reports securely.

Concepts of Linux clusters, Virtual machines (virtual box in chapter 3), creating VMs, allocating resources, interconnection between VMs, Containers concepts

Week 13: Service Management & Disk Mounting

Use Case: Adding Extra Storage Without Reboot

Lab Activity:

Create a new virtual disk in Virtual Box. Partition and format it. Mount it to /mnt/data and ensure it auto-mounts on reboot. Enable a required service (like ssh or apache2) using system ctl and check its status.

Week 14: Backup & Recovery

Use Case: Disaster Recovery After Accidental Deletion

Lab Activity:

Use a backup script to create a backup of critical folders. Simulate file deletion and restore them using your backup. Analyze /var/log/syslog or equivalent to trace user activity that led to the issue.

Week 15: Mini Project – Tool Development

Use Case: Custom Shell Tool for New Employee Onboarding or Admin Task

Lab Activity:

Develop a complete shell-based tool. Examples:

- A user account creation wizard for new employees
- A disk usage monitoring alert system
- A log cleaner tool that archives and clears logs weekly Include user prompts, help menu, error checks, and logging features.

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Week 16: Final Demo & Viva

Use Case: Present Your Solution to the Faculty Team

Lab Activity:

Demonstrate your mini project. Explain your code, how it solves the problem, test cases handled, and improvements you'd make. Submit your code with screenshots, logs, and a short user manual or README

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B.Tech.

II Year - I Semester

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ENVIRONMENTAL SCIENCE

(Common for CSE,ECE)

Course Objectives:

1. Understand the components, structure, and functions of ecosystems and their relevance to human society.
2. Comprehend classification, sustainable management, and challenges of natural resources including water, minerals, land, forests, and energy.
3. Grasp the significance, value, and conservation approaches for biodiversity, including threats and legislative frameworks.
4. Analyze types, sources, and impacts of environmental pollution, and learn technological and policy measures for pollution prevention and control.
5. Develop awareness about global environmental challenges, international agreements, and the role of policy, law, and Environmental Impact Assessment (EIA) in sustainable development.

Course Outcomes:

1. Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
2. Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
3. Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
4. Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
5. Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio-magnification, ecosystem value, services and carrying capacity.

UNIT-II

Natural Resources: Classification of Resources:, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source.

UNIT-III

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of

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biodiversity Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; In- Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: **Environmental Pollution:** Air Pollution: Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions/ Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. **EIA:** EIA structure, Overview on Impacts of air, water, biological and Socio-economical aspects. Sustainable development goals (SDGs); Environmental policies and international agreements, Environmental Impact of tyres, Batteries, and Plastics, concepts of Extended Producer Responsibility(EPR), Environmental Sustainable Governance (ESG).

Text Books:

1. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission
3. Environmental Studies by R. Rajagopalan, Oxford University Press.

Reference Books:

1. Environmental Science: towards a sustainable future by Richard T. Wright.2008. PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B.Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4thEdition, Newage international publishers.
5. Text book of Environmental Science and Technology-Dr.M.Anji Reddy 2007,BS Publications..

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Annexure

IV

25MA401BS

Vignan's Institute of Management and Technology for Women
An Autonomous Institution

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B.Tech. ECE

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II Year - II Semester

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Numerical Methods and Complex Variables**Course Objectives:**

- To understand the fundamentals of Fourier series and Fourier transforms and their role in solving engineering and scientific problems.
- Develop competence in numerical methods for solving algebraic, transcendental equations, interpolation, and integration problems.
- Apply numerical techniques to solve ordinary differential equations arising in engineering applications.
- Analyze the concepts of complex differentiation and analyticity to study properties of complex functions.
- Apply principles of complex integration and residue theory for evaluating integrals and analyzing singularities.

Course Outcomes: The student will learn to

- Demonstrate the ability to develop Fourier series and Fourier sine/cosine transforms for given functions and interpret their significance in engineering applications.
- Apply appropriate numerical techniques, including bisection, Newton-Raphson, Regula-Falsi, and interpolation methods, to solve algebraic and transcendental equations.
- Implement standard numerical integration schemes and numerical methods to obtain approximate solutions of first-order ordinary differential equations.
- Analyze complex-valued functions for analyticity and harmonic properties using Cauchy-Riemann equations and determine the corresponding harmonic conjugates.
- Evaluate complex integrals and examine the nature of singularities using Taylor series, Laurent series, and the residue theorem.

UNIT-I: Fourier Series & Fourier Transforms

8 L

Fourier series – Dirichlet's Conditions – Half-range Fourier series – Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

UNIT-II: Numerical Methods-I

10 L

Solution of polynomial and transcendental equations: Bisection method – Iteration Method – Newton Raphson method and Regula-Falsi method. Finite differences: forward differences – backward difference – central differences – symbolic relations – Interpolation using Newton's forward and backward difference formulae – Lagrange's method of interpolation.

UNIT-III: Numerical Methods-II

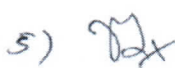
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Numerical integration: Trapezoidal rule - Simpson's 1/3rd and 3/8th rules. Ordinary differential equations: Taylor's series – Euler's method – Runge-Kutta method of fourth order for first order ODE.

UNIT-IV: Complex Differentiation

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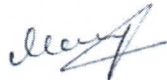
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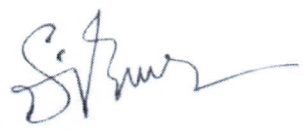
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Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne-Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT-V: Complex Integration

10 L

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue theorem (All theorems without Proof).

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books:

1. Murray R. Spiegel, Ph.D., Seymour Lipschutz, Ph.D., John J. Schiller, Ph.D., Dennis Spellman, Ph.D., Complex Variables (Schaum's outline).
2. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

1) Grewal 2) Sastry 3) ~~Spiegel~~ 4) ~~Spiegel~~

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B.Tech.ECE

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II Year-II Semester

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ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

Prerequisite: Mathematics

Course Objectives:

- To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields and apply them to solve physics and engineering problems.
- To distinguish between static and time-varying fields and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to Communication engineering problems.
- To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
- To analyze the propagation of waves in transmission line and able to solve transmission line problem using Smith Chart.

Course Outcomes: Upon completing this course, the student will be able to

- Acquiring knowledge of Basic Laws, Concepts and Solving problems related to Electrostatic Fields and Magnetostatics Fields.
- Differentiate the static and time-varying EM fields and apply Maxwell's Equations at different Boundaries.
- Able to classify conductors and dielectric materials and analyze the Wave Propagations in those mediums.
- To solve transmission line problems numerically and using smith charts.
- Analyze the Design aspect of transmission line parameters and configurations

UNIT-I: Electrostatics

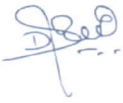
Review of Coordinate Systems & Vector Calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and its applications, Electric Potential, Relation between E and V, Maxwell's Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitors–Parallel Plate, Coaxial, Spherical.

UNIT-II: Magneto statics

Biot-Savart's Law, Ampere's Circuit Law and its applications, Magnetic Flux Density, Maxwell's equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

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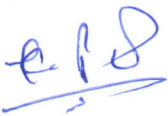
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UNIT-III: Maxwell's Equations (Time Varying Fields)

Faraday's Law, Transformer and Motional EMF, Inconsistency in Ampere's Law and Displacement Current Density, Maxwell's Equations in Differential, Integral and Phasor form. Electric and magnetic Boundary Conditions (Dielectric – Dielectric, Conductor– Dielectric, Conductor– Free Space interfaces).

UNIT-IV: EM Wave Characteristics

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves– Definitions, Relation between E&H, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin Depth, Surface Impedance, Wave Polarization. Poynting Vector and Poynting Theorem.

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection,

UNIT-V: Transmission Lines

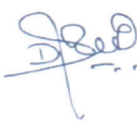
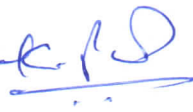
Types, Parameters, Equivalent Circuit, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless Lines, Types of Distortions, condition for Distortion less transmission lines, Minimum Attenuation, Loading – Types of Loading, Input Impedance, SC and OC Lines, Reflection Coefficient, VSWR, Impedance Transformations - $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines, Smith Chart-Configuration and Applications, Single Stub Matching.

Text Books:

1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 8th Ed., McGrawHill, 2014
2. Principles of Electromagnetics – Matthew N.O. Sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Asian Edition, 2015.

Reference Books:

1. Electromagnetic Waves and Radiating Systems–E.C. Jordan and K.G. Balmain, 2nd Ed., PHI, 2000.
2. Engineering Electromagnetics – Nathan Ida, 2nd Ed., Springer (India) Pvt. Ltd., New Delhi, 2005.
3. Electromagnetic Field Theory Fundamentals – Bhag Singh Guru and Hussey in R. Hizirolu, Cambridge University Press, 2nd Ed., 2006.

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B.Tech.ECE

II Year-II Semester

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ANALOG AND DIGITAL COMMUNICATIONS

Prerequisite: Signals and Systems

Course Objectives:

- To develop ability to analyze system requirements of analog and digital communication systems.
- To understand the generation, detection of various analog and digital modulation techniques.
- To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
- To understand the concepts of baseband transmissions.

Course Outcomes: Upon completing this course, the student will be able to:

- Design and analyze various Analog and digital Modulation and Demodulation techniques.
- Understand the effect of noise present in continuous wave Modulation techniques.
- Understand the concept of Super heterodyne Receiver and Pulse Modulation Techniques
- Analyze and design the various coding techniques and Base band Transmission.
- Acquire the knowledge of each block in AM, FM transmitters and receivers.

UNIT-I: Amplitude Modulation

Need for modulation, Amplitude Modulation: Time and frequency domain description, Generation – Switching modulator, Detection – Envelope detector, DSB-SC Modulation: Generation – Balanced Modulator, Detection- Synchronous detector, COSTAS Loop, SSB Modulation: Time and frequency domain description, Generation – Phase discrimination Method and Demodulation – coherent detection, Vestigial side band modulation and demodulation.

Angle Modulation

Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis, Carson's Rule, Generation of FM Waves- Armstrong Method, Detection of FM Waves - Phase locked loop, Comparison of FM and AM.

UNIT-II: Transmitters & Receivers

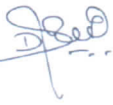
Classification of Transmitters, AM Transmitters, FM Transmitters, AM Receiver - Super heterodyne receiver, FM Receivers, Stereo FM multiplex reception, Comparison of AM and FM Receiver. Noise analysis in AM, DSB, SSB and FM Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis, and de-emphasis

Pulse Modulation

Types of Pulse modulation-PAM, PWM and PPM, Comparison of FDM and TDM..

UNIT-III: Detection and Estimation

Model of Digital Communication Systems, Geometric Interpretation of Signals, Gram-Schmidt Orthogonalization, Response of Bank of correlators to Noisy Input, Detection of Known Signals in Noise, Probability of error, Optimum Receivers Using Coherent Detection: Matched filter Receiver and its Properties, Correlation receiver, Detection of signals with unknown Phase in Noise Base Band Shaping for Data Transmission: Requirements of a line encoding format, various line encoding formats- Unipolar, Polar, Bipolar, Discrete PAM signals, Inter symbol interference, Nyquist criterion, Correlation coding: Duobinary signaling, Modified Duobinary technique, generalized form of correlation coding, Eye pattern.

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UNIT-IV: Digital Modulation Techniques:

PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM. Digital Modulation formats, Coherent binary modulation techniques (BPSK, BFSK), Coherent quadrature modulation techniques (QPSK), Non Coherent binary modulation techniques (BFSK, DPSK), QAM, M-ary modulation techniques (PSK, FSK, QAM), Comparison of M-ary digital modulation techniques, power spectra, bandwidth efficiency, constellation diagrams...

UNIT-V: Information theory

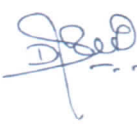
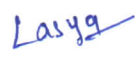
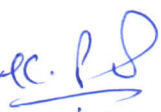
Entropy, Information rate, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade-off between bandwidth and SNR. Source coding - Huffman coding, Shannon Fano coding, Channel coding - Linear block codes and cyclic codes.

Text Books:

1. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, PHI, 2009.
2. Digital and Analog Communication System – K. Sam Shanmugam, Wiley, 2019.
3. Principles of Communication Systems - Herbert Taub, Donald L Schilling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008.

Reference Books:

1. Electronic Communications – Dennis Roddy and John Coolean, 4th Edition, PEA, 2004
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH, 2004
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5th edition, 2022

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B.Tech.ECE
II Year-II Semester

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ELECTRONIC CIRCUIT ANALYSIS**Course Overview:**

The Electronic Circuit Analysis course provides foundational and advanced knowledge in the design and analysis of analog electronic circuits. This includes the study of multistage amplifiers, feedback amplifiers, oscillators, power amplifiers, and multi vibrators. Emphasis is placed on frequency response, feedback theory, transistor behavior at high frequencies, and waveform generation techniques. The course equips students with the necessary analytical and practical skills required in analog circuit design and communication systems.

Course Outcomes: By the end of this course, students will be able to:

CO1: Analyze and classify multistage amplifier configurations and determine the impact of coupling schemes on amplifier performance and frequency response.

CO2: Apply the hybrid- π transistor model to evaluate high-frequency behavior of common-emitter amplifiers and calculate gain-bandwidth product.

CO3: Examine feedback amplifier types and assess the influence of negative feedback on gain stability, bandwidth, and distortion.

CO4: Design and analyze LC, RC, and crystal oscillators based on the Barkhausen criterion to generate sinusoidal waveforms.

CO5: Design power amplifiers and multivibrator circuits, and evaluate their performance in terms of efficiency, distortion, and waveform generation.

UNIT-I: Multistage Amplifiers:

Classification of Amplifiers, Distortion in Amplifiers, Coupling schemes: RC, Transformer, Direct coupling, Frequency response of multistage amplifiers, Transistor configuration choice in cascade amplifiers, Cascade and Cascode amplifiers, Darlington pair amplifier.

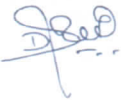
High-Frequency Transistor Model: Hybrid- π model, Hybrid- π parameters: Conductance and capacitances, CE short-circuit current gain, Gain with resistive load and gain-bandwidth product

UNIT-II: Feedback Amplifiers

Concept and need for feedback in amplifiers, Types and classification of feedback amplifiers, Characteristics of negative feedback: Gain stability, bandwidth, noise, distortion, Voltage series, Voltage shunt, Current series, Current shunt configurations.

UNIT-III: Oscillator

Principle of positive feedback, Barkhausen Criterion for oscillations, LC Oscillators: Generalized analysis, Hartley, Colpitts, RC Oscillators: RC phase shift, Wien bridge, Crystal oscillator: Working and advantages

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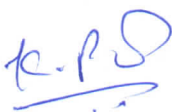
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UNIT-IV: Power Amplifiers

Classification: Class A, B, AB, C, Series-fed Class A amplifier, Transformer-coupled Class A amplifier, Class B amplifier: Push-pull, Complementary symmetry, Efficiency calculations and Cross over distortion.

UNIT-V: Multi vibrators

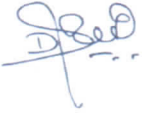
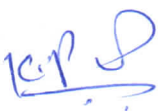
Analysis and design of Bistable, Monostable and A stable multi vibrators and Schmitt Trigger using transistors. Time Base Generators: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators, Linearity improvement techniques

Text Books:

1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. McGraw-Hill Education, 2008.
2. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 2008.
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. 7th ed., Oxford University Press, 2015.

Reference Books:

1. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. 11th ed., Pearson Education, 2013.
2. Millman, Jacob, and Arvin Grabel. Microelectronics. 2nd ed., McGraw-Hill, 1987.
3. Malvino, Albert Paul. Electronic Principles. 7th ed., McGraw-Hill Education, 2007.
4. Millman, Jacob, and Herbert Taub. Pulse, Digital, and Switching Waveforms. McGraw-Hill Education, 1991..

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B.Tech.ECE

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II Year-II Semester

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LINEAR AND DIGITAL IC APPLICATIONS

Prerequisites: Switching Theory and Logic Design.

Course Objectives: The main objectives of the course are:

- To introduce the basic building blocks of linear integrated circuits.
- To introduce the theory and applications of analog multipliers and PLL.
- To introduce the concepts of waveform generation and introduce some special function ICs.
- To understand and implement the working of basic digital circuits.

Course Outcomes: Upon completing this course, the student will be able to

- A thorough understanding of operational amplifiers with linear integrated circuits.
- Attain the knowledge of functional diagrams and design applications of IC555 and IC565.
- Acquire the knowledge and design the Data converters.
- Understanding of the different families of digital integrated circuits and their characteristics.

UNIT-I: Operational Amplifier

Ideal and Practical Op-Amp Characteristics, features of 741 Op- Amp, Modes of Operation -Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT-II: Op-Amp, IC-555 & IC565 Applications

Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and A stable Operations, Applications, IC565 PLL - Block Schematic, principle and Applications.

UNIT-III: Data Converters

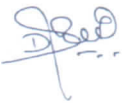
Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT- IV: Combinational Logic ICs

Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators..

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UNIT- V: Sequential Logic IC's and Memories

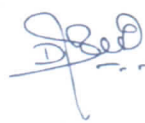
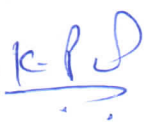
Familiarity with commonly available 74XX & CMOS40XX Series ICs– All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Text Books:

1. Op-Amps & Linear ICs– Ramakanth A. Gayakwad, PHI, 2003.
2. Digital Fundamentals –Floydand Jain, Pearson Education,8th Ed., 2005.

Reference Books:

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2ndEd., 2003.
2. Digital Design Principles and Practices–John. F. Wakerly, Pearson 3rd Ed., 2009.
3. Linear Integrated Circuits and Applications – Salivahana, TMH, 2008.
4. OperationalAmplifierswithLinearIntegratedCircuits,4th Ed., William D. Stanley, Pearson Education India, 2009.

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B.Tech.		L T P C
II Year - II Semester		0 0 2 1
	Computational Mathematics Lab (Common for ECE & CSE)	

Course Objectives:

- To Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
- To Solve Algebraic and Transcendental Equations using Python/MATLAB
- To Solve problems of Linear system of equations
- To Solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients.
- To Solve problems of Applied Statistics

Course Outcomes: The student will learn

- Calculate eigenvalues and eigenvectors of matrices and construct their geometric representations to explain how linear transformations scale and rotate vectors.
- Apply bracketing and open numerical methods to locate roots of nonlinear equations and illustrate the step-by-step convergence behavior graphically.
- Execute iterative algorithms for linear systems and analyze the rate of convergence by comparing graphical residuals between Jacobi and Gauss-Seidel methods.
- Model real-world physical systems use ordinary differential equations and evaluate their behavior through numerical solution plots (e.g., population growth or cooling).
- Appraise experimental data by deriving best-fit curves and correlation coefficients to quantify and visualize the strength of relationships between variables.

Visualize all solutions Graphically through programmes

UNIT - I: Eigen values and Eigenvectors: 6P

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT-II: Solution of Algebraic and Transcendental Equations 6P

Bisection method, Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

UNIT-III: Linear system of equations: 6P

Jacobi's iteration method and Gauss-Seidel iteration method

Programs:

- Solution of given system of linear equations using Jacobi's method
- Solution of given system of linear equations using Gauss-Seidel method

UNIT-IV: First-Order ODEs & Higher order LDE with constant coefficients 12P

Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.

Programs:

- Solving exact and non-exact equations

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- Solving exponential growth/decay and Newton's law of cooling problems
- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

UNIT-V: Applied Statistics

6P

Programs:

Curve Fitting – Straight Line & Second-Degree Curve
 Karl Pearson's Correlation Coefficient
 Regression Lines y on x & x on y
 Spearman's Rank Correlation (With & Without Ties)
 Combined Statistical Analysis

Textbooks:

1. MATLAB and its Applications in Engineering, **Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma**, Pearson publication.
2. **Kenneth A. Lambert**, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by **Allen B. Downey**, Orielly publishing.
4. Introduction to Python Programming, **William Mitchell, Povel Solin, Martin Novak et al.**, NCLab Public Computing, 2012.
5. Introduction to Python Programming, ©**Jacob Fredslund**, 2007.

Reference Books:

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

Minimum Requirement of Software & Hardware:

Computer Systems with Python/Scilab/MATLAB installed

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B.Tech.ECE

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II Year-II Semester

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ANALOG AND DIGITAL COMMUNICATIONS LAB

Course Outcomes:

- Will be able to design and implement various Analog modulation and demodulation Techniques and observe the time and frequency domain characteristics of these modulated Signals
- Will be able to design and implement various Pulse modulation and demodulation Techniques and observe the time and frequency domain characteristics of these modulated Signals
- Will be able to understand the concept of aliasing and different types of Sampling with various Sampling rates and duty Cycles by implementing practically
- Will be able to design and implement various Digital modulation and demodulation Techniques and observe the waveforms of these modulated Signals practically
- Apply time division multiplexing concepts in different pulse modulation techniques.

Note:

- Minimum 12 experiments should be conducted.
- All these experiments are to be simulated first either using MATLAB, Commsim or any other simulation package and then to be realized in hardware.

List of Experiments:

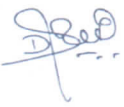
1. Generate Amplitude modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
2. Generate Frequency modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
3. Generate modulated and demodulate DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically
4. Generate and demodulate SSB-SC modulated Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate theoretically and practically the modulation index in each case
5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting at least 4 different signals simultaneously with respect to time and recovering without distortion.

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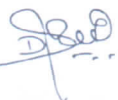
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6. Verify Sampling theorem for different sampling rates, Sampling types and Duty Cycles and Plot the sampled and reconstructed Signals. Write the conclusions, based on practical observations
7. Design and implement a Pulse Amplitude Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
8. Design and implement a Pulse Width Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
9. Design and implement a Pulse Position Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations..
10. Generate PCM Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations
11. Generate Delta Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
12. Generate FSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
13. Generate practically Binary PSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
14. Generate practically DPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
15. Generate practically QPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
16. Plot Signal Constellation for BPSK, BFSK and QPSK
17. Analyze the performance of BPSK, BFSK and QPSK under noisy environment through constellation diagram
18. Demonstrate ISI through eye diagram
19. Simulate raised cosine signal and duo binary signals
20. Encode data using Shannon Fano /Huffman Coding through Hardware / Simulator
21. Analyze the performance of a Matched filter.

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B.Tech.ECE

II Year-II Semester

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ELECTRONIC CIRCUIT ANALYSIS LAB

Course Overview:

The Electronic Circuit Analysis Laboratory is designed to provide hands-on experience in designing, building, and analyzing analog electronic circuits. It focuses on the practical implementation of amplifiers, oscillators, power amplifiers, multivibrators, and waveform generators using discrete components and simulation tools. The lab strengthens understanding of frequency response, gain, feedback, waveform shaping, and time base generation.

Course Outcomes (COs): Upon successful completion of this lab, students will be able to:

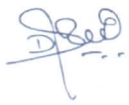
- Design and analyze multistage and power amplifiers and evaluate their frequency response and efficiency.
- Implement and examine feedback and oscillator circuits and validate theoretical conditions for sustained oscillations.
- Develop and interpret waveform generation circuits such as multivibrators and time base generators.
- Perform simulations to validate analog circuit performance using industry-standard software tools.
- Correlate practical results with theoretical predictions and identify deviations due to real-world constraints.

List of Experiments:

A. Hardware Experiments (7):

Perform practical design, implementation, and waveform analysis of amplifiers, oscillators, power stages, and multivibrators to validate theoretical concepts and observe real-world circuit behavior.

1. Design and analyze a two-stage RC coupled amplifier to demonstrate gain enhancement and study coupling capacitance effects.
2. Design Hartley and Colpitts oscillators for a specified frequency and observe their output waveforms.
3. Design an RC phase shift oscillator and derive the practical gain condition for oscillations at a given frequency.
4. Design a transformer-coupled class A power amplifier, observe input/output waveforms, and calculate efficiency.
5. Design a class B power amplifier, analyze input/output waveforms, and evaluate harmonic distortion.
6. Design a bistable multivibrator, analyze commutating capacitor effects, and record transistor waveforms.
7. Design an astable multivibrator and observe transistor base and collector waveforms.

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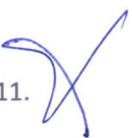
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B. Software Simulations (7):

Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:

1. Simulate four feedback amplifier topologies and compare their frequency responses with and without feedback.
2. Simulate a monostable multivibrator and analyze its input/output waveforms.
3. Simulate a Schmitt trigger for gain greater values than and less than one and analyze response behavior.
4. Simulate a bootstrap time base generator using BJT and observe the output sweep waveform.
5. Simulate a Miller sweep circuit using BJT and observe the time base output waveform.
6. Simulate a complementary symmetry push-pull amplifier and verify elimination of crossover distortion.
7. Simulate a single tuned amplifier and determine the quality factor (Q) of its tuned circuit.

Software Requirements:

Simulation Tools: LTspice / Multisim / PSpice / Proteus / NI Multisim Live or equivalent

Operating System: Windows 10/11 or Linux (Ubuntu preferred)

Hardware Requirements:

1. Dual Power Supply ($\pm 15\text{V}$, 0–30V)
2. Function Generator (up to 1 MHz)
3. CRO / DSO (Dual Channel, 20 MHz or more)
4. Digital Multimeters
5. Breadboards and Connecting Wires
6. BJTs: BC107, BC547, BC557, 2N2222, etc.
7. Resistors, Capacitors (Wide range of values)
8. Transformers (for power amplifiers)
9. Inductors, Crystals (1 MHz, 4 MHz, etc.)
10. Heat sinks, transistors for power stages (e.g., TIP41, TIP42 etc.)

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B.Tech.ECE

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II Year-II Semester

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LINEAR AND DIGITAL IC APPLICATIONS LAB

Course Outcomes:

- Design and implementation of various analog circuits using 741 ICs.
- Design and implementation of various Multivibrators using 555 timers
- Design and implement various circuits using digital ICs
- Design and implement ADC, DAC and voltage regulators.
- Design a Schmitt Trigger Circuit and find its LTP and UTP

Note:

- Minimum 12experiments should be conducted.
- Verify the functionality of the IC in the given application.

List of Experiments:

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op-Amp and draw the comparison results of $A=B$, $A<B$, $A>B$.
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHz and find the roll off of it.
6. Design a Circuit using IC741 to generate sine / square / triangular wave with period of 1 KHz and draw the output waveform.
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct A stable Multivibrator using IC 555 and draw its output waveform and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Frequency modulator and demodulator circuit and draw the respective waveforms.
11. Design Voltage Regulator using IC723, IC 7805 / 7809 / 7912 and find its load regulation factor.
12. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
13. Design Parallel comparator type / counter type / successive approximation ADC and find its efficiency.
14. Design a Gray code converter and verify its truth table.
15. Design an even priority encoder using IC74xx and verify its truth table.
16. Design a 8x1multiplexer using digital ICs.
17. Design a 4-bit Adder / Subtractor using digital ICs and Add / Sub the following bits.

(i) 1010

(ii) 0101

(iii) 1011

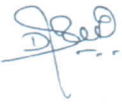
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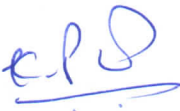
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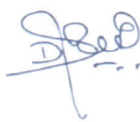
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18. Design a Decade counter and verify its truth table and draw respective waveforms.
19. Design a Up/downcounter using IC74163 and draw read/write waveforms.
20. Design a Universal shift register using IC74194 / 195 and verify its shifting operation.
21. Design a 16x4 RAM using 74189 and draw its read /write operation.
22. Design a 8x3 encoder / 3x8 decoder and verify its truth table.

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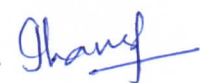
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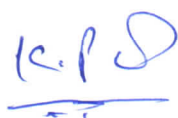
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Web and Mobile Applications

Course Outcomes: The student will learn

1. Understand and apply core web technologies (HTML, CSS, JavaScript) for structured, styled, and interactive webpages.
2. Build responsive websites using frameworks like Bootstrap and manage code using Git/GitHub.
3. Create simple server-side functionality using Node.js and store/retrieve data from basic databases.
4. Design and develop mobile applications using Flutter for Android and iOS.
5. Integrate web and mobile development into a functional mini-project with deployment.

Week 1: Introduction to the Web

Understand web architecture, clients, servers, and workflows. Explore an existing website's structure and elements using browser DevTools.

Week 2: HTML Basics

Learn about different markup languages and their significance. Create a homepage for a static site using paragraphs, headings, lists, links, and images.

Week 3: CSS – Layout & Design Foundations

Apply colors, spacing, and layouts using CSS. Practice Flexbox and Grid techniques by cloning a simple website layout.

Week 4: Introduction to JavaScript

Understand the Document Object Model (DOM) and basic JavaScript constructs. Add interactivity to a webpage with a 'Contact Us' form that dynamically displays/hides details.

Week 5: Combining HTML, CSS, and JavaScript

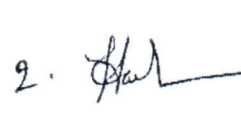
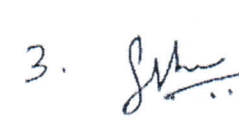
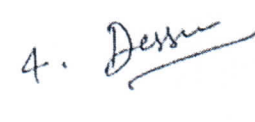
Integrate skills from previous weeks to start building a personal portfolio website.

Week 6: Responsive Design using Bootstrap

Make your site adapt to different screen sizes (mobile, tablet, desktop) using Bootstrap's grid system and components.

Week 7: Deployment using GitHub

Learn version control basics with Git and GitHub. Publish your portfolio online via GitHub Pages

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and collaborate with classmates for code reviews.

Week 8: Basic Server Concepts & Node.js

Set up a basic Node.js server to serve web content. Understand server-side fundamentals and simple routing.

Week 9: Introduction to Databases

Learn to store and retrieve data using JSON or SQLite. Save contact form submissions from your portfolio into a database.

Week 10: Introduction to Flutter

Understand Flutter's widget structure and framework basics. Design a simple login and landing page for a mobile app.

Week 11: Mobile App Interactivity

Create a Flutter app that displays a list of events. Add RSVP functionality with confirmation messages.

Week 12: Full-Stack Integration

Build a registration page that saves new members to a database and displays a welcome message. Connect your Flutter app to a database for data-driven functionality.

Week 13: Project Work

Apply all learned skills to build a real-world project such as a club/college event management application integrating both web and mobile interfaces.

Week 14: Final Presentations

Present your completed project to classmates, highlighting key features, responsive design, and integration. Gather peer feedback for improvement.

Mini-Project Example Themes

- Event registration & tracking for college clubs
- Simple inventory tracking system
- Student feedback & announcement portal
- IoT project dashboards (linking to electronics projects)

Reference Books:

1. Web Technologies: HTML, CSS, JavaScript – Uttam K. Roy (Oxford University Press).
2. Web Technology: Theory and Practice – M.N. Rao & P.S. Rao (Pearson).

3. Web Technologies: TCP/IP, Web/HTTP, Web Servers, Web Applications, and Cloud Computing – Achyut S. Godbole & Atul Kahate (McGraw-Hill Education).
4. Mobile Application Development – Debasis Samanta & Goutam Kumar Panda (Prentice Hall India).
5. Full Stack Web Development – V. Srinivasa Rao (Notion Press).

Annexure

VI

Approval Syllabus for VR 24-IV B.Tech I Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-I	Microwave and Optical Communications	ECE
2	VR 24	IV-I	Professional Elective – III	ECE
3	VR 24	IV-I	Professional Elective – IV	ECE
4	VR 24	IV-I	Microwave and Optical Communications Laboratory	ECE
5	VR 24	IV-I	Project Stage –I	ECE

Approval Syllabus for VR 24-IV B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-II	Professional Elective – V	ECE
2	VR 24	IV-II	Professional Elective – VI	ECE
3	VR 24	IV-II	Project Stage – II including Seminar	ECE

Approval Syllabus for VR 24-IV B.Tech I Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-I	Radar Systems	ECE
2	VR 24	IV-I	CMOS Analog IC Design	ECE
3	VR 24	IV-I	Artificial Neural Networks	ECE

Approval Syllabus for VR 24-IV B.Tech I Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-I	Network Security and Cryptography-IT	ECE
2	VR 24	IV-I	Satellite Communications	ECE
3	VR 24	IV-I	Biomedical Instrumentation	ECE

Approval Syllabus for VR 24-IV B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-II	Artificial Intelligence	ECE
2	VR 24	IV-II	5G and beyond Communications	ECE
3	VR 24	IV-II	Machine learning	ECE

Approval Syllabus for VR 24-IV B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-II	Multimedia Database Management Systems	ECE
2	VR 24	IV-II	System on Chip Architecture	ECE
3	VR 24	IV-II	Wireless sensor Networks	ECE

Approval Syllabus for VR 24-IV B.Tech I Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-I	Electronic Sensors	ECE
2	VR 24	IV-I	Electronics for Health Care	ECE
3	VR 24	IV-I	Telecommunications for Society	ECE

Approval Syllabus for VR 24-IV B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	IV-II	Measuring Instruments	ECE
2	VR 24	IV-II	Communication Technologies	ECE
3	VR 24	IV-II	Fundamentals of Social Networks	ECE



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ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE-VR24

IV B.Tech.-I Semester

S.No.	Course Code	Course	L	T	P	Credits
1	EC701PC	Microwave and Optical Communications	3	1	0	4
2		Professional Elective – III	3	0	0	3
3		Professional Elective – IV	3	0	0	3
4		Open Elective – II	3	0	0	3
5	MS702BS	Professional Practice, Law & Ethics	2	0	0	2
6	EC703PC	Microwave and Optical Communications Laboratory	0	0	4	2
7	EC704PC	Project Stage –I	0	0	6	3
Total			15	1	10	20

IV B.Tech.-II Semester

S.No.	Course Code	Course	L	T	P	Credits
1		Professional Elective – V	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4	EC801PC	Project Stage – II including Seminar	0	0	22	11
5		Total	9	0	22	20

Note: L-Theory

T-Tutorial

P-Practical

C-Credits

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Annexure

VIII



VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN

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Professional Elective -III

S.No.	Course Code	Course	L	T	P	Credits
1	EC731PE	Radar Systems	3	0	0	3
2	EC732PE	CMOS Analog IC Design	3	0	0	3
3	EC733PE	Artificial Neural Networks	3	0	0	3

Professional Elective -IV

S.No.	Course Code	Course	L	T	P	Credits
1	IT741PE	Network Security and Cryptography-IT	3	0	0	3
2	EC742PE	Satellite Communications	3	0	0	3
3	EC743PE	Biomedical Instrumentation	3	0	0	3

Professional Elective -V

S.No.	Course Code	Course	L	T	P	Credits
1	ML851PE	Artificial Intelligence	3	0	0	3
2	EC852PE	5G and beyond Communications	3	0	0	3
3	ML853PE	Machine learning	3	0	0	3

Professional Elective -VI

S.No.	Course Code	Course	L	T	P	Credits
1	CS861PE	Multimedia Database Management Systems	3	0	0	3
2	EC862PE	System on Chip Architecture	3	0	0	3
3	EC863PE	Wireless sensor Networks	3	0	0	3

Open Elective-II

S.No.	Course Code	Course	L	T	P	Credits
1	EC721OE	Electronic Sensors	3	0	0	3
2	EC722OE	Electronics for Health Care	3	0	0	3
3	EC723OE	Telecommunications for Society	3	0	0	3

Open Elective-III

S.No.	Course Code	Course	L	T	P	Credits
1	EC831OE	Measuring Instruments	3	0	0	3
2	EC832OE	Communication Technologies	3	0	0	3
3	CS833OE	Fundamentals of Social Networks	3	0	0	3

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B. Tech (ECE)

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IV Year-I Semester

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MICROWAVE AND OPTICAL COMMUNICATIONS (PC)**Prerequisite:** Antennas and Propagation.**Course Objectives:** To learn

- To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of conventional tubes at these frequencies.
- To distinguish between different types of microwave tubes, their structures and principles of microwave power generation.
- To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S Matrix for various types of microwave junctions.
- Understand the utility of Optical Fibers in Communications.

Course outcomes: Upon completing this course, the student will be able to

- Known power generation at microwave frequencies and derive the performance characteristics.
- Realize the need for solid state microwave sources and understand the principles of solid-state devices.
- Distinguish between the different types of waveguide and ferrite components, and select proper components for engineering applications
- Measure the S-parameters in microwave component design.
- Demonstrate the mechanism of light propagation through Optical Fibers

UNIT-I: Microwave Tubes

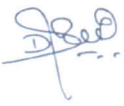
Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes: 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for O/P Power and Efficiency. Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics.

Helix TWTs: Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

UNIT-II: M-Type Tubes

Introduction, Crossfield Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI Mode, o/p characteristics, Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices

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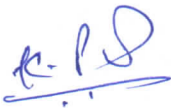
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UNIT-III: Waveguide Components

Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters – Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions - E plane and H plane Tees. Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator,

UNIT-IV: Scattering matrix

Scattering Matrix Properties, Directional Couplers – 2 Hole, Bethe Hole, [s] matrix of Magic Tee and Circulator.

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, Measurement of Attenuation, Frequency. Standing Wave Measurements, measurement of Low and High VSWR, Cavity Q, Impedance Measurements. Cauchy-Riemann equations

UNIT-V: Optical Fiber Transmission Media

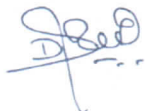
Optical Fiber types, Light Propagation, Optical fiber Configurations, Optical fiber classifications, Losses in Optical Fiber cables, Light Sources, Optical Sources, Light Detectors, LASERS, WDM Concepts, Optical Fiber System link budget.

Text Books:

1. Samuel Y. Liao -Microwave Devices and Circuits, 3rd Edition, Pearson, 2003.
2. Wayne Tomasi- Electronic Communications Systems, 5th Edition, Pearson,

Reference Books:

1. Gerd Keiser - Optical Fiber Communication, 4th Edition, TMH, 2008.
2. David M. Pozar - Microwave Engineering – 3rd edition, John Wiley & Sons (Asia) Pvt Ltd., 2011 Reprint.
3. G.S. Raghuvanshi - Microwave Engineering, Cengage Learning India Pvt. Ltd., 2012.
4. George Kennedy - Electronic Communication System, 6th Edition, McGraw Hill.

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B.Tech.ECE

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IV Year-I Semester

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RADAR SYSTEMS (PE – III)

Prerequisite: Analog and Digital Communications

Course Objectives:

- To explore the concepts of radar and its frequency bands.
- To understand Doppler effect and get acquainted with the working principles of CW radar, FMCW radar.
- To impart the knowledge of functioning of MTI and Tracking Radars.
- To explain the designing of a Matched Filter in radar receivers.

Course Outcomes: Upon completing this course, the student will be able to

- Derive the complete radar range equation.
- Familiarize the functioning of CW, FM-CW and MTI radars
- Known various Tracking methods.
- Derive the matched filter response characteristics for radar receivers
- Understand the concepts of radar and its frequency bands.

UNIT-I: Basics of Radar

Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation.

Radar Equation: SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment)

UNIT-II: CW and Frequency Modulated Radar

Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar.

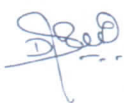
FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter.

UNIT-III: MTI and Pulse Doppler Radar

Principle, MTI Radar - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

UNIT-IV: Tracking Radar

Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

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UNIT-V: Detection of Radar Signals in Noise

Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

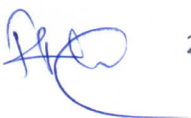
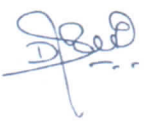
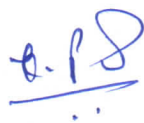
Radar Receivers – Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

Text Books:

1. Merrill I. Skolnik- Introduction to Radar Systems, 2nd Edition, TMH Special Indian Edition, 2007.

Reference Books:

1. Byron Edde - Radar: Principles, Technology, Applications, Pearson Education, 2004.
2. Peebles, Jr., P.Z., Wiley - Radar Principles, New York, 1998.
3. Mark A. Richards, James A. Scheer, William A. Holm, Yes Dee - Principles of Modern Radar: Basic Principles, 2013
4. Merrill I. Skolnik -Radar Handbook, 3rd Edition., McGraw-Hill Education, 2008.

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B.Tech.ECE

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IV Year-I Semester

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CMOS ANALOG IC DESIGN (PE - III)**Pre-Requisite:** Analog Electronics

Course Objectives: Analog circuits play a very crucial role in all electronic systems and due to continued miniaturization, many of the analog blocks are not getting realized in CMOS technology.

- To understand most important building blocks of all CMOS Analog ICs.
- To study the basic principle of operation, the circuit choices and the trade-offs involved in the MOS transistor level design are common to all Analog CMOS ICs.
- To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
- To understand the design of differential amplifiers, current amplifiers and OPAMPs

Course Outcomes: After studying the course, each student is expected to be able to

- Design basic building blocks of CMOS Analog ICs.
- Carry out the design of single and two stage operational amplifiers and voltage references.
- Determine the device dimensions of each MOSFETs involved
- Design various amplifiers like differential, current and operational amplifiers.
- Analyze the effects of noise, mismatch, and process variations on CMOS analog circuit performance.

UNIT-I: MOS Devices and Modeling

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT-II: Analog CMOS Sub-Circuits

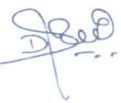
MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascade current Mirror and Wilson Current Mirror, Current and Voltage References, Bandgap Reference.

UNIT-III: CMOS Amplifiers

Inverters, Differential Amplifiers, Cascade Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT-IV: CMOS Operational Amplifiers

Design of CMOS Op-Amps, Compensation of Op-Amps, Design of Two-Stage Op-Amps, Power Supply, Rejection Ratio of Two-Stage Op-Amps, Cascade Op-Amps, Measurement Techniques of OP Amp.

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UNIT-V: Comparators

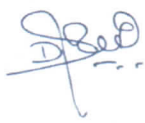
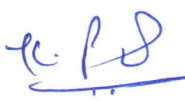
Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

Text Books:

1. Philip E. Allemand Douglas, R. Holberg – CMOS Analog Circuit Design, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Paul R. Gray, Paul J. Hurst, S. Lewis and R.G. Meyer -Analysis and Design of Analog Integrated Circuits, 5th edition, Wiley India, 2010.

Reference Books:

1. David A. Johns, Ken Martin- Analog Integrated Circuit Design, Wiley Student Edn, 2013.
2. Behzad Razavi – Design of Analog CMOS Integrated Circuits, TMH.
3. Baker, Liand Boyce - CMOS: Circuit Design, Layout and Simulation, PHI.

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B.Tech.ECE

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IV Year-I Semester

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ARTIFICIAL NEURAL NETWORKS (PE – III)**Prerequisite:** Nil**Course Objectives:**

- To understand the biological neural network and to model equivalent neuron models.
- To understand architecture, learning algorithms
- To know the issues of various feed forward and feedback neural networks.
- To explore the Neuro dynamic models for various problems.

Course Outcomes: Upon completing this course, the student will be able to

- Explore the similarity of Biological networks and Neural networks
- Perform the training of neural networks using various learning rules.
- Demonstrate the concepts of forward and backward propagations.
- Construct Hopfield models.

UNIT-I: Introduction

A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT-II: Single Layer Perceptron's

Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

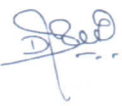
Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT-III: Back Propagation

Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

UNIT -IV: Self-Organization Maps (SOM)

Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

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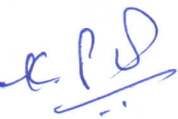
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UNIT-V: Neuro Dynamics

Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

Hopfield Models – Hopfield Models, restricted boltzman machine.

Text Books:

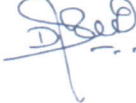
1. Simon S Haykin - Neural Networks a Comprehensive Foundations, PHI
2. Jacek M. Zurada - Introduction to Artificial Neural Systems, JAICO Publishing House, 2006.

Reference Books:

1. Li Min Fu - Neural Networks in Computer Intelligence, TMH 2003
2. James A Freeman David M S Kapura - Neural Networks, Pearson, 2004.
3. B. Vegnanarayana -Artificial Neural Networks, Prentice Hall of India P Ltd, 2005

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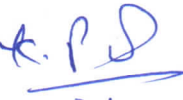
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B.Tech. ECE

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IV Year - I Semester

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NETWORK SECURITY AND CRYPTOGRAPHY

Course Objectives:

- Understand the basic concept of Cryptography and Network Security, their mathematical models
- To understand the necessity of network security, threats/ vulnerabilities to networks and counter measures
- To understand Authentication functions with Message Authentication Codes and Hash Functions.
- To provide familiarity in Intrusion detection and Firewall Design Principles

Course Outcomes: The student will learn

1. Describe fundamental concepts and principles of network and information security.
2. Encrypt and decrypt data using symmetric block cipher algorithms and key management techniques.
3. Analyze public key cryptographic and key agreement algorithms to identify strengths and weaknesses.
4. Apply hash functions, message authentication, and digital signature techniques to ensure data integrity and authentication.
5. Identify and assess network security mechanisms and threats such as intruders, malware, viruses, and firewall vulnerabilities.

UNIT - I:

Security Services, Mechanisms and Attacks, A Model for Internet work security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

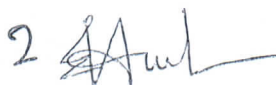
Modern Techniques: Simplified DES, Block Cipher

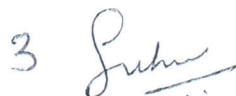
Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

UNIT - II:

Encryption: Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric block Ciphers, Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

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UNIT - III:

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

UNIT - IV:

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

Hash and Mac Algorithms: MD-5, Message digest Algorithm, Secure Hash Algorithm.

Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.

Authentication Applications: Kerberos, Electronic Mail Security: Pretty Good Privacy, SIME/MIME.

UNIT - V:

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

Intruders, Viruses and Worms: Intruders, Viruses and Related threats.

Fire Walls: Fire wall Design Principles, Trusted systems

Text Books:

1. William Stallings- Cryptography and Network Security: Principles and Practice, Pearson Education.
2. Robert Bragg, Mark Rhodes- Network Security: The complete reference, TMH, 2004.

Reference Books:

1. William Stallings-Network Security Essentials (Applications and Standards), Pearson Education.
2. Eric Maiwald – Fundamentals of Network Security, Dream tech press
3. Whitman- Principles of Information Security, Thomson.
4. Buchmann- Introduction to Cryptography, Springer

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B.Tech.ECE

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SATELLITE COMMUNICATIONS (PE – IV)**Prerequisite:** Analog and Digital Communications**Course Objectives:**

- To acquire foundation in orbital mechanics and launch vehicles for satellites
- To provide basic knowledge of link design of satellite.
- To understand multiple access systems and earth station technology
- To understand the concepts of satellite navigation and GPS.

Course Outcomes: Upon completing this course, the student will be able to

- Explore the basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.
- Envision the satellite sub systems and design satellite links for specified C/N.
- Familiarize the various multiple access techniques for satellite communication systems and earth station technologies.
- Known the concepts of LEO, GEO Stationary Satellite Systems and satellite navigation
- Known Tracking Systems, Terrestrial Interface.

UNIT -I: Introduction

Origin of Satellite Communications, Historical Background, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

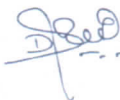
Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Launches and Launch vehicles, Orbital Effects in Communication Systems Performance

UNIT-II: Satellite Subsystems

Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification

UNIT-III: Satellite Link Design

Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples.

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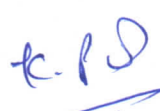
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Multiple Access: Frequency Division Multiple Access (FDMA), Inter modulation, Calculation of C/N, Time Division Multiple Access (TDMA), Frame Structure, Examples, Satellite Switched TDMA Onboard Processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms

UNIT-IV: Earth Station Technology

Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

UNIT-V: Low Earth Orbit and Geo-Stationary Satellite Systems

Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs.

LEO-Introduction, Origin of LEO, Low-Latency Communication in LEO Systems, Beamforming & Phased Array Antennas for LEO, Security Challenges in LEO Satellite Networks, LEO Satellites for 5G & 6G Integration.

Text Books:

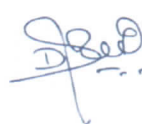
1. Timothy Pratt, Charles Bostian and Jeremy Allnutt - Satellite Communications, WSE, Wiley Publications, 2nd Edition, 2003.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud - Satellite Communications Engineering, 2nd Edition, Pearson Publications, 2003

Reference Books:

1. M. Richharia - Satellite Communications: Design Principles, 2nd Edition, BS Publications, 2003
2. D.C Agarwal - Satellite Communication, 5th Edition, Khanna Publications,
3. K.N. Raja Rao - Fundamentals of Satellite Communications, PHI, 2004
4. Dennis Roddy - Satellite Communications, 4th Edition, McGraw Hill, 2009

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BIOMEDICAL INSTRUMENTATION (PE – IV)**Course Objectives:**

- **Identify** significant biological variables at cellular level and ways to acquire different bio-signals.
- **Elucidate** the methods to monitor the activity of the heart, brain, eyes and muscles.
- **Introduce** therapeutic equipment for intensive and critical care.
- **Outline** medical imaging techniques and equipment for certain diagnosis and therapies.

Course Outcomes: After completion of the course the student is able to:

- Explore biosystems and medical systems from an engineering perspective.
- Identify the techniques to acquire record and primarily understand physiological activity of the human body through cell potential, ECG, EEG, BP and blood flow measurement and EMG.
- Articulate the working of various medical instruments and critical care equipment.
- Know the imaging techniques including CT, PET, SPECT and MRI used in diagnosis of various medical conditions
- Analyse the working principles and characteristics of biomedical transducers and electrodes used for physiological measurements.

UNIT -I: Bio-Potential Signals and Electrodes

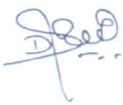
Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials. Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems. Bio-potential electrodes – Body surface recording electrodes, Internal electrodes, micro electrodes. Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

UNIT-II: Cardiovascular Instrumentation

Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements electro cardiography – electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement

UNIT-III: Neurological Instrumentation

Neuronal communication, electro encephalogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers. EMG block diagram and Stimulators

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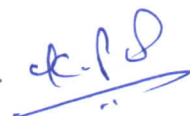
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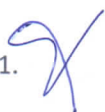
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UNIT-IV: Equipment for Critical Care

Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators

UNIT-V: Principles of Medical Imaging

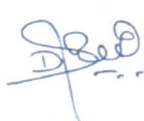
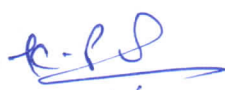
Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

Text Books:

1. R.S. Khandpur - Handbook of Biomedical Instrumentation, McGraw-Hill, 2003.
2. John G. Webster = Medical Instrumentation, Application and Design, John Wiley

Reference Books:

1. Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer - Biomedical Instrumentation and Measurements, PHI.
2. L.A. Geodes and L.E. Baker - Principles of Applied Biomedical Instrumentation, John Wiley and Sons.
3. Joseph Carr and Brown - Introduction to Biomedical equipment technology

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B.Tech.ECE

IV Year-I Semester

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ELECTRONIC SENSORS (OE - II)**Course Objectives:**

- To teach the characterization of sensors.
- To provide knowledge on working of Electromechanical, Thermal, Magnetic and radiation sensors
- To provide basic Understanding of Electro analytic and smart sensors
- provide different applications of sensors.

Course Outcomes: Upon completing this course, the student will be able to

- Learn about sensor Principle, Classification and Characterization.
- Explore the working of Electromechanical, Thermal, Magnetic radiation and Electro analytic sensors.
- Understand the basic concepts of Smart Sensors.
- Design a system with sensors.
- Select and apply appropriate sensors for specific engineering applications.

UNIT -I: Sensors / Transducers

Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors

UNIT-II: Thermal Sensors

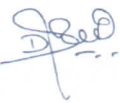
Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermos sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors

UNIT-III: Magnetic sensors

Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchro's.

UNIT-IV: Radiation Sensors

Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fiber Optic Sensors Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

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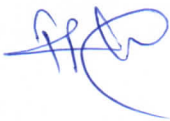
Text Books:

1. V Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy, B. S. Manoj, Pearson
2. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE

Reference Books:

1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.

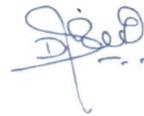
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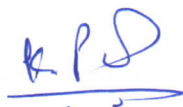
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B.Tech.ECE

IV Year-I Semester

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ELECTRONICS FOR HEALTH CARE (OE-II)**Course Objectives:**

- To provide knowledge on Health care data
- To demonstrate need of Electronics in Health Care.
- To give basic knowledge on electronic equipment used in medical field.

Course Outcomes: Upon completion of this course, the students will be able to

- Know about health care data and its conversion to information and to knowledge.
- Acquiring knowledge on (Electronic Health Records) EHRs and their Implementation.
- Understand the working of electronic devices used for patient monitoring.
- Know the concepts of Telemedicine and therapeutic devices used inside the human body
- Evaluate performance and safety considerations in biomedical instrumentation

UNIT -I: Health care data, Information and Knowledge

Definitions and Concepts, Converting Data to Information to Knowledge, Clinical Data Warehouses, What makes Health Informatics Difficult, Why Health IT fails Sometimes, Terminology of Analytics, Challenges to Data Analytics, Research and application of analytics, Role of Informatics in analytics.

UNIT-II: Electronic Health Records

Introduction, Need for Electronic Health Records, Institute of Medicine's Vision for EHRs, Electronic Health Record Key Component, Electronic Prescribing, Electronic Health Record Adoption, Electronic Health Record Adoption and Meaningful use Challenges, Electronic Health Record Examples, Logical Steps to Selecting and Implementing an HER

UNIT-III: Patient Monitoring Systems

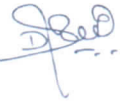
System Concepts, Cardiac Monitor, Bedside Patient Monitoring Systems, Central Monitors, Measurement of Heart Rate, Measurement of Pulse Rate, Blood Pressure Measurement, Measurement of Temperature, Measurement of Respiration Rate, Catheterization Laboratory Instrumentation

UNIT-IV: Biomedical Telemetry and Telemedicine

Wireless Telemetry, Single Channel Telemetry Systems, Multi-channel Wireless Telemetry Systems, Multi-patient Telemetry, Implantable Telemetry Systems, Transmission of Analog Physiological Signals, Over Telephone, Telemedicine.

UNIT-V: Therapeutic devices

Need for Cardiac Pacemaker, Implantable Pacemakers, DC Defibrillator, Electronics in the An aesthetic Machine.

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UNIT-V: Smart Sensors

Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Text Books:

1. Sensors and Transducers - D. Patra Nabis” –PHI Learning Private Limited., 2003.
2. Introduction to sensors- John vitelline, Aravind Raghu, CRC press, 2011

Reference Books:

1. Sensors and Actuators, D. Patra Nabis, 2nd Ed., PHI, 2013.
2. Make sensors: Teravainen, Kemo, Karvina and villeyvaltokari, 1st edition, maker media, 2014.
3. Sensor's handbook- Sabri Soloman, 2nd Ed. TMH, 2009

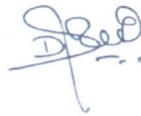
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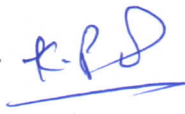
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B.Tech.ECE

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III Year-I Semester

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TELECOMMUNICATIONS FOR SOCIETY (OE - II)

Course Objectives:

- To introduce Telecommunications and its vast development.
- To give knowledge on voice, Data and image transmission.
- To treat with different types of noise/distortions that occur during transmissions.
- To make topics like TV transmission by satellite and broadcasting understandable.

Course Outcomes: Upon completion of this course, the students will be able to

- Understand the concepts of simplex, half duplex, and full duplex of one-way and two-way circuits.
- Get knowledge on subscriber loop design and VF repeaters of voice telephony.
- Get brief overview of video transmission and its broadcasting standards in television transmission.
- Know different of modes of television transmission.
- Analyze the role of wired and wireless communication networks in connecting communities.

UNIT -I: Introductory Topics in Telecommunications

End-Users, Nodes, and Connectivity, Telephone Numbering and Routing, Use Of Tandem Switches in a Local Area Connectivity, Introduction to the Busy Hour and Grade Of Service, Simplex, Half-Duplex, and Full Duplex, One-Way and Two-Way Circuits, Network Topologies, Variations in Traffic Flow, Quality Of Service, Standardization in Telecommunications, The Organization of the PSTN in the United States, Points Of Presence

UNIT-II: Quality of Service and Telecommunication Impairments

Objective, Quality of Service: Voice, Data, and Image, Signal-to-Noise Ratio, Voice Transmission, Data Circuits, Video (Television), The Three Basic Impairments and How They Affect the End-User, Amplitude Distortion, Phase Distortion, Noise Level, Typical Levels, Echo and Singing.

UNIT-III: Transmission Aspects of Voice Telephony

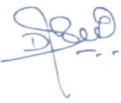
Definition of the Voice Channel, Operation of the Telephone Subset, Subscriber Loop Design, Design of Local Area Wire-Pair Trunks (Junctions), VF Repeater (Amplifiers)..

UNIT-IV: Television Transmission

Background and Objectives, An Appreciation of Video Transmission, Critical Video Parameters, Video Transmission Standards (Criteria for Broadcasters), Methods of Program Channel Transmission, The Transmission of Video Over LOS Microwave, TV Transmission by Satellite Relay, Digital Television, Conference Television, Brief Overview of Frame Transport for Video Conferencing

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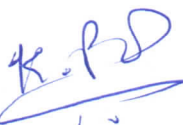
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Text Books:

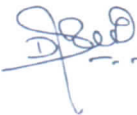
1. Robert E. Hoyt MD FACP "Health Informatics" sixth edition 2007.
2. R. S. Kandpur "Biomedical Instrumentation Technology and Applications" second edition Tata McGraw-Hill.

Reference Books:

1. Edward H. Shortliffe, James J. Cimino "Biomedical Informatics, Computer applications in Health care and Biomedicine" third edition Springer.
2. G.V.R.K. Acharyulu, Bhimaraya Metri, L. Kalyan Viswanath REDDY "Health care and Hospital Management Contemporary Issues and Strategies".

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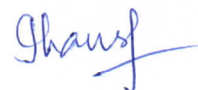
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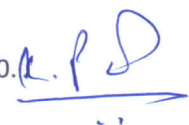
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B.Tech. (AIML & ECE)

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IV Year - I Semester

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PROFESSIONAL PRACTICE, LAW & ETHICS
(Common for AIML & ECE)

Course Objectives:

- Understand professional and engineering ethics, responsibilities, and governance mechanisms.
- Learn fundamentals of contract law and special contracts.
- Gain knowledge of arbitration and ADR mechanisms.
- Understand arbitration procedures and dispute resolution systems.
- Understand intellectual property laws and their protection in India.

Course Outcomes: The student will learn

- The concept of professional ethics, ethical responsibilities of engineers, and mechanisms to maintain professional integrity.
- To analyze and apply principles of contract law including formation, performance, and remedies for breach of contract in engineering practice.
- To interpret and differentiate among arbitration, conciliation, and alternative dispute resolution methods as per the Arbitration Act 1996.
- Examine labor laws, employment acts, and safety regulations related to construction and infrastructure projects.
- Understand and explain intellectual property rights (IPR), copyright, trademarks, patents, and design laws relevant to engineering innovations.

UNIT - I: Professional Practice and Ethics

Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stakeholders.

UNIT - II: Law of Contract

Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of Goods Act - 1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT - III: Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system

Arbitration - meaning, scope and types - distinction between laws of 1940 and 1996; UNCITRAL model law - Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration.

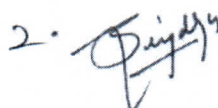
UNIT - IV: Arbitration agreements:

Essential and kinds, validity, reference and interim measures by court; Arbitration tribunal - appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalat's.

Unit V: Law relating to Intellectual property

Introduction - meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright - computer programs, Ownership of copyrights

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and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India;
Law relating to Patents under Patents Act, 1970.

TEXTBOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016

REFERENCE BOOKS:

1. Wadhwa (2004), Intellectual Property Rights, Universal Law Publishing Co.
2. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
3. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.

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B.Tech.ECE

IV Year-I Semester

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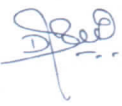
MICROWAVE AND OPTICAL COMMUNICATIONS LABORATORY**Course Outcomes:**

- Demonstrate the characteristics and working principles of microwave components such as the Reflex Klystron, Gunn diode, and directional coupler
- Measure and analyze microwave parameters including attenuation, frequency, impedance, and VSWR using standard techniques.
- Examine and evaluate the scattering parameters (S-parameters) of waveguide components for understanding signal behavior in microwave systems
- Analyze the characteristics and performance of optoelectronic devices such as LEDs and Laser diodes and demonstrate their use in optical communication links.
- Determine key parameters of optical fiber communication systems such as numerical aperture, data rate, and link losses to assess system efficiency.

Note: Any twelve of the following experiments**List of Experiments**

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation measurement
4. Directional coupler Characteristics.
5. Scattering parameters of wave guide components
6. Frequency measurement.
7. Impedance measurement
8. VSWR measurement
9. Characterization of LED.
10. Characterization of Laser Diode.
11. Intensity modulation of Laser output through an optical fiber.
12. Measurement of Data rate for Digital Optical link.
13. Measurement of Numerical Aperture of fiber cable.
14. Measurement of losses for Optical link



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B.Tech.

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IV Year - II Semester

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ARTIFICIAL INTELLIGENCE (Professional Elective-V)
(ECE)**Course Objectives:** The objectives of the course are to:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: Upon completing this course, the students will be able to

- Understand the basics of the theory and about intelligent agents.
- Capable of using heuristic searches, aware of knowledge based systems and expert systems.
- Ability to understand applying the Prolog for AI experiments.
- Apply AI techniques to real-world problems to develop intelligent systems.
- Select appropriately from a range of techniques when implementing intelligent systems.

UNIT - I: Introduction

Introduction-Definition – foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation

UNIT - II: Problem Solving Methods

Problem solving Methods – Search Strategies- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT - III: Knowledge Representation

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining- Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering- Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information

UNIT - IV: Knowledge Acquisition

Introduction to Learning, Rule Induction, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning. Learning Using neural Networks, Probabilistic Learning Natural Language Processing.

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UNIT - V: Expert systems

Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.

TEXT BOOKS:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press.

REFERENCE BOOKS:

1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
2. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

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5. K. Becker

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B.Tech.ECE

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IV Year–II Semester

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5G AND BEYOND COMMUNICATIONS (PE-V)**Course Objectives:**

- Enable students to understand the evolution and fundamentals of wireless communication systems, emphasizing 5G.
- Develop knowledge of 5G architecture, protocols, and radio access technologies.
- Provide analytical skills related to key enabling technologies such as massive MIMO, mm Wave, beamforming, and network slicing.
- Expose students to performance requirements, use cases, and applications of 5G systems.
- Introduce students to future research directions in beyond-5G and 6G communications

Course Outcomes:

- Explain the evolution and basic principles of wireless communication systems up to 5G
- Describe the 5G NR architecture, protocol stack, and core network functions
- Analyze key enabling technologies such as massive MIMO, mm Wave, and beamforming
- Evaluate 5G performance metrics and service requirements for e MBB, URLLC, and Mm tc
- Apply 5G concepts to real-world applications such as IoT, smart cities, and autonomous systems.

UNIT -I: Multiple Input Multiple Output (MIMO) Communications

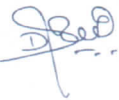
Spatial Multiplexing, Spatial Diversity, Beamforming in MIMO systems, Hybrid Precoding, 5G Communication Landscape, Related work on 5G.

UNIT-II: Introduction to Mobile Wireless Technology Generations 5G

WISDOM, GIMVC, Requirements of 5G, standardization of WISDOM, Vision of 5G, WISDOM Concept and Challenges, Cellular D2D Communication, D2D Using Physical Layer Network Coding, Using FFR and Using Cognitive Radio. SMNAT: Introduction, Network Architecture and the Process, Implementation of SMNAT for In-Band D2D and Interoperability with WISDOM, Description of Network elements of SMNAT and Call Flow for Session Establishment

UNIT-III: Radio Wave Propagation for Mm Wave

Introduction, Large-scale Propagation Channel Effects, Small-Scale Channel Effects, Spatial Characterization of Multipath and Beam Combining, Outdoor Channel Models, Indoor Channel Models

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UNIT-IV: Higher layer Design Considerations for Mm Wave

Challenges when Networking Mm Wave Devices, Beam Adaptation Protocols, Relaying for Coverage Extension, Support for Multimedia Transmission, Multiband considerations, Performance of Cellular networks, Mm Wave Standardization: ECMA-387, IEEE 802.11ad..

UNIT-V: BEYOND 2020

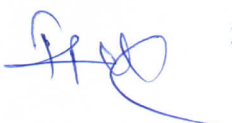
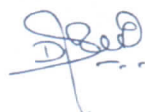
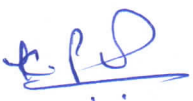
Major Challenges Surrounding Future Cyber Security, Users Awareness, Spectrum Related Security Issues in CRNs. Challenges for 2020 and beyond, Future Mobile Technologies, High Altitude Stratospheric Platform Station Systems, Human Bond Communications, CONASENSE. based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty

Text Books:

1. Ramjee Prasad, 5G: 2020 and Beyond, River Publishers
2. T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock, Millimeter Wave Wireless Communication, Pearson Education, 2015.

Reference Books:

1. M. Manish, G. Devendra, P. Pattanayak, and N. Ha, 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology
2. M. Vaezi, Z. Ding, and H. V. Poor, Multiple Access techniques for 5G Wireless Networks and Beyond, Springer Nature, Switzerland, 2019.

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B.Tech. L T P C
IV Year - II Semester 3 0 0 3

MACHINE LEARNING (Professional Elective-V)
(ECE)

Course Objectives:

- To introduce the foundations of Artificial Neural Networks
- To acquire the knowledge on Deep Learning Concepts
- To learn various types of Artificial Neural Networks
- To gain knowledge to apply optimization strategies

Course Outcomes:

- Ability to understand the concepts of Neural Networks
- Ability to select the Learning Networks in modeling real world systems
- Ability to use an efficient algorithm for Deep Models
- Ability to apply optimization strategies for large scale applications
- Ability to understand and apply efficient algorithm for implementing the LLMs

UNIT - I:

Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT - II:

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT - III:

Linear Models: Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares, Sequential learning, Regularized least squares, Multiple outputs, The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic Generative Models-Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions.

UNIT - IV:

Kernel Methods: Constructing Kernels, Radial Basis Function Networks - Nadaraya-

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Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Blockchain Case Studies: Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyper ledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

1. Blockchain Technology, Chandramouli Subramanian, Asha A. George, Abhilasj K A and Meena Karthikeyan, Universities Press.

1. Michael Juntao Yuan, Building Blockchain Apps, Pearson, India.
2. Blockchain Blueprint for Economy, Melanie Swan, SPD O'reilly.
3. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson.

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B.Tech.ECE

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IV Year-II Semester

MULTIMEDIA DATABASE MANAGEMENT SYSTEMS (PE – VI)**Prerequisite: Data Structures****Course Objectives:**

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques

Course Outcomes:

- Gain knowledge of fundamentals of DBMS, database design and normal forms
- Master the basics of SQL for retrieval and management of data.
- Be acquainted with the basics of transaction processing and concurrency control.
- Familiarity with database storage structures and access techniques
- Design and implement multimedia database queries and applications using appropriate tool

UNIT -I: Database System Applications

A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model.

UNIT-II: Introduction to the Relational Model

Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views. Relational Algebra, Tuple relational Calculus, Domain relational calculus

UNIT-III: SQL Queries, Constraints, Triggers:

form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases.

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

UNIT-IV:

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation-Based Protocols, Multiple Granularity, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions

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UNIT-V:

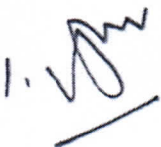
Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning, Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure

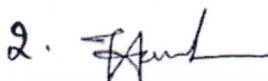
Text Books:

1. Database Management Systems, Raghu ram Krishnan, Johannes Gehrke, Tata Mc Graw Hill 3rd Edition
2. Database System Concepts, Silberschatz, Korth, Mc Graw hill, V edition

Reference Books:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
 2. Fundamentals of Database Systems, Elmasri Narrate, Pearson Education
 3. Introduction to Database Systems, C. J. Date, Pearson Education
 4. Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD.
 5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
- Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

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B.Tech.ECE

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IV Year-II Semester

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SYSTEM ON CHIP ARCHITECTURE (PE – VI)**Prerequisite:** Embedded System Design**Course Objectives:**

- To introduce the architectural features of system on chip.
- To imbibe the knowledge of customization using case studies

Course Outcomes:

- Expected to understand SOC Architectural features
- To acquire knowledge on processor selection criteria and limitations
- To acquires knowledge of memory architecture on SOC.
- To understands the interconnection strategies and their customization on SOC
- Demonstrate the capability to design and analyze reconfigurable parallel architectures for specific computational tasks

UNIT -I: Introduction to the System Approach

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity

UNIT-II: Processors

Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT-III: Memory Design for SOC

Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

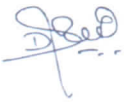
UNIT-IV: Interconnect Customization

Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization:

UNIT-V: Configuration

An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism

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Text Books:

1. M. E. J. Newman "Networks an introduction" Oxford University Press 2010.
2. Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010.

Reference Books:

1. Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.
2. Maksim Tsvetovat and Alexander Kouznetsov. "Social Network Analysis for Startups". O'Reilly Media, 2011.

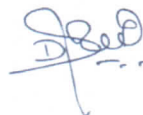
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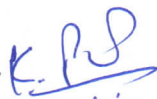
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B.Tech.ECE

IV Year–II Semester

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WIRELESS SENSOR NETWORKS (PE – V)**Prerequisite: Analogue and Digital Communications****Course Objectives:**

- To acquire the knowledge about various architectures and applications of Sensor Networks
- To understand issues, challenges and emerging technologies for wireless sensor networks
- To learn about various routing protocols and MAC Protocols
- To understand various data gathering and data dissemination methods
- To Study about design principals, node architecture, hardware and software required for implementation of wireless sensor networks

Course Outcomes: Upon completion of the course, the student will be able to:

- Analyze and compare various architectures of Wireless Sensor Networks
- Understand Design issues and challenges in wireless sensor networks
- Analyze and compare various data gathering and data dissemination methods.
- Design, Simulate and Compare the performance of various routing and MAC protocol
- Apply localization, time synchronization, and coverage techniques in sensor networks.

UNIT -I:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT-II:

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

UNIT-III:

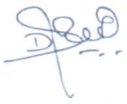
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

UNIT-IV:

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols

UNIT-V:

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to Tiny OS and nesC

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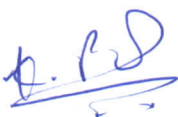
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Text Books:

1. Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiley India Pvt. Ltd.
2. ARM System on Chip Architecture – Steve Furber –2nd Ed., 2000, Addison Wesley Professional.

Reference Books:

1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer
2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newness, BK and CDROM
3. System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.

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B.Tech.ECE

IV Year-II Semester

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MEASURING INSTRUMENTS (OE - III)

Course Objectives:

- To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
- To provide better familiarity with the concepts of Sensors and Measurements.
- To provide knowledge of various measurement methods of physical parameters like velocity, acceleration, force, pressure and viscosity.

Course Outcomes: Upon Completion of this course the student is

- Able to identify suitable sensors and transducers for real-time applications.
- Able to translate theoretical concepts into working models.
- Able to understand the basics of measuring devices and use them in relevant situations
- Analyze the characteristics, accuracy, and errors associated with different measurement devices.
- Design and implement measurement and instrumentation circuits for practical applications.

UNIT -I: Introduction to measurements

Physical measurement, Forms and methods of measurements, Measurement errors, Statistical analysis of measurement data, Probability of errors, Limiting errors, Standards, Definition of standard units, International standards, Primary standards, Secondary standards, Working standards, Voltage standard, Resistance standard, Current standard, Capacitance standard, Time and frequency standards.

UNIT-II: Passive Sensors Resistive Sensors

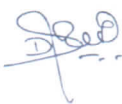
Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers, Capacitive Sensors: Variable capacitors, Differential capacitors, Inductive Sensors: Reluctance variation sensors, Eddy current sensors.

UNIT-III: Metrology

Measurement of length – Plainness – Area – Diameter – Roughness – Angle – Comparators – Gauge Blocks, Optical Methods for length and distance measurements. Velocity and Acceleration Measurement: Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods, Accelerometers- different types, Gyroscopes- applications.

UNIT-IV: Force and Pressure Measurement

Gyroscopic Force Measurement – Vibrating wire Force transducer. Basics of Pressure measurement –Manometer types – Force-Balance and Vibrating Cylinder Transducers – High- and Low-Pressure measurement

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UNIT-V : Community Antenna Television (Cable Television):

Objective and Scope, The Evolution of CATV, System Impairments and Performance Measures, Hybrid Fiber-Coax (HFC) Systems, Digital Transmission of CATV Signals, Two-Way CATV Systems, Two-Way Voice and Data over CATV Systems Based on the DOCSIS 2.0 Specification, Sub split/Extended Sub split Frequency Plan, Other General Information

Text Books:

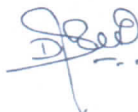
1. Roger L. Freeman "Fundamentals of Telecommunications" 2nd Edition, John Wiley & Sons Publications 2005.
2. Annabel Z. Dodd "The Essential Guide to Telecommunications" 5th Edition, Prentice Hall 2012. McGraw-Hill.

Reference Books:

1. JYRKI T. J. Penttinen "the telecommunications handbook" John Wiley & Sons Publications 2015.
2. Prof. Dr. Muhammad EL-SABA "Telecommunications systems and data networks" 3rd Edition 2015.

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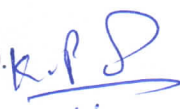
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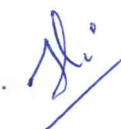
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B.Tech.ECE**L T P C****IV Year–II Semester****3 0 0 3**

COMMUNICATION TECHNOLOGIES (OE-III)

Course Objectives:

- To give an overview of Source-Destination communication.
- To provide the different modes of communication technologies like wireless and cellular mobile networks.
- To make familiar with the generations of communications like 1G, 2G, 3G, 4G and 5G.
- To give brief explanation on security of network and its management.

Course Outcomes: upon completing this course the students will be able to

- Understand the information theory and its coding styles.
- Acquire knowledge on satellite communication and broadcasting services.
- Know GSM, LTE and 5G mobile networks.
- Know about network security through encryption and decryption.

UNIT -I: Information Theory

Shanon Capacity, Multimedia Data, Data Processing, Boolean Logics, Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet.

UNIT-II: Wireless Communication Technologies

WLAN, Wifi, Bluetooth, Other Wireless PAN And WAN Technologies, Satellite Communications, Broadcast Services.

UNIT-III: Cellular Mobile Network

GSM(2G), UMTS (3G), LTE(4G), 5G Mobile Networks, Mobile Network Planning Aspects.

UNIT-IV: Free Space Optical Communications

Optical Fiber, FTTC, FTTH, FTTBS, Free Space Optical Link, Channel Model with Different Factors, Deep Space Optical Communications.

UNIT–V : Network Security and Management

Symmetrical Encryption, Asymmetrical Encryption, Authentication, Hash-Value, Integrity Check, Telecommunications Management Network, SNMP, Functionalities of Network Management, Trends and Future Development.

Text Books:

1. Shun-Ping Chen, “Fundamentals of Information and Communication Technologies” 2020
2. B.P. Lathi, “Communication systems”- BS Publications, 2006

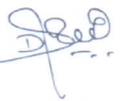
Reference Books:

1. Simon Haykin, John Wiley “Digital Communications” 2005.
2. Herbert Taub, Donald L Schilling Gautham Saha “Principles of Communication systems” 3rd edition McGraw-Hill 2008. Startups”. O’Reilly Media, 2011.



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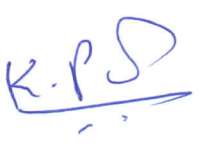
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B.Tech.ECE

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IV Year–II Semester

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FUNDAMENTALS OF SOCIAL NETWORKS (OE-III)**Course Objectives:**

- To give overview on social networks.
- To make social media, information networks and world wide web concepts more familiar.
- To provide knowledge on social network ties.
- To provide knowledge on power laws related to information networks.

Course Outcomes: upon completing this course the students will be able to

- Understand concepts like small-world experiment and snowball sampling related to social networks.
- Get knowledge on ties, weak ties and their strength.
- Know about structure of the web, modern web search, link analysis using hubs.
- Acquire knowledge on power laws and analysis of Rich-get-Richer phenomena.
- Identify ethical, privacy, and security issues associated with social networks.

UNIT -I: Introduction to social networks

The Empirical Study of Social Networks, Interviews and Questionnaires, Direct Observation, Data from Archival or Third-Party Records, Affiliation Networks, The Small-World Experiment, Snowball Sampling, Contact Tracing, and Random Walks.

UNIT-II: Graph theory and Social Networks

Basic definitions, Paths and Connectivity, The strength of weak ties, Tie Strength and Network Structure in Large-Scale Data, Tie strength, social media, passive engagement.

UNIT-III: Information networks and World Wide Web

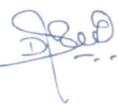
The World Wide Web, Information Networks, Hypertext, and Associative Memory, The Web as a Directed Graph, The Bow-Tie Structure of the Web, the emergence of web 2.0, Searching the Web: The Problem of Ranking Link Analysis using Hubs and Authorities, PageRank, Applying Link Analysis in Modern Web Search.

UNIT-IV: Power Laws and Rich-Get-Richer Phenomena

Popularity as a Network Phenomenon, Power Laws, Rich-Get-Richer Models, The Unpredictability of Rich-Get-Richer Effects, The Long Tail, The Effect of Search Tools and Recommendation Systems, Advanced Material: Analysis of Rich-Get Richer Processes.

UNIT-V :The Small-World Phenomenon

Six Degrees of Separation, Structure and Randomness, Decentralized Search, Modeling the Process of Decentralized Search, Empirical Analysis and Generalized Models, Core-Periphery Structures and Difficulties in Decentralized Search, Advanced Material: Analysis of Decentralized Search.

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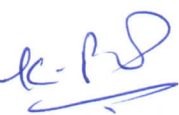
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UNIT-V : Flow

Density and Viscosity Measurements: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, Density measurements – Strain Gauge load cell method – Buoyancy method. Units of Viscosity, Two float viscorator –Industrial consistency meter

Text Books:

1. Measurement Systems – Applications and Design – by Doe blin E.O., 4/e, McGraw Hill International, 1990.
2. Principles of Industrial Instrumentation – Patra Nabis D. TMH. End edition 1997.

Reference Books:

1. Sensor Technology Hand Book – Jon Wilson, Newne 2004.
2. Instrument Transducers – An Introduction to their Performance and design – by Herman K.P. Neubrat, Oxford University Press.
3. Measurement system: Applications and Design – by E.O. Doebelin, McGraw Hill Publications.
4. Electronic Instrumentation by H.S. Kalsi.

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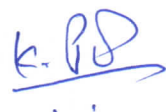
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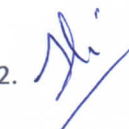
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Annexure

V

Approval Syllabus for VR 24-III B.Tech I Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	III-I	Microcontrollers	ECE
2	VR 24	III-I	IoT Architectures and Protocols	ECE
3	VR 24	III-I	Control Systems	ECE
4	VR 24	III-I	Professional Elective – I	ECE
5	VR 24	III-I	Microcontrollers Laboratory	ECE
6	VR 24	III-I	IoT Architectures and Protocols Laboratory	ECE

Approval Syllabus for VR 24-III B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	III-II	Antennas and Wave Propagation	ECE
2	VR 24	III-II	Digital Signal Processing	ECE
3	VR 24	III-II	CMOS VLSI Design	ECE
4	VR 24	III-II	Professional Elective - II	ECE
5	VR 24	III-II	Digital Signal Processing Laboratory	ECE
6	VR 24	III-II	CMOS VLSI Design Laboratory	ECE
7	VR 24	III-II	Advanced Communication Laboratory	ECE
8	VR 24	III-II	Industry Oriented Mini Project/ Internship	ECE

Approval Syllabus for VR 24-III B.Tech I Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
3	VR 24	III - I	Electronic Measurements and Instrumentation	ECE

Approval Syllabus for VR 24-III B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	III - II	Digital Image Processing	ECE
2	VR 24	III - II	Embedded System Design	ECE
3	VR 24	III - II	Mobile Communications and Networks	ECE

Approval Syllabus for VR 24-III B.Tech II Semester

S.No.	Regulation	Year & Sem	Subject Name	Department
1	VR 24	III - II	Fundamentals of Internet of Things	ECE
2	VR 24	III - II	Principles of Signal Processing	ECE
3	VR 24	III - II	Digital Electronics for Engineering	ECE



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ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE-VR24

III B.Tech.-I Semester

S.No.	Course Code	Course	L	T	P	Credits
1	EC501PC	Microcontrollers	3	1	0	4
2	EC502PC	IoT Architectures and Protocols	3	0	0	3
3	EC503PC	Control Systems	3	1	0	4
4	MS504BS	Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective – I	3	0	0	3
6	EC505PC	Microcontrollers Laboratory	0	0	2	1
7	EN506BS	Advanced English Communication Skills Laboratory	0	0	2	1
8	EC507PC	IoT Architectures and Protocols Laboratory	0	0	2	1
9	MC508BS	Intellectual Property Rights	3	0	0	0
		Total	18	2	6	20

III B.Tech.-II Semester

S.No.	Course Code	Course	L	T	P	Credits
1	EC601PC	Antennas and Wave Propagation	3	0	0	3
2	EC602PC	Digital Signal Processing	3	0	0	3
3	EC603PC	CMOS VLSI Design	3	0	0	3
4		Professional Elective - II	3	0	0	3
5		Open Elective – I	3	0	0	3
6	EC604PC	Digital Signal Processing Laboratory	0	0	2	1
7	EC605PC	CMOS VLSI Design Laboratory	0	0	2	1
8	EC606PC	Advanced Communication Laboratory	0	0	2	1
9	EC607PC	Industry Oriented Mini Project/ Internship	0	0	4	2
10	MC608BS	Environmental Science	3	0	0	0
		Total	18	0	10	20

Note: L-Theory

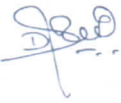
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P-Practical

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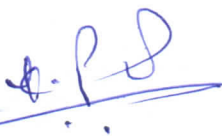
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ELECTRONICS AND COMMUNICATION ENGINEERING

Professional Elective-I

S.No.	Course Code	Course	L	T	P	Credits
1	OS511PE	Computer Organization & Operating Systems	3	0	0	3
2	IT512PE	Data Communications and Computer Networks	3	0	0	3
3	EC513PE	Electronic Measurements and Instrumentation	3	0	0	3
4	EC514PE	Signal Engineering & Automatic Train Protection-Kavach	3	0	0	3

Professional Elective-II

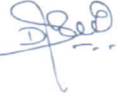
S.No.	Course Code	Course	L	T	P	Credits
1	EC621PE	Digital Image Processing	3	0	0	3
2	EC622PE	Mobile Communications and Networks	3	0	0	3
3	EC623PE	Embedded System Design	3	0	0	3

Open Elective-I

S.No.	Course Code	Course	L	T	P	Credits
1	EC621OE	Fundamentals of Internet of Things	3	0	0	3
2	EC622OE	Principles of Signal Processing	3	0	0	3
3	EC623OE	Digital Electronics for Engineering	3	0	0	3

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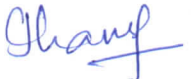
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B.Tech.ECE

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III Year-I Semester

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MICROCONTROLLERS

Prerequisite: Nil

Course Objectives: To learn

- To familiarize the architecture of microprocessors and micro controllers
- To provide knowledge about interfacing techniques of bus & memory.
- To understand the concepts of ARM architecture
- To study the basic concepts of Advanced ARM processors

Course Outcomes: Upon completing this course, the student will be able to

- Understand the architecture, instruction set, and addressing modes of 8086 microprocessor and 8051 micro controllers.
- Develop assembly language programs for solving arithmetic, logical, and control-based problems on 8086/8051
- Interface microprocessors and microcontrollers with peripherals such as ADC, DAC, timers, and serial communication modules.
- Analyze real-time embedded system requirements and apply microcontroller concepts for practical applications
- Use modern tools and hardware kits to design, debug, and evaluate microprocessor/microcontroller-based systems.

UNIT-I: 8086 Architecture

8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT-II: Introduction to Microcontrollers

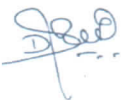
Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT-III: I/O And Memory Interface

LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

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UNIT-IV: ARM Architecture

ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT-V: Advanced ARM Processors

Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

Text Books:

1. A. K. Ray and K. M. Bhurchandani -Advanced Microprocessors and Peripherals, TMH, 2nd Edition 2006.
2. Andrew N SLOSS, Dominic SYMES, Chris WRIGHT -ARM System Developers guide, Elsevier, 2012.

Reference Books:

1. Kenneth. J. Ayala-The 8051 Microcontroller, Cengage Learning, 3rd Ed, 2004.
2. D. V. Hall -Microprocessors and Interfacing, TMGH, 2nd Edition, 2006.
3. K. Uma Rao, Andhe Pallavi-The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 2009
4. Donald Reay-Digital Signal Processing and Applications with the OMAP- L138 Experimenter, WILEY 2012.

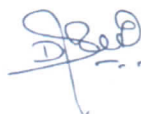
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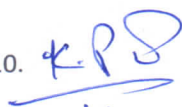
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III Year-I Semester

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IOT ARCHITECTURES AND PROTOCOLS**Prerequisite:** Nil**Course Objectives:**

- To provide basic knowledge on IOT.
- To explain the different components and Architectures from M2M to IOT.
- To provide knowledge on different protocols of IoT.
- To impart knowledge on implementations of different protocols of IOT.

Course Outcomes: After completion of this course the student will be able to

- Explore the Evolution of IoT, its Growth and Applications.
- Know the components of IoT and Compare the various architectures of IoT
- Acquire knowledge on data management of IoT.
- Establish the knowledge on various IoT protocols like Data link, Network, Transport, Session, Service layers
- Understand the different components and Architectures from M2M to IoT.

UNIT-I: IOT Introduction

Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types.

UNIT- II: IOT and M2M

M2M to IoT – A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, international driven global value chain and global information monopolies

IOT Architecture: IoT Architecture components, Comparing IoT Architectures, A simplified IoT Architecture, core IoT functional stack, IoT data management and compute stack

UNIT- III: IOT Data link layer and Network layer protocols

PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer- IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP

UNIT-IV: Transport and Session layer protocols

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

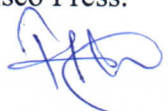
UNIT-V: Service layer protocols and Security Lasers

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 6LoWPAN, RPL, Application Layer.

Text Books:

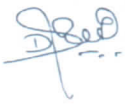
1. Sudip Misra, Ananda up Mukherjee, Arijit Roy -Introduction to IOT, Cambridge University Press.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob barton, Jerome henry-IoT Fundamentals Networking Technologies, Protocols and Use cases for IoT", Cisco Press.

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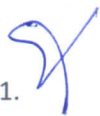
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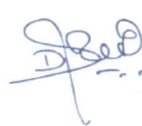
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Reference Books:

1. Cunopfister-Getting started with the internet of things, O Reilly Media, 2011
2. Francis DaCosta, -Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications
3. Arshdeep Bahga, Vijay Madisetti -Internet of Things A Hands-on approach, Universities
4. Press Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan-Internet of things, John Wiley and Sons.
5. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers

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B.Tech.ECE

L T P C

III Year-I Semester

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CONTROL SYSTEMS

Prerequisite: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

Course Objectives:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Model the linear-time-invariant systems using transfer function and state-space representations
- Understand the concept of stability and its assessment for linear-time invariant systems
- Design simple feedback controllers.
- Estimate the system performance using time domain analysis and methods for improving it
- Estimate the system performance using frequency domain analysis and techniques for improving the performance

UNIT-I: Introduction to Control Problem

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems.

Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT-II: Time Response Analysis of Standard Test Signals

Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT-III: Frequency-Response Analysis

Frequency-Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin Closed-loop frequency response

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UNIT-IV: Introduction to Controller Design

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

UNIT-V: State Variable Analysis and Concepts of State Variables

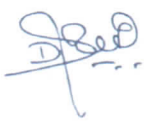
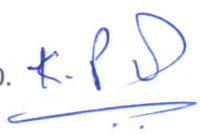
State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Text Books:

1. M. Gopal, -Control Systems: Principles and Design, McGraw Hill Education, 1997.
2. B. C. Kuo, -Automatic Control System, Prentice Hall, 1995.

Reference Books:

1. K. Ogata=Modern Control Engineering, Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal-Control Systems Engineering, New Age International, 2009.

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B.Tech. (AIML & ECE)

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III Year - I Semester

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BUSINESS ECONOMICS AND FINANCIAL ANALYSIS
(Common for AIML & ECE)

Course Objectives:

- To understand the fundamentals of business and economics.
- To analyze demand and supply concepts.
- To explain production and cost theories.
- To develop foundational knowledge of financial accounting.
- To interpret and analyze financial statements using ratio analysis, fund flow, and cash flow analysis for assessing the financial performance and position of a business.

Course Outcomes: The student will learn

- The students will understand the various Forms of Business and the impact of economic variables on the Business.
- Understand the elasticity of the demand of the product, different types, and measurement of elasticity of demand and factors influencing on elasticity of demand and supply.
- Recognize the Production function, features of Iso-Quants and Iso-Costs, Market Structure, Pricing aspects are learnt.
- The students can study the firm's financial position by analyzing the Financial Statements of a Company.
- Evaluate different types of financial ratios knowing liquidity, solvency and profitability position of business.

UNIT - I: Introduction to Business and Economics

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics

UNIT - II: Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making,

Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting. Supply Analysis: Determinants of Supply, Supply Function & Law of Supply

UNIT - III: Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT - IV: Financial Accounting:

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

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B.Tech. ECE

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III Year - I Semester

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COMPUTER ORGANIZATION & OPERATING SYSTEMS

(Professional Elective-I)

Course Objectives:

- To understand the structure of a computer and its operations.
- To understand the RTL
- To understand Micro-level operations and control in a computer.
- Understanding the concepts of I/O and memory organization
- And also understanding the concept of Operating Systems.

Course Outcomes: The student will learn

- Visualize the organization of different blocks in a computer.
- Utilize the micro-level operations to control different units in a computer.
- Implement Operating systems in a computer.
- Implement to analysis the various Data sources
- Utilize the Visualizing Complex Data and Relations

UNIT - I

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT - II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and Variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

UNIT - III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT - IV

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc.

Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

UNIT - V

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

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Text Books:

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques. Han, Kamber, 3rd Edition. Morgan Kaufmann Publishers.

Reference Books:

1. Introduction to Data Mining. Tan, Steinbach and Kumar, Addison Wesley, 2006.
2. Data Mining Analysis and Concepts. M. Zaki and W. Meira
3. Mining of Massive Datasets. Jure Leskovec Stanford Univ. Anand Rajaraman
Milliway Labs Jeffrey D Ullman Stanford Univ.

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B.Tech. ECE

III Year - I Semester

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Data Communications and Computer Networks

Course Objectives:

- Explore basic concepts of data communication
- Introducing students to TCP/IP and OSI models along with their merits and demerits
- Explore in detail services offered by various layers of OSI Model.
- Understand link layer protocols, UDP, TCP and application layer protocols.

Course Outcomes: The student will learn

- Understand fundamentals of data communication and network models.
- Analyze transmission media, switching techniques, and protocols.
- Design and evaluate network architectures and typologies.
- Apply TCP/IP protocols and understand routing and congestion control.
- Understand network security concepts and emerging technologies.

UNIT - I:

Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies – Protocols and Standards – ISO / OSI model. Example Networks such as ATM, Frame Relay, ISDN

Physical layer: Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

UNIT - II:

Data link layer: Introduction, Framing, and Error – Detection and Correction – Parity – LRC, CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols, III Medium Access sub layer: ALOHA, CSMA/CD, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization

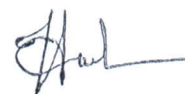
UNIT - III:

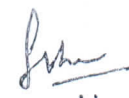
Network layer: Logical Addressing, Internet working, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.

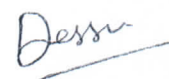
UNIT - IV:

Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.

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UNIT - V:

Application Layer: Domain name space, DNS in Internet, Electronic Mail, SMTP, FTP, WWW, HTTP, SNMP.

Textbooks:

1. Data Communications and Networking, Behrouz A. Forouzan, Fourth Edition TMH.

Reference Books:

1. Computer Networks, Andrew S Tanenbaum, 6th Edition, Pearson Education.
2. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose & Keith W. Ross, 3rd Edition, Pearson Education
3. Data communications and Computer Networks, P.C Gupta, PHI.
4. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.

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B.Tech.ECE

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III Year-I Semester

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ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (PE-I)**Pre-requisite:** Basic Electrical and Electronics Engineering**Course Objectives:**

- It provides an understanding of various measuring system functioning and metrics for performance analysis.
- Provides understanding of principles of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- Understanding the concepts of various measuring bridges and their balancing conditions.
- Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes: Upon completing this course, the student will be able to

- Measure electrical parameters with different meters and understand the basic definition of measuring parameters.
- Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
- Operate an Oscilloscope to measure various signals.
- Measure various physical parameters by appropriately selecting the transducers. Design and analyze various error detection techniques.
- Design and implement signal conditioning and interfacing circuits for measurement applications.

UNIT-I: Block Schematics of Measuring Systems

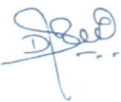
Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D'Arson Val Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments

UNIT-II: Signal Analyzers

AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

UNIT-III: Oscilloscopes

CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

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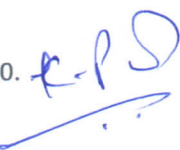
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Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT-IV: Transducers

Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchro's, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers

UNIT - V: Bridges

Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems

Text Books:

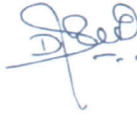
1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W. D. Cooper: PHI 5th Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

Reference Books:

1. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpati Rai & Sons, 2013.
2. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3. Industrial Instrumentation: T.R. Padmanabhan Springer 2009.
4. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010. Andrew S Tanenbaum - Computer Networks, 4th Edition, Pearson Education

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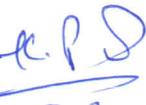
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B.Tech.ECE	L	T	P	C
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Signal Engineering& Automatic Train Protection-Kavach
(Professional Elective-I)

Prerequisites: Physics & Mathematics, Network Layers, TDMA/FDMA/SDMA

Course Objectives:

- To introduce the fundamental principles of railway signaling, including signaling elements, station layouts, interlocking, and systems of train working for safe train operations.
- To impart knowledge of signaling equipment and subsystems, emphasizing fail-safe concepts, safety requirements, and signaling practices in electrified railway sections.
- To introduce train protection systems and provide in-depth knowledge of the Kavach (Indian Railways ATP) system and its architecture.
- To explain the working and interaction of onboard, wayside, and stationary subsystems of Kavach.
- To train students in designing, simulating, testing, and validating Kavach system configurations using plans, control tables, and a test bench

Course Outcomes: On completion of the course, students will be able to

- Explain and analyze railway signaling principles, elements, station layouts, and interlocking systems to ensure safe train operations.
- Apply knowledge of signaling equipment and fail-safe concepts to real-time railway scenarios with emphasis on safety and reliability.
- Explain the concepts, needs, architecture, and working of train protection systems, including Kavach and its onboard and stationary subsystems.
- Analyze Kavach operational concepts such as train positioning, movement authority, braking curves, and speed monitoring.
- Design, simulate, verify, and validate Kavach scheme plans, control tables, interface diagrams, and system configurations using a test bench

UNIT-I : Introduction to General Signaling and Railway Signaling

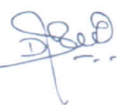
Opening of Railways: Signalling and Inter locking Installations, Catechism for Signalling and Interlocking Installations, for 25KV AC, Isolation, Ruling gradients, Slip, Catch sidings

General Rules: Definitions, Type of Signals; Adequate Distance, System of Working, Absolute Block system, Automatic Block System, Block Working, Level Crossings, Station Working Rules

Station Layouts: MACLS, Signal Aspects, Location of Signals; Station Layouts: Single Line, Double Line, 2-Road, 3-Road, 4-Road

Station Layouts: Track Circuits & Axle Counters, Block Instruments, Relay Inter locking; and Electronic Inter locking, Requirement of Signaling in 25KV AC Electrified Area.

Signaling Interlocking Plan: Essentials of Interlocking, Train Detection, Level Crossing

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Gate, Point Switching, Signal, Block Control, Aspect Control Chart

UNIT-II: Signaling Equipment

Details of Relays, Signal Cables. Signals, Control Panel & Operation-Safety features, Working, Details of Point Machines-Components, Working, Circuit Progression, Testing, Safety features, Level Crossing Gates-Working, Circuit Progression, Safety features, Details of Track Circuits, Axle Counters- Single section, Multi-section, Subsystems; Working and Application, Details about Block Instruments - Types, Working, Circuit Progression, safety features, Data Acquisition System-Interfaces, Fault logic, Details of Integrated Power Supply, CLS Panel, Lightning and Surge Protection

UNIT-III: Introduction to Train Protection Systems -Kavach

Train Protection Systems: Auxiliary Warning Systems, European Train Control Systems Communication, Spot and Continuous Relay of Information, Working of Interfaces
Subsystem: Onboard Kavach: Driver Machine Interlocking, Braking Interface, Radio Equipment, On board Computer, Transponder Receiver, Odometry, GNSS, GPRS, GSM

Subsystem: Stationary Kavach: Station Kavach, Track Side Equipment, signaling Interface, Radio & Tower, GNSS, Transponders, Network Monitoring System

Concepts: Location Referencing-Train position, Modes of Onboard subsystem, Train Characteristics, Mode Transitions, Braking Curves, Speed Profiles, Communication Protocols, Key Management System(KMS), Messages & Language

UNIT-IV: Design-Kavach & Installation

Station Design: Kavach Scheme Plan, Kavach Control Table, Signaling Interface Diagram, Connectivity Plans for Remote Interface Units (RIUs), Power Supply Plan

Tower Design: Soil Testing, Foundation design, Super Structure Design

Stationary Kavach: Inter locking Interface, RFID Tags, Station Master Operation Console Indication Panel (SM_OCIP),GPS/GSM Antennas, Pre-commissioning Checklist, Testing, On board Kavach

UNIT-V: Simulation

Test bench, Preparation and deployment of Stationary Kavach Data: Configuration involving Topographical Information-Arrangement of Signals/Markers, Transponders, Inter signal Distances, Signal Routes, Gradients, Speed Restrictions ; Verification and Validation of On-board Data-Ceiling.

Text Books:

1. Indian Railway Signal Engineering Vol-1, 2008, Pramod P Goel, Bahri Publishers
2. Indian Railway Signal Engineering Vol-IV, 2010, Pramod P Goel, Bahri Publishers
3. Kavach Cab Signalling and Automatic Train Protection Systems for Digital Railways,2023, Lalit Kumar Mansukhani, Chandra Kishore Prasad, Y, Ramesh babu, BS Publications

Reference Books:

1. Fundamentals of Railway Signalling,2016, C.R. Sengupta, Citadel
2. Electronics Interlocking on Indian Railways, 2018,V, Purna Chandra Rao, Notion Press.

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B.Tech.ECE

III Year I Semester

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MICROCONTROLLERS LABORATORY

Course Outcomes: Upon completing this course, the students will be able to

- Develop assembly language programs using 8086 microprocessors for arithmetic, logical, and string operations.
- Interface peripheral devices (ADC, DAC, Stepper Motor, Keyboard Display) with 8086 and verify their operation.
- Write embedded C programs for 8051 microcontrollers using timers, counters, I/O ports, and serial communication
- Design and implement real-time applications using microprocessor and microcontroller interfacing techniques
- Use simulation/debugging tools (Keil, MASM, Proteus, etc.) to analyze and test microprocessor/microcontroller programs.

Cycle 1: Using 8086 Processor Kits and/or Assembler

- Assembly Language Programs to 8086 to Perform
 1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
 2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

Cycle 2: Using 8051 Microcontroller Kit

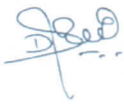
- Introduction to IDE
 1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
 2. Time delay Generation Using Timers of 8051.
 3. Serial Communication from / to 8051 to / from I/O devices.
 4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

Cycle 3: Interfacing I/O Devices to 8051

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8-bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

Cycle 4: Experiments to be carried out on Cortex-M3 development boards and using GNU toolchain7 Segment Display to 8051.

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.

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III Year – I Semester

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ADVANCED ENGLISH COMMUNICATION SKILLS LAB
(Common for ECE, CSE, IT, CSE(DS), CSE(AI&ML))**1. Introduction**

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3rd year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. Taking part in social and professional communication.

2. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, with a focus on vocabulary
- To enable them to listen to English spoken at normal conversational speed by educated English speakers
- To respond appropriately in different socio-cultural and professional contexts
- To communicate their ideas relevantly and coherently in writing
- To prepare the students for placements

3. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. Activities on Listening and Reading Comprehension:

Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Subskills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice

2. Activities on Writing Skills:

Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing – Writing a Letter of Application – Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.

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3. Activities on Presentation Skills

Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Gloss phobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation

4. Activities on Group Discussion (GD):

Functions: Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do's and Don'ts - GD Strategies – Exercises for Practice.

5. Interview Skills:

Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

4. Minimum Requirement:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- One PC with latest configuration for the teacher
- T.V, a digital stereo & Camcorder
- Headphones of High quality

5. Suggested Software: The software consisting of the prescribed topics elaborated above should be procured and used.

- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- Oxford Advanced Learner's Dictionary, 10th Edition
- Cambridge Advanced Learner's Dictionary
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech

6. Books Recommended:

1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015). *Engineering English*. Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). *Academic Writing: A Handbook for International Students*. (5th Edition). Routledge.
4. Koneru, Aruna. (2016). *Professional Communication*. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2022). *Technical Communication, Principles and Practice*. (4th Edition) Oxford University Press.
6. Anderson, Paul V. (2007). *Technical Communication*. Cengage Learning Pvt. Ltd. New

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7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use Series*. Cambridge University Press
8. Sen, Leela. (2009). *Communication Skills*. PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). *Writing with Power*. Oxford University Press.
10. Goleman, Daniel. (2013). *Emotional Intelligence: Why it can matter more than IQ*. Bloomsbury Publishing.

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B.Tech.ECE

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III Year I Semester

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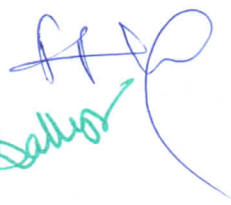
IOT ARCHITECTURE AND PROTOCOLS LABORATORY**Course Outcomes:** Upon completing this course, the students will be able to:

- Understand the fundamentals of IoT, analyzing different architectures and protocols
- Utilize the different sensors like room temperature, DHT, Humidity etc.,
- Interface the sensors and processor for transmission of data.
- Capture the images and process it on Arduino/NodeMCU/Raspberry Pi.
- know the utilization of various protocols like I2c, UART communication etc.,

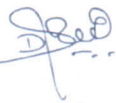
List of Experiments:

1. Demonstrate blinking of an LED every 5 seconds and control brightness of an LED.
2. Read Humidity and Room Temperature using DHT sensor and display the readings.
3. Send the recorded values of Temperature/Humidity to the Internet via GSM module using Arduino/NodeMCU/Raspberry Pi.
4. Demonstrate Interfacing NodeMCU/Raspberry Pi with the Cloud using REST API and MQTT protocol.
5. Demonstrate Switching lights on /off remotely using Arduino/NodeMCU/Raspberry Pi.
6. Voice-based Home Automation for switching lights on/off using Google Assistant, IFTTT and MQTT.
7. Interfacing DHT11 sensor with Raspberry pi/equivalent and uploading temperature and humidity values to the cloud.
8. Design an obstacle detection unit using ultrasonic sensor.
9. Capture images from web camera using Raspberry Pi/equivalent and apply filters in increase image quality.
10. Access a remote computer from Raspberry Pi and display the remote screen.
11. Design an automatic water sprinkler based on soil moisture using Arduino/NodeMCU/Raspberry Pi.
12. Design an RFID based attendance system using Arduino/NodeMCU/Raspberry Pi.
13. Write an Arduino program to demonstrate interrupts
14. Write an Arduino program to demonstrate UART communication protocol
15. Write an Arduino program to demonstrate I2C communication protocol
16. Write an Arduino program to demonstrate SPI communication protocol.



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B.Tech. (AIML, DS, CSE, ECE, IT)

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III Year - I Semester

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INTELLECTUAL PROPERTY RIGHTS
(Common for AIML, DS, CSE, ECE, IT)

Course Objectives:

- To introduce the fundamentals of Intellectual Property Rights (IPRs).
- To provide comprehensive knowledge of trademark law.
- To explain the principles of copyright and patent laws.
- To familiarize students with trade secrets and unfair competition laws.
- To expose students to recent developments and international perspectives in IPR.

Course Outcomes: The student will learn

- Understand and explain the concept, importance, and types of Intellectual Property Rights along with international IPR organizations, treaties, and agencies.
- Analyze and apply trademark laws to identify protectable trademarks, evaluate trademark selection, and understand the trademark registration process.
- Explain and differentiate copyright and patent laws, including originality, ownership, rights, registration, patent searching, and transfer of rights.
- Interpret trade secret and unfair competition laws, and assess legal issues related to misappropriation, false advertising, and rights of publicity.
- Evaluate recent and international developments in IPR and perform basic intellectual property audits in global business and innovation contexts.

UNIT - I: Introduction to Intellectual property

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II: Trademarks:

Purpose and function of trademarks, acquisition of trademark rights, protectable matter, selecting, and evaluating trademarks, trademark registration processes.

UNIT - III:

Law of copyrights:

Fundamental copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT - IV: Trade Secrets:

Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation. Unfair competition: Misappropriation of the right of publicity, false advertising.

UNIT-V: New development of intellectual property:

New developments in trademark law; copyright law, patent law, intellectual property audits. International overview on intellectual property, international – trademark law, copyright law, international patent law, and international development in trade secrets law.

TEXTBOOKS:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

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6. Sree 7. Nirmala 8. Niru 9. K. Jayaram 10. *[Signature]*

Annexure VII

B.Tech.ECE

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III Year-II Semester

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ANTENNAS AND WAVE PROPAGATION**Pre-requisite:** Electromagnetic Theory and Transmission Lines**Course Objectives:** The course objectives are:

- To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
- To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.
- To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.
- To understand the concepts and set-up requirements for microwave measurements and familiarize with the procedure to enable antenna measurements.
- To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved

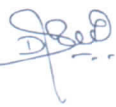
Course outcomes: Upon completing this course, the student will be able to

- Explain the mechanism of radiation, definitions of different antenna characteristic parameters and establish their mathematical relations.
- Analyze and characterize antennas based on operating frequency, geometry, and construct radiation patterns for various antennas and arrays.
- Demonstrate and evaluate antenna measurement setups for far-field pattern and gain determination.
- Classify the different wave propagation mechanisms, determine the characteristic features of different wave propagation, and estimate the parameters involved
- Design and analyze antennas using modern simulation tools and evaluate their performance for specific communication applications

UNIT-I: Antenna Basics

Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem

Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Field

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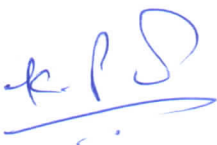
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of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

UNIT-II: Antenna Arrays

Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays.

Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

UNIT-III: VHF, UHF and Microwave Antennas - I

Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

UNIT-IV: VHF, UHF and Microwave Antennas - II

Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

UNIT-V: Wave Propagation

Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts,

Ground Wave Propagation –Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

Space Wave Propagation –Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

Sky Wave Propagation –Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation

Text Books:

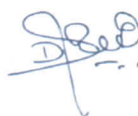
1. J.D. Kraus, R.J. Marhefka and Ahmad S. Khan -Antennas and Wave Propagation, 4th ed., (Special Indian Edition), TMH, New Delhi, 2010.
2. E.C. Jordan and K.G. Balmain -Electromagnetic Waves and Radiating Systems, PHI, 2nd ed., P2000

Reference Books:

1. C.A. Balanis - Antenna Theory, 3rd Edition. John Wiley & Sons, 2005.
2. K.D. Prasad, Satya Prakashan - Antennas and Wave Propagation, Tech India Publications, New Delhi, 2001.
3. Keith Henney - Radio Engineering Handbook, 3rd edition TMH.
4. John Leonidas Volakis -Antenna Engineering Handbook, 3rd edition, 2007G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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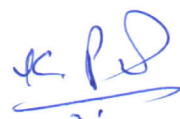
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B.Tech.ECE

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III Year-II Semester

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DIGITAL SIGNAL PROCESSING**Prerequisite:** Signals and Systems**Course Objectives:**

- To provide background and fundamental material for the analysis and processing of digital signals.
- To understand the fast computation of DFT and appreciate the FFT processing.
- To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specification.
- To acquaint in Multi-rate signal processing techniques and finite word length effects.

Course Outcomes: Upon completing this course, the student will be able to Students will

- Students will be able to understand LTI system characteristics and Multi rate signal processing.
- Students will be able to represent inter-relationship between DFT and various transforms.
- Students will be able to design a digital IIR filter for a given specification.
- Students will be able to design a digital FIR filter for a given specification.
- Students will be able to acknowledge the significance of various filter structures and effects of round off errors.

UNIT-I: Introduction:

Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems

Multi rate Digital Signal Processing: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

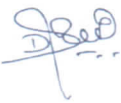
UNIT-II Discrete Fourier series:

Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

UNIT-III: IIR Digital Filters

Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

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UNIT-IV: FIR Digital Filters

Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

UNIT-V: Realization of Digital Filters

Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

Text Books:

1. A. V. Oppenheim and R.W. Schaffer - Discrete Time Signal Processing, PHI, 2009
2. John G. Prokes, Dimitris G. Manolakis - Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education / PHI, 2007.

Reference Books:

1. Li Tan - Digital Signal Processing – Fundamentals and Applications, Elsevier, 2008
2. Robert J. Schilling, Sandra L. Harris - Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2007
3. S. Saliva Hanan, A. Vallavaraj and C. Ghanapriya - Digital Signal Processing, TMH, 2009
4. Emmanuel C. Ifeachor and Barrie W. Jervis - Digital Signal Processing - A Practical approach, 2 Nd Edition, Pearson Education, 2009



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III Year-II Semester

CMOS VLSI DESIGN**Prerequisite:** Electronic Circuit Analysis; Switching Theory and Logic Design**Course Objectives:** The objectives of the course are to:

- Give exposure to different steps involved in the fabrication of ICs.
- Explain electrical properties of MOS and Bi CMOS devices to analyze the behavior of inverters designed with various loads.
- Give exposure to the design rules to be followed to draw the layout of any logic circuit.
- Provide design concepts to design building blocks of data path of any system using gates.
- Understand basic programmable logic devices and testing of CMOS circuits

Course Outcomes: Upon completing this course, the student will be able to

- Understand MOS transistor theory, fabrication process, and electrical characteristics used in VLSI design
- Analyze CMOS logic styles, circuit design principles, and performance metrics such as delay, power, and noise.
- Design combinational and sequential logic circuits using CMOS technology and optimize for area, speed, and power.
- Apply VLSI design methodology, including layout design rules, stick diagrams, and transistor-level implementation
- Use EDA tools (Cadence/Mentor/DSCH/Micro wind) to simulate, verify, and evaluate VLSI circuits and systems.

UNIT-I: Introduction

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi CMOS

Basic Electrical Properties: Basic Electrical Properties of MOS and Bi CMOS Circuits: I_{ds} - V_{ds} relationships, MOS transistor threshold Voltage, g_m , g_{ds} , Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.**UNIT-II: VLSI Circuit Design Processes**

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT-III: Gate Level Design

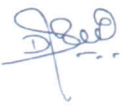
Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

UNIT-IV: Data Path Subsystems

Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.**UNIT-V: Programmable Logic Devices**

Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs. CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

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Text Books:

1. Kamran Eshraghian, Eshraghian Douglas and A. Puck Nell - Essentials of VLSI circuits and systems, PHI, 2005
2. Neil H. E Weste, David Harris, Ayan Banerjee - CMOS VLSI Design – A Circuits and Systems Perspective, 3rd Edition, Pearson, 2009.

Reference Books:

1. Ming-BO Lin - Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2011
2. John. P. Uyemura - CMOS logic circuit Design, Springer, 2007.
3. Wayne Wolf - Modern VLSI Design, 3rd Edition, Pearson Education, 1997.
4. K. Lal Kishore, V. S. V. Prabhakar -VLSI Design, I.K International, 2009.

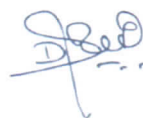
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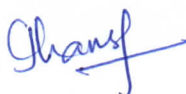
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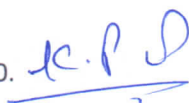
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B.Tech.ECE

III Year-II Semester

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DIGITAL IMAGE PROCESSING (PE – II)**Prerequisite:** Digital Signal Processing**Course Objectives:**

- To provide an approach towards image processing and introduction about 2D transforms
- To expertise about enhancement methods in time and frequency domain
- To expertise about segmentation and compression techniques
- To understand the Morphological operations on an image

Course Outcomes: Upon completing this course, the student will be able to

- Explore the fundamental relations between pixels and utility of 2-D transforms in image processor.
- Articulate the enhancement, segmentation and restoration processes on an image.
- Implement the various Morphological operations on an image
- Utilize basic compression algorithms
- Apply image restoration, segmentation, and compression techniques to digital images.

UNIT-I: Digital Image Fundamentals & Image Transforms

Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.**UNIT-II: Image Enhancement (Spatial Domain)**

Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

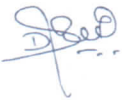
Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.**UNIT-III: Image Restoration**

Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT-IV: Image Segmentation

Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.

Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

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UNIT-V: Image Compression

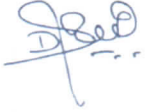
Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods -Digital Image Processing, 3rd Edition, Pearson, 2008
2. S Jayaraman, S Sakurajima, T Veerakumar - Digital Image Processing- - TMH, 2010.

Reference Books:

1. Scotte Umbaugh- Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools, 2nd Ed, CRC Press, 2011
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings - Digital Image Processing using MATLAB, 2nd Edition, TMH, 2010.
3. Somka, Hlavac, Boyle-Digital Image Processing and Computer Vision –Cengage Learning (Indian edition) 2008.
4. Adrian low- Introductory Computer Vision Imaging Techniques and Solutions-,2nd Edition, BS Publication, 2008.

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MOBILE COMMUNICATIONS AND NETWORKS (PE-II)**Prerequisites:** Analog and Digital Communications**Course Objectives:**

- To provide the student with an understanding of the cellular concept, frequency reuse, handoff strategies.
- To provide the student with an understanding of Co-channel and Non-Co-Channel interferences.
- To give the student an understanding of cell coverage for signal and traffic, diversity techniques and channel assignment
- To give the student an understanding type of handoff.
- To understand challenges and application of Ad hoc wireless Networks

Course Outcomes: Upon completing this course, the student will be able to

- Known the evolution of cellular and mobile communication system.
- Explore the Co-Channel and Non-Co-Channel interferences.
- Known how to overcome the different fading effects
- Familiar with cell coverage for signal and traffic, diversity, techniques, frequency management, Channel assignment and types of handoffs.
- Demonstrate the difference between cellular and Ad hoc Networks and design goals of MAC Layer protocol.

UNIT-I: Introduction to Cellular Mobile Radio Systems

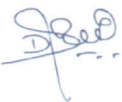
Limitations of Conventional Mobile Telephone Systems. Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems. Uniqueness of Mobile Radio Environment-Fading-Tie Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in an Omni Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems Cell Splitting, Sectoring, Microcell Zone Concept.

UNIT-II: Co-Channel Interference

Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and their effects, diversity techniques-space diversity, polarization diversity, frequency diversity, time diversity.

Non-Co-Channel Interference: Adjacent Channel Interference, Near end far end interference, cross talk, effects on coverage and interference by power decrease, antenna height decrease, effects of cell site components.

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UNIT-III: Cell Coverage for Signal and Traffic

Signal Reflections in flat and Hilly Terrain, effects of Human Made Structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, path loss from a point-to-point prediction model in different conditions, merits of lee model.

Frequency Management and Channel Assignment: Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

UNIT- IV: Handoffs and Dropped Calls

Handoff Initiation, types of Handoffs, Delaying Handoff, advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem handoff, Introduction to Dropped Call Rates and their Evaluation.

UNIT- V: Ad Hoc Wireless Networks

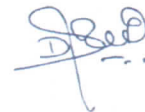
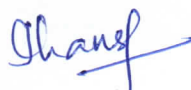
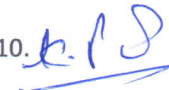
Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

Text Books:

1. W.C.Y. Lee - Mobile Cellular Telecommunications, 2nd edition, Mc Graw Hill, 1989.
2. Theodore. S. Rappoport - Wireless Communications, 2nd edition, Pearson Education, 2002.

Reference Books:

1. C. Siva ram Murthy and B.S. Manoj - Ad Hoc Wireless Networks: Architectures and Protocols, PHI, 2004.
2. Simon Haykin, Michael Moher - Modern Wireless Communications, Pearson Education, 2005.
3. Vijay Garg - Wireless Communications and Networking, Elsevier Publications, 2007.
4. Andrea Goldsmith - Wireless Communications-, Cambridge University Press, 2005.

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B.Tech.ECE

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III Year-II Semester

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EMBEDDED SYSTEM DESIGN (PE-II)**Prerequisites:** Microprocessors and Microcontrollers; Computer Organization and Operating Systems**Course Objectives:**

- To provide an overview of Design Principles of Embedded System.
- To provide clear understanding about the role of firmware.
- To understand the necessity of operating systems in correlation with hardware systems.
- To learn the methods of interfacing and synchronization for tasking.

Course Outcomes: Upon completing this course, the student will be able to

- Understand the architecture, components, and design principles of embedded systems including hardware–software co-design.
- Analyze embedded processors, memory, buses, I/O interfaces, and real-time operating systems for various applications.
- Apply real-time constraints, scheduling algorithms, and embedded firmware development techniques.
- Design embedded system applications using microcontrollers, sensors, actuators, and communication interfaces
- Use embedded design tools (Keil, MPLAB, Arduino/ARM IDEs) to model, simulate, and evaluate embedded applications

UNIT-I: Introduction to Embedded Systems

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-II: Typical Embedded System

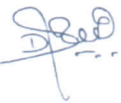
Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT-III: Embedded Firmware

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT- IV: RTOS Based Embedded System Design

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

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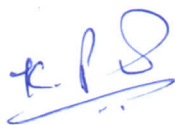
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UNIT- V: Task Communication

Shared Memory, Message Passing, Remote Procedure Call and Sockets

Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

Text Books:

1. Shibu K.V - Introduction to Embedded Systems, Mc Graw Hill.

Reference Books:

1. Raj Kamal - Embedded Systems, TMH.
2. Frank Vahid, Tony Givargis - Embedded System Design, John Wiley.
3. Lyla - Embedded Systems, Pearson, 2013
4. David E. Simon - An Embedded Software Primer, Pearson Education, 2007.

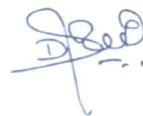
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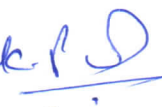
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B.Tech.ECE

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III Year-II Semester

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DIGITAL SIGNAL PROCESSING LABORATORY

Course Outcomes: Upon completing this course, the student will be able to

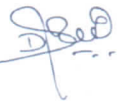
- Implement basic DSP operations (convolution, correlation, DFT/IDFT, FFT/IFFT) using MATLAB / Python / DSP processors
- Design and analyze digital IIR and FIR filters using standard techniques and verify the responses through simulation
- Develop real-time DSP applications using DSP kits / processors and evaluate system performance.
- Implement sampling, quantization, and multi rate signal processing concepts in software/hardware.
- Prepare technical reports and demonstrate DSP experiments effectively through oral presentation

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

Note: - Minimum of 12 experiments must be conducted.

List of Experiments:

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
6. Implementation of FFT of given Sequence
7. Determination of Power Spectrum of a given Signal(s)
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Narrow Band Signal through Filtering
11. Generation of DTMF Signals
12. Implementation of Decimation Process
13. Implementation of Interpolation Process
14. Implementation of I/D Sampling Rate Converters
15. Impulse Response of First order and Second Order Systems.

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B.Tech.ECE

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III Year-II Semester

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CMOS VLSI DESIGN LABORATORY

Note: Any **SIX** of the following experiments from each part are to be conducted (Total 12)

Course Outcomes: Upon completing this course, the student will be able to

- Understand the physical design process of Digital Integrated Circuits
- Describe procedure for designing of programmable circuits.
- Demonstrate the ability to use various EDA tools for digital system design
- Implement various combinational and sequential circuits using VHDL on FPGA
- Implement schematic and layout of various digital CMOS logic circuits using EDA tools.

Part - I

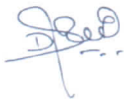
All the following experiments must be implemented using HDL

1. Realize all the logic gates
2. Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder
3. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer
4. Design of 4 bit binary to gray code converter
5. Design of 4-bit comparator
6. Design of Full adder using 3 modeling styles
7. Design of flip flops: SR, D, JK, T
8. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
9. Finite State Machine Design

Part - II

Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:

1. Basic logic gates
2. CMOS inverter
3. CMOS NOR/ NAND gates
4. CMOS XOR and MUX gates
5. Static / Dynamic logic circuit (register cell)
6. Latch
7. Pass transistor
8. Layout of any combinational circuit (complex CMOS logic gate)

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B.Tech.ECE**L T P C****III Year-II Semester****0 0 2 1****ADVANCED COMMUNICATIONS LABORATORY****Course Outcomes:**

- The ability to analyse and simulate antenna performance
- Generation of different types of signals using Vector Signal Generator
- Study the features of Network and spectrum analyzer
- Simulate the Radiation resistance for different antennas using HFSS/ ADS/ MATLAB and compare the measurement using Network analyzer
- Reading analog and digital sensors data using UART Using ICONT setup.

Note: Minimum Eight experiments should be conducted**List of Experiments:**

1. Study the features of Network and spectrum analyzer
2. Simulate the Radiation pattern for different antennas using HFSS/ADS/MATLAB and compare the measurement using Network analyzer.
 - i. Dipole Antenna
 - ii. Horn antenna
 - iii. Microstrip Antenna etc.
3. Simulate the Radiation resistance for different antennas using HFSS/ ADS/ MATLAB and compare the measurement using Network analyzer.
 - i. Dipole Antenna
 - ii. Horn antenna
 - iii. Microstrip Antenna etc.
4. Plotting eye diagram for baseband signal using MATLAB and verifying using Network analyzer.
5. Plotting Constellation Diagram of QAM using MATLAB and verify using kit.
6. OFDM generation and detection using Simulink and verify using kit.
7. Generation of different types of signals using Vector Signal Generator
8. Modulation analysis on digital modulated single carrier signals using MATLAB.
9. Reading analog and digital sensors data using UART Using ICONT setup.
10. Collecting sensor values of remote nodes using RIME broadcasting Using ICONT setup.

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B.Tech.

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III Year - II Semester

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ENVIRONMENTAL SCIENCE

(Common for ECE, IT, CSE, CSE(DS), CSE(AI&ML))

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations.

Course Outcomes:

1. Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
2. Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
3. Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
4. Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
5. Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

UNIT-I:

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem. Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio-magnification, ecosystem value, services and carrying capacity, Field visits.

UNIT – II :

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies

UNIT – III :

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In- Situ and Ex-situ conservation. National Biodiversity act

UNIT – IV :

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and

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types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions/ Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT – V :

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA:EIA structure, methods of baseline data acquisition. Over view on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

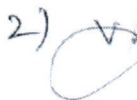
Text Books :

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

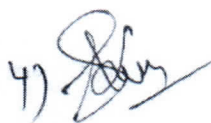
Reference Books :

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

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