R18(B.Tech ECE)

Curriculum & Syllabus for B.Tech Under Autonomy

Electronics and Communication Engineering

(Effective From 2018-19 admission Batch)

1st Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 101	Mathematics -I	3	1	0	4	4
2	BS	CH 101/ PH 101	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	ES	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
4	HS	HU 101	English	2	0	0	2	2
Total of Theory							**12**	**12**
B. PRACTICAL								
5	BS	CH 191/ PH191	Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B)	0	0	3	3	1.5
6	ES	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B)	0	0	3	3	1.5
7	ES	ME 191/ ME 192	Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B)	0	0	3	3	1.5
8	PROJ	PR 191	PROJECT-IA	0	0	1	1	0.5
9	PROJ	PR 192	PROJECT-IB	0	0	1	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
8	MC	MC 181	Induction Program	0	0	0	0	
Total of Theory, Practical & Mandatory Activities/Courses							**23**	**17.5**

2nd Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Credit Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 201	Mathematics -II	3	1	0	4	4
2	BS	CH 201/ PH 201	Chemistry - (Gr. B) / Physics – I (Gr. A)	3	0	0	3	3
3	ES	EE 201/ EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
4	ES	CS 201	Programming for Problem Solving	3	0	0	3	3
5	ES	ME 201	Engineering Mechanics	3	0	0	3	3
Total of Theory							**16**	**16**
B. PRACTICAL								
6	ES	CS291	Programming for Problem Solving Lab	0	0	3	3	1.5
7	BS	CH 291/ PH 291	Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A)	0	0	3	3	1.5
8	ES	EE 291/ EC 291	Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A)	0	0	3	3	1.5
9	ES	ME 291/ ME 292	Engineering Graphics & Design (Gr B) / Workshop/Manufacturing Practice (Gr-A)	0	0	3	3	1.5
10	HS	HU 291	Language Lab	0	0	2	2	1
11	PROJ	PR 291	Project-II	0	0	1	1	0.5
12	PROJ*	PR 292	Innovative activities-I	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**34**	**24**

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

3rd Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 301	Mathematics-III	3	1	0	4	4
2	ES	M (CS) 301	Numerical Methods	3	0	0	3	3
3	PC	EC 301	Solid State Devices	3	0	0	3	3
4	PC	EC 302	Circuit Theory & Networks	3	0	0	3	3
5	ES	EC 303	Data Structure	3	0	0	3	3
6	HS	HU 301	Values & Ethics in Profession	2	0	0	2	2
Total of Theory							**18**	**18**
B. PRACTICAL								
7	ES	M (CS) 391	Numerical Methods Lab	0	0	3	3	1.5
8	PC	EC 392	Circuit Theory & Networks Lab	0	0	3	3	1.5
9	ES	EC 393	Data Structure Lab	0	0	3	3	1.5
10	PROJ	PR 391	Project-III	0	0	2	2	1
11	PROJ*	PR 392	Innovative activities-II	0	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 381	Behavioural & Interpersonal skills	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**33**	**24**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

4th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	PH(ECE) 401	Physics II	3	0	0	3	3
2	PC	EC 401	Signals & Systems	3	0	0	3	3
3	PC	EC 402	Analog Electronic Circuits	3	0	0	3	3
4	PC	EC 403	Digital Electronic Circuits	3	0	0	3	3
5	PC	EC 404	Antenna & wave propagation	3	0	0	3	3
Total of Theory							**15**	**15**
B. PRACTICAL								
6	BS	PH(ECE)491	Physics II Lab	0	0	3	3	1.5
7	PC	EC 492	Analog Electronic Circuits Lab	0	0	3	3	1.5
8	PC	EC 493	Digital Electronic Circuits Lab	0	0	3	3	1.5
9	PC	EC 494	Antenna & wave propagation Lab	0	0	3	3	1.5
10	PROJ	PR 491	Project-IV	0	0	2	2	1
11	PROJ*	PR 492	Innovative activities-III	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 401	Environmental Science	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**32**	**22.5**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities

5th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	HS	HU 502	Economics for Engineers	2	0	0	2	2
2	PC	EC 501	Analog & Digital Communication Systems	3	0	0	3	3
3	PC	EC 502	Microprocessor & Micro Controller	3	0	0	3	3
4	PC	EC 503	Digital Signal Processing	3	0	0	3	3
5	PE	EC 504	A. Information Theory & Coding B. Renewable Energy Sources & Applications C. Nano Electronics	3	0	0	3	3
Total of Theory							**14**	**14**
B. PRACTICAL								
6	PC	EC 591	Analog & Digital Communication Systems Lab	0	0	3	3	1.5
7	PC	EC 592	Microprocessor & Micro Controller Lab	0	0	3	3	1.5
8	PC	EC 593	Digital Signal Processing Lab	0	0	3	3	1.5
10	PROJ	PR 591	Project-V	0	0	2	2	1
11	PROJ*	PR 592	Innovative activities-IV	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 501	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**31**	**20**

* Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

6th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	PC	EC 601	VLSI & Microelectronics	3	0	0	3	3
2	PC	EC 602	Control System	3	0	0	3	3
3	PC	EC 603	RF & Microwave Engineering	3	0	0	3	3
4	PE	EC 604	A. Mobile Communication & Network	3	0	0	3	3
			B. Advanced Microprocessor & Microcontroller					
			C. Introduction to Python					
5	OE	EC 605	A. Object Oriented Programming using JAVA	3	0	0	3	3
			B. Computer Communication & Network Security					
			C. Artificial Intelligence & Robotics					
	Total of Theory						**15**	**15**
B. PRACTICAL								
6	PC	EC 691	VLSI & Microelectronics Lab	0	0	3	3	1.5
7	PC	EC 692	Control System Lab	0	0	3	3	1.5
	PC	EC 693	RF & Microwave Engineering Lab	0	0	3	3	1.5
8	PE	EC 694	A. Mobile Communication & Network Lab	0	0	3	3	1.5
			B. Advanced Microprocessor & Microcontroller Lab					
			C. Python Programming Lab					
9	OE	EC 695	A. Object Oriented Programming using JAVA Lab	0	0	3	3	1.5
			B. Computer Communication & Network Security Lab					
			C. Artificial Intelligence & Robotics Lab					
10	PROJ	PR 691	Project-VI	0	0	2	2	1
11	PROJ*	PR 692	Innovative activities-V	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 681	Technical Lecture Presentation & Group Discussion-I	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**32**	**24**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

7th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	HS	HU 704	Principles of Management	2	0	0	2	2
2	PE	EC 701	A. Satellite & Optical Communication	3	0	0	3	3
			B. Digital Image & Video Processing					
			C. Remote Sensing & GIS					
3	OE	EC 702	A. Data Base Management Systems	3	0	0	3	3
			B. Machine Learning					
			C. Internet of Things (IOT)					
Total of Theory							**8**	**8**
B. PRACTICAL								
4	PE	EC 791	A. Satellite & Optical Communication Lab	0	0	3	3	1.5
			B. Digital Image & Video Processing Lab					
			C. Remote Sensing & GIS Lab					
5	OE	EC 792	A. Data Base Management Systems Lab	0	0	3	3	1.5
			B. Machine Learning Lab					
			C. Internet of Things (IOT) Lab					
6	PROJ	PR 791	Project-VII	0	0	0	6	3
7	PROJ*	PR 792	Innovative activities-VI	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
8	MC	MC 781	Technical Lecture Presentation & Group Discussion-II	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**23**	**14.5**

*Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head / Event Coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

8th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	PE	EC 801	A. Adaptive Signal Processing B. Wireless Sensor Network C. Embedded System	3	0	0	3	3
2	OE	EC 802	A. Cloud Computing B. Data Science C. Block Chain	3	0	0	3	3
3	OE	EC 803	A. Biomedical Electronics & Imaging B. Automotive Electronics C. Physical Design, Verification & Testing	3	0	0	3	3
Total of Theory							**9**	**9**
B. PRACTICAL								
4	PE	EC 891	A. Adaptive Signal Processing Lab B. Wireless Sensor Network Lab C. Embedded System Lab	0	0	3	3	1.5
5	PROJ	PR 891	Project-VIII	0	0	0	6	3
C. MANDATORY ACTIVITIES / COURSES								
6	MC	MC 801	Essence of Indian Knowledge Tradition	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**21**	**13.5**

Mandatory Credit Point=160

For Honors additional 20 Credit Point is to be earned (1st Sem to 8th Sem) through MOOCs courses. All the Certificates received by the students across all semesters for MOOCs Courses from approved organization (Appendix A) is to be submitted to CoE office prior to 8th Semester Examination.

Credit Distribution Ratio:

Category	Credit Allocation As per Autonomy	Credit Allocation As per AICTE
Humanities, Social Sciences & Management Courses	9	12*
Basic Sciences Courses	25.5	25*
Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc	28.5	24*
Professional Core Courses	51	48*
Professional Elective Courses relevant to chosen specialization/Branch	16.5	18*
Open Elective Courses-Electives from other technical and / or emerging subjects	15	18*
Project work, seminar and internship in industry or elsewhere	14.5	15*
Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities	Non-credited	Non-credited
Total	160	160

* Minor Variation is allowed as per need of the respective disciplines.

Subject Distribution in Different Category:

Sl No	Paper Code	Theory	Contact Hours /Week				Credit Points
			L	T	P	Total	
A. Humanities, Social Sciences & Management Courses (HS)							
1	HU 101	English	2	0	0	2	2
2	HU 291	Language Lab	0	0	2	2	1
3	HU 301	Values & Ethics in Profession	2	0	0	2	2
4	HU 502	Economics for Engineers	2	0	0	2	2
5	HU 704	Principles of Management	2	0	0	2	2
		Total Credit:					**9**
B. Basic Sciences Courses (BS)							
1	M 101	Mathematics -I	3	1	0	4	4
2	CH 101/ PH	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	CH 191/	Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B)	0	0	3	3	1.5
4	M 201	Mathematics -II	3	1	0	4	4
5	CH 201/ PH	Chemistry - (Gr. B) /	3	0	0	3	3
6	CH 291/ PH 291	Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A)	0	0	3	3	1.5
7	M 301	Mathematics-III	3	1	0	4	4
8	PH(ECE) 401	Physics II	3	0	0	3	3
9	PH(ECE)491	Physics II Lab	0	0	3	3	1.5
		Total Credit:					**25.5**
C. Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc (ES)							
1	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
2	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B)	0	0	3	3	1.5
3	ME 191/ ME 192	Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B)	0	0	3	3	1.5
4	EE 201/ EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
5	CS 201	Programming for Problem Solving	3	0	0	3	3
6	ME 201	Engineering Mechanics	3	0	0	3	3
7	CS291	Programming for Problem Solving Lab	0	0	3	3	1.5
8	EE 291/ EC 291	Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A)	0	0	3	3	1.5
9	ME 291/ ME 292	Engineering Graphics & Design (Gr B) / Workshop/Manufacturing Practice (Gr-A)	0	0	3	3	1.5
10	M (CS) 301	Numerical Methods	3	0	0	3	3
11	M (CS) 391	Numerical Methods Lab	0	0	3	3	1.5
12	CS(ECE) 301	Data Structure	3	0	0	3	3
13	CS (ECE) 391	Data Structure Lab	0	0	3	3	1.5
		Total Credit:					**28.5**
D. Professional Core Courses (PC)							
1	EC 301	Solid State Devices	3	0	0	3	3
2	EC 302	Circuit Theory & Networks	3	0	0	3	3
3	EC 392	Circuit Theory & Networks Lab	0	0	3	3	1.5
4	EC 401	Signals & Systems	3	0	0	3	3
5	EC 402	Analog Electronic Circuits	3	0	0	3	3
6	EC 403	Digital Electronic Circuits	3	0	0	3	3

7	EC 404	Antenna & Wave Propagation	3	0	0	3	3
8	EC 492	Analog Electronic Circuits Lab	0	0	3	3	1.5
9	EC 493	Digital Electronic Circuits Lab	0	0	3	3	1.5
10	EC 494	Antenna & Wave Propagation Lab	0	0	3	3	1.5
11	EC 501	Analog & Digital Communication Systems	3	0	0	3	3
12	EC 502	Microprocessor & Micro Controller	3	0	0	3	3
13	EC 503	Digital Signal Processing	3	0	0	3	3
14	EC 591	Analog & Digital Communication Systems Lab	0	0	3	3	1.5
15	EC 592	Microprocessor & Micro Controller Lab	0	0	3	3	1.5
16	EC 593	Digital Signal Processing Lab	0	0	3	3	1.5
19	EC 601	VLSI & Microelectronics	3	0	0	3	3
20	EC 602	Control System	3	0	0	3	3
	EC 603	RF & Microwave Engineering	3	0	0	3	3
21	EC 691	VLSI & Microelectronics Lab	0	0	3	3	1.5
22	EC 692	Control System Lab	0	0	3	3	1.5
	EC 693	RF & Microwave Engineering Lab	0	0	3	3	1.5
		Total Credit:					**51**
E. Professional Elective Courses relevant to chosen specialization/Branch (PE)							
1	EC 504	A. Information Theory & Coding B. Renewable Energy Sources & applications C. Nano Electronics	3	0	0	3	3
2	EC 604	A. Mobile Communication & Network B. Advanced Microprocessor Microcontroller C. Computer Communication & Network Security	3	0	0	3	3
3	EC 694	A. Mobile Communication & Network Lab B. Advanced Microprocessor & Microcontroller Lab C. Computer Communication & Network Security Lab	0	0	3	3	1.5
4	EC 701	A. Satellite & Optical Communication B. Digital Image & Video Processing C. Remote Sensing & GIS	3	0	0	3	3
5	EC 791	A. Satellite & Optical Communication Lab B. Digital Image & Video Processing Lab C. Remote Sensing & GIS Lab	0	0	3	3	1.5
6	EC 801	A. Adaptive Signal Processing B. Wireless Sensor Network C. Embedded System	3	0	0	3	3
8	EC 891	A. Adaptive Signal Processing Lab B. Wireless Sensor Network Lab C. Embedded System Lab	0	0	3	3	1.5
		Total Credit:					**16.5**

F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE):							
1	EC 605	A. Object Oriented Programming using JAVA B. Software Engineering C. Machine Learning	3	0	0	3	3
2	EC 695	A. Object Oriented Programming using JAVA Lab B. Software Engineering Lab C. Machine Learning Lab	0	0	3	3	1.5
3	EC 702	A. Data Base Management Systems B. Artificial Intelligence & Robotics C. Internet of Things (IOT)	3	0	0	3	3
4	EC 792	A. Data Base Management Systems Lab B. Artificial Intelligence & Robotics Lab C. Internet of Things (IOT) Lab	0	0	3	3	1.5
5	EC 802	A. Cloud Computing B. Data Science C. Block Chain	3	0	0	3	3
6	EC 803	A. Biomedical Electronics & Imaging B. Scientific Computing C. Physical Design, Verification & Testing	3	0	0	3	3
		Total Credit:					**15**
G. Project work, seminar, and internship in industry or elsewhere (PW)							
1	PR 191	Project-IA	0	0	1	1	0.5
2	PR 192	Project-IB	0	0	1	1	0.5
3	PR 291	Project-II	0	0	1	1	0.5
4	PR 292	Innovative activities I	0	0	0	0	0.5
5	PR 391	Project-III	0	0	2	2	1
6	PR 392	Innovative activities-II	0	0	0	1	0.5
7	PR 491	Project-IV	0	0	1	1	1
8	PR 492	Innovative activities-III	0	0	0	0	0.5
9	PR 591	Project-V	0	0	2	2	1
10	PR 592	Innovative activities-IV	0	0	0	0	0.5
11	PR 691	Project-VI	0	0	2	2	1
12	PR 692	Innovative activities V	0	0	0	0	0.5
13	PR 791	Project-VII	0	0	0	6	3
14	PR 792	Innovative activities-VI	0	0	0	0	0.5
15	PR 891	Project-VIII	0	0	0	8	3
		Total Credit:					**14.5**

H. Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities (MC)							
1	MC181	Induction Program	0	0	6	6	
2	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	3	3	
3	MC 381	Behavioural & Interpersonal skills	0	0	3	3	
4	MC 401	Environmental Science	3	0	0	3	
5	MC 501	Constitution of India	3	0	0	3	
6	MC 681	Technical Lecture Presentation & Group Discussion-I	0	0	3	3	
7	MC 781	Technical Lecture Presentation & Group Discussion-II	0	0	3	3	
8	MC 801	Essence of Indian Knowledge Tradition	3	0	0	3	

Format for Project Work Evaluation (B. Tech)

College Name: ***Department :***

Paper Name : **Paper Code :**

STREAM : **Semester :**

University Roll No.	Name of the Student	Title of the Project	Semester Examination								
			Project Report (10)	Development of Prototype/ Model (20)	Power point presentation (15)	Viva-Voce (15)	Usage of Modern Tool / Technology (10)	Innovative-ness (10)	Individual contribution (10)	Group activity (10)	Total (100)

(Signature of the Project Supervisor(s)) (Signature of the HoD)

Appendix A

MOOCs Courses

For B.Tech Students for AY 2018-19

(1st Semester to 8th Semester)

Total Credit for MOOCs Subjects will be 20.

List of websites which offers online certification Courses

List of Websites which offers online certification courses:

1. Swayam-https://swayam.gov.in/
2. NPTEL-https://onlinecourses.nptel.ac.in/
3. Mooc- http://mooc.org/
4. Edx -https://www.edx.org/
5. Coursera-https://www.coursera.org/
6. Udacity -https://in.udacity.com/
7. Udemy -https://www.udemy.com/
8. Khan academy -https://www.khanacademy.org/
9. Skill sahre -https://www.skillshare.com/
10. Harvard University -https://online-learning.harvard.edu/
11. Ted - https://ed.ted.com/
12. Alison - https://alison.com/
13. Future learn https://www.futurelearn.com/
14. Web Development - https://digitaldefynd.com/best-free-web-development-courses-tutorials-certification/
15. Digital Marketing - https://digitaldefynd.com/best-free-digital-marketing-certifications/
16. ios app development - https://digitaldefynd.com/best-ios-app-development-course-tutorial/
17. Open Learn -http://www.open.edu/openlearn/
18. Future Learn -https://www.futurelearn.com/
19. Tuts Plus -https://tutsplus.com/
20. Open Culture -http://www.openculture.com/

For Honors additional 20 Credit Point is to be earned (1st Sem to 8th Sem) through MOOCs courses. All the Certificates received by the students across all semester for MOOCs Courses from approved organization, should be submitted to CoE office prior to 8th Semester Examination.

Credit distribution with respect to weeks are as follows:
4 to 7 weeks: 2 Credits
8 to 11 weeks: 3 Credits
12 to 15 weeks: 4 Credits
16 or more than that: 6 Credits

20 credit for Honors, should be earned by the students from the MOOC Basket and any other subjects related to the specific program of the respective departments.

MOOCs Basket for Electronics & Communication Engineering

Sl No	MOOC Courses	Applicable Students (Semester wise)
1	Environmental Science & Studies	**I/II**
2	Computer Fundamentals	**I/II**
3	C Programming	**III/IV**
4	Programming of C++	**III/IV**
5	Data Structure	**III/IV**
6	Basic Electrical Engineering	**III/IV**
7	Basic Electronics Engineering	**III/IV**
8	Solid State Physics	**III/IV**
9	Programming Using Python	**III/IV/V/VI**
10	Engineering Simulation Tools	**V/VI**
11	Solid State Devices	**III/IV**
12	Circuit Theory & Network	**III/IV**
13	Digital Electronics & Microprocessor	**IV/V/VI**
14	Signal & Systems	**III/IV**
15	Advanced Microprocessor & Microcontroller	**VII/VIII**
16	Control Engineering	**V/VI**
17	Analog Circuits	**IV/V/VI**
18	Analog & Digital Communication	**V/VI**
19	EM theory & Its Applications	**V/VI**
20	Principles of Communication	**V/VI**
21	Satellite Communication	**VII/VIII**
22	Wireless & Cellular Communication	**VII/VIII**
23	Microwave Integrated Circuits	**VII/VIII**
24	VLSI & Microelectronics	**VII/VIII**
25	Signal Processing	**VII/VIII**
26	Electronics Measurement	**V/VI**
27	Integrated Circuits	**V/VI**
28	Programming with MATLAB	**III/IV/V/VI**
29	Renewable Energy Sources & Its Applications	**IV/V/VI/VII**
30	Remote Sensing	**VI/VII**
31	Sensor Network	**VI/VII**
32	Advanced Communications	**VII/VIII**
33	Information Theory & Coding	**V/VI**
34	Design of PV System	**III/IV/V**
35	Digital Image Processing	**VII/VIII**
36	Digital Speech & Audio Processing	**VII/VIII**
37	Biomedical Signal Processing	**VI/VII**
38	Embedded System	**VII/VIII**
39	Mobile Communication	**VI/VII**
40	Optical fibre Communication	**VII/VIII**
41	Biomedical Instrumentation & Imaging	**VI/VII**
42	Artificial Intelligence & Robotics	**VII/VIII**
43	Cyber Security & Cryptography	**VI/VII/VIII**
44	Internet of Things (IOT)	**VI/VII/VIII**
45	Quantum Computing	**VI/VII/VIII**
46	Data Sciences	**VI/VII/VIII**
47	Big Data	**VI/VII/VIII**
48	Cloud Computing	**VI/VII/VIII**
49	Machine Learning	**VI/VII/VIII**
50	Operating System	**VI/VII/VIII**
51	Arduino	**V/VI**
52	Software Engineering	**VII/VIII**
53	DBMS	**VI/VII**

54	Object Oriented Programming with JAVA	**VI/VII**
55	Computer Network	**VI/VII**
56	Graph Theory	**VI/VII**
57	Privacy & Security in Online Social Media	**VI/VII**
58	Compilers	**VII/VIII**
59	Responsive Website Basics: Code with HTML, CSS and JAVA script	**V/VI/VII**
60	Android App Development	**VII/VIII**

* For Mandatory Additional Requirement (MAR), Student may opt any subject but other than the above listed subjects.

Appendix B

Mandatory Additional Requirement(MAR):

List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B. Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club (Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Department: Electronics & Communication Engineering

LIST OF MOOCS COURSES FOR MAR

MOOCs Equivalent (Theory)	Minimum Duration	Suggested MAR Point
Ethics in Engineering Practice	8weeks	16
Environmental Studies: A Global Perspective	6weeks	12
Introduction To Biology: The Secret of Life	12weeks	20
Engineering Econometrics	12weeks	20
Management in Engineering	8weeks	16
Human Resource Development	12 weeks	20
Organizational Behavior	7 weeks	16
Project Management for Managers	12weeks	20
International Cyber Conflicts	5weeks	10
Fundamentals of Digital Marketing, social media, and E-Commerce	6weeks	12
Developing Soft Skills and Personality	8 weeks	16
History of English Language and Literature	12 weeks	20
Interpersonal Skills	8 weeks	16
Soft skills	12 weeks	20
Technical English for engineers	8 weeks	16
Better Spoken English	12 weeks	20
Business English Communication	4 weeks	8
Calculus of One Real Variable	8 weeks	16
Educational leadership	8 weeks	16
Economics of IPR	4 weeks	8
Enhancing Soft Skills and Personality	8 weeks	16
Human Resource Development	12 weeks	20
Indian Philosophy	12 weeks	20
Intellectual Property	12 weeks	20
Introduction on Intellectual Property to Engineers and Technologists	8 weeks	16
Literature, Culture and Media	12 weeks	20
Science, Technology and Society	12 weeks	20
Soft Skill Development	8 weeks	16
Speaking Effectively	8 weeks	16
Strategic Performance Management	8 weeks	16
Water, Society and Sustainability	4 weeks	8
Calculus of Several Real Variables	8 weeks	16
Higher Engineering Mathematics	12 weeks	20
Introduction to Abstract and Linear Algebra	8 weeks	16

Note: This is a basic guideline for MAR point. More courses can be taken in consultation with the Department.

Record of Activities for Mandatory Additional Requirement

College Name (College Code):							Department:					
Student Name:		University Roll No:					Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	*MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course*											
	For 12 weeks duration	**20**	**40**									
	For 8 weeks duration	**16**										
2	*Tech Fest/Teachers Day/Freshers Welcome*											
	Organizer	**5**	**10**									
	Participants	**3**	**6**									
3	Rural Reporting	**5**	**10**									
4	Tree Plantation and up keeping (per tree)	**1**	**10**									
5	Participation in Relief Camps	**20**	**40**									
6	Participation in Debate/Group Discussion/ Tech quiz	**10**	**20**									
7	*Publication of Wall magazine in institutional level (magazine/article /internet)*											
	Editor	**10**	**20**									
	Writer	**6**	**12**									
8	Publication in News Paper, Magazine & Blogs	**10**	**20**									
9	Research Publication (per publication)	**15**	**30**									
10	Innovative Projects (other than course curriculum)	**30**	**60**									
11	Blood donation	**8**	**16**									
	Blood donation camp Organization	**10**	**20**									

Record of Activities for Mandatory Additional Requirement (Contd.)

Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
12	*Participation in Sports/Games*											
	College level	**5**	**10**									
	University Level	**10**	**20**									
	District Level	**12**	**24**									
	State Level	**15**	**30**									
	National/International Level	**20**	**20**									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	**10**	**20**									
14	Member of Professional Society	**10**	**20**									
15	Student Chapter	**10**	**20**									
16	Relevant Industry Visit & Report	**10**	**20**									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	**5**	**10**									
18	Participation in Yoga Camp (Certificate to be submitted)	**5**	**10**									
19	Self-Entrepreneurship Programme	**20**	**20**									
20	Adventure Sports with Certification	**10**	**20**									
21	Training to under privileged / Differently abled	**15**	**30**									
22	Community Service & Allied Activities	**10**	**20**									
Total Points												
Signature of Mentor												
Signature of HoD												

Department: Electronics & Communication Engineering

Curriculum Structure & Syllabus

(Effective from 2018-19 admission batch)

Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

1st Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 101	Mathematics -I	3	1	0	4	4
2	BS	CH 101/ PH 101	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	ES	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
4	HS	HU 101	English	2	0	0	2	2
Total of Theory							**12**	**12**
B. PRACTICAL								
5	BS	CH 191/ PH191	Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B)	0	0	3	3	1.5
6	ES	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B)	0	0	3	3	1.5
7	ES	ME 191/ ME 192	Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B)	0	0	3	3	1.5
8	PROJ	PR 191	PROJECT-IA	0	0	1	1	0.5
9	PROJ	PR 192	PROJECT-IB	0	0	1	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
8	MC	MC 181	Induction Program	0	0	0	0	
Total of Theory, Practical & Mandatory Activities/Courses							**23**	**17.5**

FOR GROUP B: CSE, IT, FT, ME, CE

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Mathematics–I
Paper Code: M101
Total Contact Hours: 40
Credit: 4

Prerequisite: Any introductory course on matrix algebra, calculus, geometry.

Course Objective: The purpose of this course is to provide fundamental concepts matrix algebra, Calculus of Single and Several Variables and Vector Analysis.

After completion of the course students would be able to

Course Outcome:

COs	DESCRIPTIONS
CO1	Understand and recall the properties and formula related to matrix algebra, differential calculus, integral calculus and vector algebra.
CO2	Determine the solutions of the problems related to matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series.
CO3	Apply the appropriate mathematical tools of matrix algebra, differential calculus, Integral Calculus, multivariable calculus, vector calculus and infinite series for the solutions of the related problems.
CO4	Analyze different engineering problems linked with matrix algebra, differential calculus, Integral Calculus, multivariable calculus, vector calculus.
CO5	Apply different engineering problems linked with matrix algebra, differential calculus, Integral Calculus, multivariable calculus, vector calculus.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M101.1	3	3	2	-								2
M101.2	3	3	3	3								2
M101.3	3	3	3	3								2
M101.4	3	3	3	3								2
M101.5	3	3	3	3								2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
M101.1	2	2	2
M101.2	2	2	2
M101.3	2	2	2
M101.4	2	2	2
M101.5	2	2	2

Course contents:

MODULE I [10L]

Matrix Algebra: Elementary row and column operations on a matrix, Rank of matrix, Normal form, Inverse of a matrix using elementary operations, Consistency and solutions of systems of linear equations using elementary operations, Linear dependence and independence of vectors, Concept & Properties of different matrices (unitary, orthogonal, symmetric, skew-symmetric, Hermitian, skew-Hermitian), Eigen values and Eigen vectors of a square matrix (of order 2 or 3), Characteristic polynomials, Caley-Hamilton theorem and its applications, Reduction to diagonal form (up to 3rd. order).

MODULE II [10L]

Calculus-I (Functions of single variable): Rolle's theorem, Mean value theorem- Lagrange & Cauchy, Taylor 's and Maclaurin's theorems, Expansion of simple functions by Taylor's and Maclaurin's Theorems, Fundamental theorem of integral calculus, Evaluation of plane areas, volume and surface area of a solid of revolution and lengths, Convergence of Improper integrals, Beta and Gamma Integrals - Elementary properties and the Inter relations.

MODULE III [12L]

Calculus-II (Functions of several variables): Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives, Total Differentiation, Derivatives of composite and implicit functions, Euler's theorem on homogeneous functions, Chain rule, Maxima, and minima of functions of two variables – Lagrange 's method of Multipliers, Change of variables-Jacobians (up to three variables), Double and triple integrals.

MODULE IV [8L]

Vector Calculus: Scalar and vector triple products, Scalar and Vector fields, Vector Differentiation, Level surfaces, Directional derivative, Gradient of scalar field, Divergence and Curl of a vector field and their physical significance, Line, surface and volume integrals, Green 's theorem in plane, Gauss Divergence theorem, Stokes 'theorem, Applications related to Engineering problems.

Text Books:

1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley, 1999.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, 2008.
4. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley, 1995.
5. G. Strang, Linear algebra and its applications (4th Edition), Thomson, 2006.

Reference Books:

6. S. Kumaresan, Linear algebra - A Geometric approach, Prentice Hall of India, 2000.
7. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
8. TG. B. Thomas and R. L. Finney, Calculus and Analytic Geometry (9th Edition), ISE Reprint, Addison-Wesley, 1998.
9. Hughes-Hallett et al., Calculus - Single and Multivariable (3rd Edition), John-Wiley and Sons, 2003.
10. J. Stewart, Calculus (5th Edition), Thomson, 2003.
11. J. Bird, Higher Engineering Mathematics (4th Edition, 1st India Reprint), Elsevier,2006.
12. L.Rade and B.Westergen, Mathematics Handbook: for Science and Engineering (5th edition, 1st Indian Edition), Springer, 2009.
13. Murray R Spiegel and Seymour Lipschutz, Schaum's Outline of Vector Analysis.
14. Richard Bronson , Schaum's Outline of Matrix Operations.

Paper Name: Chemistry
Paper Code:CH101
Total Contact Hours:40
Credit:4

Course Objective:

Understanding of the fundamental theories and applications of thermodynamics, electrochemical principles in modern electrochemical cells and to get an insight into electronic structure of crystals and nanomaterials. Learning about the Synthesis, properties and applications of polymers, fuels, and alternative energy sources & their significance in petrochemical industries. Analyzing water quality for its various parameters & its significance in industries.

After completion of the course students would be able to

CO1	Describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table
CO2	Apply fundamental concepts of thermodynamics in different engineering applications.
CO3	Apply the knowledge of water quality parameters, corrosion control & polymers to different industries.
CO4	Determine the structure of organic molecules using different spectroscopic techniques.
CO5	Evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CH101.1	3	2	2	2	-	-	-	-	-	-	-	2
CH101.2	3	3	3	3	-	-	-	-	-	-	-	2
CH101.3	3	3	2	2	-	-	-	-	-	-	-	2
CH101.4	3	2	3	2	-	-	-	-	-	-	-	2
CH101.5	3	3	3	3	-	-	-	-	-	-	-	2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CH101.1	-	-	2
CH101.2	-	-	2
CH101.3	-	-	2
CH101.4	-	-	2
CH101.5	-	-	2

Course contents

Module 1 [8L]

Chemical Thermodynamics –I

1.1 Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property. **Introduction to first law of thermodynamics**: Different statements, mathematical form. **Internal energy**: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas.

2L

1.2 Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.

Heat Capacity: Definition, Classification of Heat Capacity (Cp and CV): Definition and General expression of Cp - CV. Expression of Cp - CV for ideal gas.

Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation. **3L**

1.3 2nd law of thermodynamics: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature (brief).

Evaluation of entropy: characteristics and expression, physical significance. Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, standard free energy and chemical potential, Condition of spontaneity and equilibrium reaction. **3L**

Module 2 [7L]

2.1 Reaction Dynamics

Reaction laws: rate and order; molecularity; zero and first order kinetics, second order kinetics (same reactant concentration), Pseudo unimolecular reaction, Arrhenius equation.

3L Mechanism and theories of reaction rates (Content beyond the syllabus)

2.2Solid state Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).

Role of silicon and germanium in the field of semiconductor, n-type, p-type semiconductor, photo voltaic cell, fabrication of integrated circuits. **4L**

Module 3 [8L] Electrochemistry

3.1 Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte)

3.2 Electrochemical cell

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell, calomel half cell (representation, cell reaction, expression of potential, Discussion, Application). **3L**

3.3 Concept of battery

Battery and Commercial electrochemical cell: Dry cell, acid storage cell, alkaline storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). **2L**

3.4 Corrosion and its control

Introduction, cause and effect of corrosion, types of corrosion: dry, wet, and other: Electrochemical corrosion, galvanic corrosion, passivation and protective measure. **2L**

Module 4 [12L]

4.1 Structure and reactivity of Organic molecule

Electronegativity, electron affinity, hybridization, Inductive effect, resonance, hyperconjugation, electrometric effect, carbocation, carbanion and free radicals. Brief study of some addition, eliminations, and substitution reactions. **3L**

4.2 Polymers

Concepts, classifications, and industrial applications. Polymer molecular weight (number avg. weight avg.: Theory and mathematical expression only), Poly dispersity index (PDI). Polymerization processes: addition and condensation polymerization (mechanism not required), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of Tm) and amorphicity (Concept of Tg) of polymer.

Preparation, structure and use of some common polymers: plastic (HDPE, LDPE, PVC, PP, PMMA, Polyester, PTFE, Bakelite), rubber (natural rubber, SBR), fiber (nylon 6, nylon 6,6), Vulcanization of rubber, Conducting polymers and biopolymers. **7L**

4.3 Nano material

Basic principles of nano science and technology, classification, preparation, properties and application of nano material. **2L**

Module 5 [5L]

5.1 Industrial Chemistry Fuels

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Proximate analysis of coal, Calorific value.

Liquid fuel: Petroleum, classification of petroleum, Refining, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Biodiesel.

Gaseous fuels: Natural gas, water gas, Coal gas, biogas, CNG, LPG. **3L**

5.2 Water

Introduction, source of water, water quality parameter, specification for drinking water (BIS and WHO standards), Chlorination of Water, Types of hardness- Units, Brief Softening methods.

Short overview of water treatment plants (Content beyond the syllabus)

Reference Books

1. Engineering Chemistry: Bandyopadhyay and Hazra
2. Physical Chemistry: P.C. Rakshit
3. Organic Chemistry: Finar, vol-1
4. Engineering Chemistry: B.Sivasankar, Tata Mc Graw Hill, 2008
5. A Text book of Engineering Chemistry: S.S.Dara, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003.
6. Engineering Chemistry Simplified: S. Nandi and R. Bhattacharyya, Chayya Prakashani Pvt. Ltd.

Course Name: Basic Electrical Engineering Course
Code: EE101
Total Contact Hours: 41
Credits: 4

Pre-requisite: Basic 12st standard Physics and Mathematics

Course Outcomes:

At the end of this course, students will able

EE 101.1	Understand and analyze basic electric and magnetic circuits.
EE 101.2	Understand and analyze basic electric and magnetic circuits.
EE 101.3	Understand and analysis transient and steady-state response of any electrical circuit/network by applying different circuit analysis methods. To understand and analyze basic electric and magnetic circuits.
EE 101.4	Understand the single-phase transformer using EMF equation, No Load no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer.
EE 101.5	Understand 3-phase induction motor using Slip and Frequency, rotor emf and current, Equivalent circuit and phasor diagram, Torque Slip characteristics torque-speed characteristics Starting of induction motor by star delta starter.

CO-PO Mapping

COs	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 101.1	3	3	3	-	-	3	-	-	3	-	2	3
EE 101.2	3	3	2	-	-	2	-	-	3	-	1	3
EE 101.3	3	3	3	-	-	1	-	-	3	-	1	3
EE 101.4	3	3	3	-	-	2	-	-	3	-	2	3
EE 101.5	3	3	3	-	-	2	-	-	3	-	2	3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
EE 101.1	**3**	**3**	-
EE 101.2	**3**	**3**	-
EE 101.3	**3**	**3**	-
EE 101.4	**3**	**3**	-
EE 101.5	**3**	**3**	-

Course Content:

DC Circuits (7L)

Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

MAGNETIC CIRCUITS (3L)
Concept of Magnetic circuit, B-H curve, Analogous quantities in magnetic and electric circuits, Faraday's law, iron losses, self and mutual inductance, Energy stored in magnetic field.

AC SINGLE PHASE CIRCUITS (8L)
Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L,C circuit, Combination R,L,C in AC series , parallel and series parallel circuits with phasor diagrams, impedance and admittance, Power factor, Power in AC circuit, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

THREE PHASE CIRCUITS (3L)
Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two-watt meters method.

DC MACHINES (6L)
Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Torque Equation, Speed Torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control).

SINGLE PHASE TRANSFORMER (5L)
Constructional parts, Types of transformers, Emf equation, No Load no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.

THREE PHASE INDUCTION MOTOR (6L)
Types, Construction, production of rotating field, principle of operation, Slip and Frequency, rotor emf and current, Equivalent circuit and phasor diagram, Torque Slip characteristics torque-speed characteristics Starting of induction motor by star delta starter and(DOL starter). Speed Control of Three phase induction motor by variation of supply frequency, supply voltage and number of poles.

GENERAL STRUCTURE OF ELECTRICAL POWER SYSTEM (3L)
Power generation to distribution through overhead lines and underground cables with single line diagram, Earthing of Electrical Equipment, Electrical Wiring Practice

Textbooks

1. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication
3. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education

Reference books

1. H. Cotton, Willey Press
2. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .
3. Kothari & Nagrath, Basic Electrical Engineering, TMH

Paper Name: Communicative English
Paper Code: HU101
Total Contact Hours: 26
Credits: 2

Prerequisites:
Basic knowledge of High School English.

Course Objectives:
Designed to meet the basic survival needs of communication in the globalized workplace, including knowledge of and competency in the use of macro-skills in reading and writing proficiency, functional grammar, and usage.

Course Outcomes:
After completion of the course students would be able to

CO1	Understand and communicate in English in a globalized workplace scenario.
CO2	Understand and apply the basic grammatical skills of the English language and develop reading and comprehension skills.
CO3	Acquire a working knowledge of writing strategies, formats and templates of professional writing.
CO4	Understand and know about and employ formal communication modes in meetings and reports.
CO5	Understand and know about and use objective and culturally neutral language in interpersonal and business communication.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU101.1	-	-	-	-	-	-	2	-	3	3	-	3
HU101.2	-	-	-	-	-	-	2	-	3	3	-	3
HU101.3	-	-	-	-	-	-	2	-	3	3	-	3
HU101.4	-	-	-	-	-	-	2	-	3	3	-	3
HU101.5	-	-	-	-	-	-	2	-	3	3	-	3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
HU101.1	2	2	2
HU101.2	2	2	2
HU101.3	2	2	2
HU101.4	2	2	2
HU101.5	2	2	2

Course Content:

The proposed revised syllabus is as follows:

Module 1: Communication: Interface in a Globalized World [5L]

a. Definition of Communication& Scope of Communication
b. Process of Communication—Models and Types

c. Verbal—Non-Verbal Communication, Channels of Communication

d. Barriers to Communication & surmounting them

[to be delivered through case studies involving intercultural communication]

Module 2: Vocabulary and Reading [5L]

a. Word origin—Roots, Prefixes and Suffixes, Word Families, Homonyms and Homophones

b. Antonyms and Synonyms, One-word substitution

c. Reading—Purposes and Skills

d. Reading Sub-Skills—Skimming, Scanning, Intensive Reading

e. Comprehension Practice (Fiction and Nonfictional Prose/Poetry)

(iii) Ruskin Bond, ―The Cherry Tree OR ―The Night Train at Deoli

(iv) Robert Frost, ―Stopping by the Woods on a Snowy Evening.

f. Precis Writing

(Use of daily newspapers for reading practice is recommended)

Module 3: Functional Grammar and Usage [6L]

a. Articles, Prepositions, Verbs

b. Verb-Subject Agreement

c. Comparison of Adjectives

d. Tenses and their Use

e. Transformation of Sentences (Singular-Plural, Active-Passive, Direct-Indirect, Degrees of Comparison)

f. Error Correction

Module 4: Business writing [10L]

a. Business Communication in the Present-day scenario

b. Business Letters (Letters of Inquiry, Sales Letters, Complaint and Adjustment Letters, Job Application Letters)

c. Drafting of a CV and Résumé

d. Memo, Notice, Advertisement, Agenda, Minutes of Meetings

e. E-mails (format, types, jargons, conventions)

References:

1. Raymond Murphy. *English Grammar in Use*. 3rd Edn. CUP, 2001.

2. Seidl & McMordie. *English Idioms& How to Use Them*. Oxford:OUP, 1978.

3. Michael Swan. *Practical English Usage*. Oxford:OUP, 1980.

4. Simeon Potter. *Our Language*. Oxford:OUP, 1950.

5. Pickett, Laster, and Staples. *Technical English: Writing, Reading & Speaking*. 8th ed. London: Longman, 2001.

6. IIT Kanpur, English Language & Communication Skills (ENG 112 C) syllabus.

Course Name: Chemistry Lab
Course Code: CH 191
Total Contact Hours: 36
Credits: 2

Prerequisite: 10+2 science with chemistry

Course Objective

Acquiring knowledge on Standard solutions and the various reactions in homogeneous and heterogenous medium. Understanding the basic principles of pH meter and conductivity meter for different applications and analyzing water for its various parameters. Synthesis of Polymeric materials and Nanomaterials.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Able to operate different types of instruments for estimation of small quantities chemicals used inindustries and scientific and technical fields.
CO2	Able to analyse and determine the composition of liquid and solid samples working as anindividual and also as an team member.
CO3	Able to analyse different parameters of water considering environmental issues
CO4	Able to synthesize drug and polymer materials
CO5	Capable to design innovative experiments applying the fundamentals of chemistry

ofperiments: 9

1. To determine the alkalinity in given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Preparation of phenol-formaldehyde resin (Bakelite).
5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
6. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
7. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
8. Determination of dissolved oxygen present in a given water sample.
9. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution).
10. Innovative experiment: Preparation of silver nano-particles.

Text Books

1.A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
2.General & Inorganic Chemistry, P.K. Dutt
3.General & Inorganic Chemistry, Vol I, R.P. Sarkar
4.Physical Chemistry, P.C. Rakshit

Reference Books

1.Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii)Fundamentals of
2. Molecular Spectroscopy, by C. N. Banwell
3.Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan
4.Physical Chemistry, by P. W. Atkins
5.Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
6.http://bcs.whfreeman.com/vollhardtschore5e/default.asp

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CH191.1	1	1	3	2	-	2	3	-	-	-	-	2
CH191.2	2	2	1	2	-	-	-	-	-	-	-	2
CH191.3	-	-	-	-	-	-	-	-	3	3	2	2
CH191.4	2	2	2	2	-	-	-	-	-	-		2
CH191.5	3	3	3	3	-	-	-	-	-	-	2	3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CH191.1	-	-	2
CH191.2	-	-	2
CH191.3	-	-	2
CH191.4	-	-	2
CH191.5	-	-	2

Course Name: Basic Electrical Engineering
Lab Course Code: EE191
Contact: 0:0:3
Credits: 1.5

Pre requisite:

Basic Physics and applied physics, Basic Mathematics, Basic concept of Electric Circuit.

Course Outcome:

COs	DESCRIPTIONS
EE 191.1	Identify common electrical components and their ratings.
EE 191.2	Make Circuit connection by wires of appropriate ratings.
EE 191.3	Understand the basic characteristics of transformers and electrical machines.
EE 191.4	Design Open circuit and short circuit test of a single-phase Transformer
EE 191.5	Design DC shunt motor and analyse single phase Energy Meter

List of Experiments:

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter method.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.
13. Innovative experiments

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 191.1	2	2	3	3	-	-	-	-	3	3	-	2
EE 191.2	3	3	2	3	-	-	-	-	3	3	-	3
EE 191.3	2	3	3	2	-	-	-	-	2	3	-	2
EE 191.4	2	3	3	3	-	-	-	-	3	3	-	2
EE 191.5	2	3	3	3	-	-	-	-	3	3	-	2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
COs	**PSO1**	**PSO2**	**PSO3**
EE 191.1	3	3	-
EE 191.2	3	3	-
EE 191.3	3	3	-
EE 191.4	3	3	-

Course Name: Engineering Graphics & Design
Course Code: ME 191
Contact: 0:0:3
Credits: 1.5

Prerequisite: Basic knowledge of geometry

Course Outcome:

COs	DESCRIPTIONS
CO1	Understand the basics of drafting.
CO2	Understand the use of drafting tools which develops the fundamental skills of industrial drawings.
CO3	Apply the concept of engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.
CO4	Analyze the concept of projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
CO5	Evaluate the design model to different sections of industries as well as for research & development.

List of Drawing:

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing
Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 3: Sections and Sectional Views of Right Angular Solids
Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only)

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics
Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering
Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, Changing line lengths (extend/lengthen); Printing documents; Drawing sectional views of solids and project the true shape of the sectioned surface; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and non parametric solid, surface and wireframe modeling, Part editing and two dimensional documentation of models.

Module 6:

Demonstration of a simple team design project

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, Use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. (Corresponding set of) CAD Software Theory and User Manuals

Reference Books:

1. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
ME191.1	2	-	-
ME191.2	2	-	-
ME191.3	2	-	-
ME191.4	2	-	-
ME191.5	2	-	-

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	2	-	-	-	-	-	-	-	-
CO2	2	-	-	2	-	-	-	-	-	-	-	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-	-	-	-
CO5	3	2	-	3	2	-	-	-	-	-	-	-

2nd Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Credit Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 201	Mathematics -II	3	1	0	4	4
2	BS	CH 201/ PH 201	Chemistry - (Gr. B) / Physics – I (Gr. A)	3	0	0	3	3
3	ES	EE 201/ EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
4	ES	CS 201	Programming for Problem Solving	3	0	0	3	3
5	ES	ME 201	Engineering Mechanics	3	0	0	3	3
Total of Theory							**16**	**16**
B. PRACTICAL								
6	ES	CS291	Programming for Problem Solving Lab	0	0	3	3	1.5
7	BS	CH 291/ PH 291	Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A)	0	0	3	3	1.5
8	ES	EE 291/ EC 291	Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A)	0	0	3	3	1.5
9	ES	ME 291/ ME 292	Engineering Graphics & Design (Gr B) / Workshop/Manufacturing Practice (Gr-A)	0	0	3	3	1.5
10	HS	HU 291	Language Lab	0	0	2	2	1
11	PROJ	PR 291	Project-II	0	0	1	1	0.5
12	PROJ*	PR 292	Innovative activities-I	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**34**	**24**

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Mathematics - II
Course Code: M 201
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard calculus.

Course Outcome:
On successful completion of the learning sessions of the course, the learner will be able to:

COs	DESCRIPTIONS
CO1	Determine and recall the properties and formula related to Ordinary differential equations, Multiple integral, vector integral and Laplace transform.
CO2	Determine the solutions of the problems related to Ordinary differential equations, Multiple integral, vector integral and Laplace transform.
CO3	Apply appropriate mathematical tools of Ordinary differential equations, Multiple integral, vector integral and Laplace transform.
CO4	Analyze engineering problems on Ordinary differential equations, Multiple integral, vector integral and Laplace transform.
CO5	Apply engineering solutions by using Ordinary differential equations, Multiple integral, vector integral and Laplace transform.

Course Content:

Module I: Multivariable Calculus (Integration): (12 Lectures)

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module II: First Order Ordinary Differential Equations (ODE): (10 Lectures)

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for p, solvable for y solvable for x and Clairaut's equation.

Module III: Second Order Ordinary Differential Equations (ODE): (12 Lectures)

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module IV: Laplace Transform (LT): (14 Lectures)

Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of , LT of $\frac{f(t)}{t}$, LT of derivatives of f (t), LT of , Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value

problem) using LT.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:

6. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
7. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
8. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
9. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
10. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M201.1	3	3	2	-	-	-	-	-	-	-	-	2
M201.2	3	3	3	3	-	-	-	-	-	-	-	2
M201.3	3	3	3	3	-	-	-	-	-	-	-	2
M201.4	3	3	3	3	-	-	-	-	-	-	-	2
M201.5	3	3	3	3	-	-	-	-	-	-	-	2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
M201.1	2	2	2
M201.2	2	2	2
M201.3	2	2	2
M201.4	2	2	2
M201.5	2	2	2

Course Name: Physics –I
Course Code: PH 201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Pre requisite: Knowledge of Physics up to 12^{th} standard.

Course Outcome

At the end of the course students should be able to

COs	DESCRIPTIONS
PH201.1	Describe different types of mechanical resonance and its electrical equivalence
PH201.2	Explain basic principles of Laser, Optical fibers and Polarization of light
PH201.3	Apply superposition principle to explain the phenomena of interference and diffraction
PH201.4	Analyze different crystallographic structures according to their co-ordination number and packing factors
PH201.5	Determine and justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

Course Content:

Module 1: Waves & Oscillations (6L)

Simple Harmonic Motion (only preliminary idea), damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems. 6L

Module 2: Classical Optics (8L)

Interference of light: Huygens's principle, superposition of waves, conditions of sustained interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems.

3

Diffraction of light: Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems. 5L

Module 3: Quantum Mechanics-I (8L)

Quantum Theory: Inadequacy of classical physics and its modifications by Planck's quantum hypothesis-qualitative (no deductions), particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment.

4L

Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems.

4L

Module 4: Solid State Physics-I (7L)

Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems.

4L

Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 3L

Module 5 : Modern Optics-I (7L)

Laser: Concepts of various emission and absorption process, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser.

5L

Fibre optics-Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, Numerical problems. 2L

Text Books:

Waves & Oscillations:

1. Sound-N. K. Bajaj (TMH)
2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
4. A text book of sound-M. Ghosh (S. Chand publishers)
5. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
6. Physics of Oscillations and Waves- R.P. Singh
7. College Physics Vol. II - A.B. Gupta
8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler
8. Optics -F.A. Jenkins and H.E White

Quantum Mechanics-I

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)
7. Quantum mechanics -A.K. Ghatak and S Lokenathan
8. Modern Physics -E.E. Anderson
9. Physics Volume 2 -Haliday, Resnick & Krane Published by Wiley India

Solid State Physics-I:

1. Solid state physics-Puri & Babbar (S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6. Problem in Solid state physics -S.O. Pillai (a. b.)

Reference Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.

COs	PSO1	PSO2	PSO3
PH201.1	2	2	2
PH201.2	2	2	2
PH201.3	2	2	2
PH201.4	2	2	2
PH201.5	2	2	2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-

Course Name: Basic Electronics
Engineering Course Code: EC 201
Contact: 3:0:0
Total Contact Hours:
36 Credits: 3

Prerequisite: A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits, series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchhoff's Law i.e. KVL, KCL, Ampere's Law etc.

Course Outcome:

COs	DESCRIPTIONS
CO1	Able to illustrate the electrical properties of conductor, semiconductor (Intrinsic & Extrinsic) and insulator with the help of energy band diagram & Fermi level.
CO2	Able to demonstrate the working principle of rectifier, voltage regulator, clipper, clamper circuit limited to 15V based on the concept of electrical characteristics of PN junction diode and Zener diode.
CO3	Able to explain biasing circuit of BJT, JFET & MOSFET based on the concept of current flow mechanism and electrical characteristics within the biasing voltage 15V for the application in switching and amplification.
CO4	Able to describe the concept of feedback to design amplifier & oscillator circuit and construct inverting, non-inverting amplifier, voltage follower, adder, subtractor, basic differentiator & integrator circuit using OPAMP within the output voltage range (-15V to +15V).
CO5	Able to demonstrate the working principle of CRO to measure voltage, frequency & phase.

Course Content:

Module-I: Basics of semiconductor **5**

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-k and Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current .

Module-II: P-N Junction Diode and its applications **7**

P-N junction formation and depletion region , energy band diagram of p-n junction at equilibrium and barrier energy , built in potential at p-n junction , energy band diagram and current through p-n junction at forward and reverse bias, V-I characteristics and current expression of diode , temperature dependencies of V-I characteristics of diode , p-n junction breakdown – conditions , avalanche and Zener breakdown , Concept of Junction capacitance, Zener diode and characteristics.
Diode half wave and full wave rectifiers circuits and operation (I_{DC} , I_{rms} , V_{DC} , V_{rms}, ripple factor without filter, efficiency ,PIV,TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems

Module III: Bipolar Junction Transistor: **8**

Formation of PNP/NPN Transistors, energy band diagram, current conduction mechanism, CE, CB, CC configurations, transistor static characteristics in CE, CB and CC mode, junction biasing condition for active, saturation and cut-off modes, current gain α, β and γ, early effect.
Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias, D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.
BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module IV: Field Effect Transistors: **6**

Concept of field effect, channel width modulation Classification of FETs-JFET, MOSFET, operating

principle of JFET. drain and transfer characteristics of JFET (n-channel and p-channel), CS,CG,CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems

Module V: Feedback and Operational Amplifier 8

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.
Operational amplifier – electrical equivalent circuit ,ideal characteristics , Non ideal characteristics of op-amp – offset voltages ;bias current ;offset current; Slew rate ; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non-inverting amplifier , Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower ; basic differentiator and integrator .
Problems on Characteristics of Op-amp, CMRR, slew rate, amplifier and application of Op-amp to be discussed. Any other relevant problems related to topic may be discussed or assigned.

Module-VI: Cathode Ray Oscilloscope (CRO) 2

Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Text Books:

1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3.Sedra & Smith, Microelectronics Engineering

Reference Books:

1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B.Gupta, Basic Electronics, S.K. Kataria.
3.Malvino: Electronic Principle.
4.Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO- PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	3	-	-	3
CO2	2	3	2	-	-	-	-	-	2	-	-	2
CO3	2	2	3	-	-	-	-	-	3	-	-	3
CO4	3	2	2	-	-	-	-	-	2	-	-	2

Course Name: Programming for Problem Solving
Course Code: CS
201 Contact: 3:0:0
Total Contact Hours:
36 Credits: 3

Prerequisite: Number system, Boolean Algebra

Course Outcome:

On completion of the course students will be able to

CO1	Able to **understand** the fundamental working principle of a computer by knowing the classification of computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices, Number System, Representation of signed and unsigned numbers.
CO2	Able to **write** basic C program by knowing variable and data Types, identifiers, operators & expressions and standard input and output.
CO3	Able to **apply** branching, looping and functions to check the condition, realize repetition of a task and to analyse the program by dividing in sub module respectively.
CO4	Able to **apply** arrays and pointers to store data in memory and access it in terms of memory address with dynamic memory allocation.
CO5	Able to **formulate** a data structures in which different types of data can be accommodated using structures, union and enum and **use** files to store data.

Course Content:

Module I: Fundamentals of Computer: (8 L)

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices

3

L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number Arithmetic – Addition and Subtraction (using 1's complement and 2's complement)

2

L

Overview of Procedural vs Structural language, compiler and assembler (basic concepts)

1

L Problem solving-Algorithm & flow chart

2

L

Module II: C Fundamentals: (28 L)

Variable and Data Types: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements

2

L

C Operators & Expressions: Arithmetic operators, relational operators, logical operators, increment and

decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity. 3L

Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields. 1L

Branching and Loop Statements: Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue 4 L

Fundamentals and Program Structures: auto, external, static and register variables Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro 5 L

Arrays, Strings and Pointers: One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a function Character array and string, array of strings, Passing a string to a function,

String related functions, Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation 7L

Structures and Unions: Basic of structures, arrays of structures, structures and pointers, structures and functions 3L

Files handling with C: Formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function 3L

Text books:

Kerninghan B.W. & Ritchie D.M. - The C Programming Language ,PHI, 2nd Edition
Kanetkar Y. - Let us C, BPB Publication, 15th Edition

Reference Books:

E Balagurusamy – Programming in ANSI C, TMH, 3rd Edition
K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition
Reema Thareja – INTRODUCTION TO C PROGRAMMING, OXFORD UNIVERSITY PRESS, 2nd Edition

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	-	-	-	-	-	-	2
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	2	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3

Course Name: Engineering Mechanics
Course Code: ME 201
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Basic Concept of Physics

Course Outcome:

CO1: To understand representation of force, moments for drawing free-body diagrams and analyze friction based systems in static condition
CO2: To locate the centroid of an area and calculate the moment of inertia of a section.
CO3: Apply of conservation of momentum & energy principle for particle dynamics and rigid body kinetics
CO4: Understand and apply the concept of virtual work, rigid body dynamics and systems under vibration.

Course Content:

Module 1: Introduction to Engineering Mechanics: Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. 6L

Module 2: Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. 2L

Module 3: Basic Structural Analysis: Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. 3L

Module 4: Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. 5L

Module 5: Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability ofequilibrium. 5L

Module 6: Review of particle dynamics: Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2^{nd} law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse- momentum (linear, angular); Impact (Direct and oblique). 5L

Module 7: Introduction to Kinetics of Rigid Bodies: Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. 5L

Module8: Mechanical Vibrations: Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums. 5L

Text books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education

Reference books:

1. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
ME201.1	-	-	-
ME201.2	-	-	-
ME201.3	-	-	-
ME201.4	-	-	-

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	-	2
CO2	3	3	-	2	-	-	-	-	-	-	-	2
CO3	3	2	-	2	-	-	-	-	-	-	-	2
CO4	3	3	-	3	-	-	-	-	-	-	-	2

Course Name: Programming for Problem Solving Lab
Course Code: CS 291
Contact: 0:0:3
Credits: 1.5

Prerequisites: **Number system, Boolean Algebra**

Course Outcomes:

On completion of the course students will be able to

CO1:	Learn the concept of DOS system commands and editor.
CO2:	To formulate the algorithms for simple problems and to translate given algorithms to a working and correct program.
CO3:	To be able to identify and correct syntax errors / logical errors as reported during compilation time and run time.
CO4:	To be able to write iterative as well as recursive programs.
CO5:	Learn the concept of programs with Arrays, Pointers, Structures, Union and Files.

List of Experiments:

1. Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
2. Writing C Programs on variable, expression, operator and type-casting.
3. Writing C Programs using different structures of if-else statement and switch-case statement.
4. Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
5. Writing C Programs demonstrating concept of Single & Multidimensional arrays.
6. Writing C Programs demonstrating concept of Function and Recursion.
7. Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.
8. Writing C Programs demonstrating concept of structures, union and pointer to structure.
9. Writing C Programs demonstrating concept of String and command line arguments.
10. Writing C Programs demonstrating concept of dynamic memory allocation.
11. Writing C Programs demonstrating concept of File Programming.
12. Innovative Experiment

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS291.1	3	3	3
CS291.2	3	3	3
CS291.3	3	3	3
CS291.4	3	3	3
CS291.5	3	3	3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	3	-	-	3
CO2	3	3	3	2	-	-	-	-	3	-	-	3
CO3	3	3	3	2	-	-	-	-	3	-	-	3
CO4	3	3	3	2	-	-	-	-	3	-	-	3
CO5	2	3	3	3	-	-	-	-	3	-	-	3

Course Name: Physics-I Lab
Course Code: PH 291
Contact: 0:0:3
Credits: 1.5

Prerequisite: Basic knowledge of 10+2

Course Outcome:

Student will able to:

CO1: Demonstrate experiments allied to their theoretical concepts

CO2: Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spctrometer

CO3: Participate as an individual, and as a member or leader in groups in laboratory sessions actively

CO4: Analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

List of Experiment:

General idea about Measurements and Errors (One Mandatory):

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 7 to be performed from the following experiments

Experiments on Oscillations& Elasticity:

1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Experiments on Lissajous figure (using CRO).
3. Experiments on LCR circuit.
4. Determination of elastic modulii of different materials (Young's modulus and Rigidity modulus)

Experiments on Optics:

5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. Determination of numerical aperture and the energy losses related to optical fiber experiment
8. Measurement of specific rotation of an optically active solution by polarimeter.

Experiments on Quantum Physics:

9. Determination of Planck's constant using photoelectric cell.
10. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
11. Innovative Experiments.

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Beyond Syllabus experiments:

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
2. Study of half-wave, quarter-wave plate (beyond the syllabus)
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poyseullie's caplillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3	-	-	-	-	-	-	-
CO2	2	3	2	3	3	-	-	-	-	-	-	-
CO3	2	3	2	3	3	-	-	-	-	-	-	-
CO4	2	3	2	3	3	-	-	-	-	-	-	-

Course Name: Basic Electronics Engineering Lab
Course Code: EC 291
Contact: 0:0:3
Credits: 1.5

Prerequisite: A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law

Course Outcome:

COs	DESCRIPTIONS
CO1	Able to Identify and Relate given passive & active electronic components such as Resistance, Capacitor, Inductor, Fuse, Diode, LED, Transistor, and their characteristics to compute, study the required parameters and specification.
CO2	Able to Demonstrate and Apply the concept behind the operation of analog and digital measuring instruments such as DC Power Supply, Function Generator, Digital Multimeter, and Oscilloscopes for the measurement of electrical quantities.
CO3	Able to Recognize and Define concepts related to Diode, LED, Transistor (BJTs and MOSFETs), OP-Amp, Logic Gate and study their characteristics and applications.
CO4	Able to Analyze and Illustrate given basic digital electronic components (AND, OR, NOT, NAND & NOR Gates) and their circuits to compute, study the required parameters and specification.
CO5	Able to Construct and Assemble an application-based circuit using analog/digital electronics components with soldering technique and simulation software.

List of Experiment:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiments

Text Books:

1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3.Sedra & Smith, Microelectronics Engineering

Reference Books:

1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B. Gupta, Basic Electronics, S.K. Kataria.

3.Malvino: Electronic Principle.
4.Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

CO- PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	3	2	-	2
CO2	3	3	2	-	-	-	-	-	3	3	-	2
CO3	3	3	2	-	-	-	-	-	3	2	-	2
CO4	3	3	2	-	-	-	-	-	3	2	-	2

CO-PSO Mapping

COs/POs	**PO1**	**PO2**	**PO3**
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2

Course Name: Workshop/Manufacturing Practices
Course Code: ME 292
Contact: 0:0:3
Credits: 1.5

Prerequisite: Higher Secondary with Mathematics, Physics and Chemistry

Course Outcome:

Upon completion of this laboratory course, students will be able to

CO1: Fabricate components with their own hands.
CO2: Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.
CO3: Produce small devices of their interest for project or research purpose.

Course Content:

(i) Theoretical discussion & videos: (6P)

Detailed contents:
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting.

(ii) Workshop Practice:

Module 1 - Machine shop (6P)

Typical jobs that may be made in this practice module:
i. To make a pin from a mild steel rod in a lathe.
ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop (6P)

Typical jobs that may be made in this practice module:
i. To make a Gauge from MS plate.

Module 3 - Carpentry (6P)

Typical jobs that may be made in this practice module:
i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) (6P)

Typical jobs that may be made in this practice module:
i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arc welding.
ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics (3P)

House wiring, soft Soldering

Module 6 - Smithy (3P)

Typical jobs that may be made in this practice module:
i. A simple job of making a square rod from a round bar or like.

Innovative Experiments:

Module 7 - Casting

Typical jobs that may be made in this practice module:

i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 8 - Plastic moulding & Glass Cutting

Typical jobs that may be made in this practice module:

i. For plastic moulding, making at least one simple plastic component should be made.

ii. At least one sample shape on glass should be made using laser cutting machine.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C.Sen and A.Bhattacharya, New Central Book Agency, Kolkata.

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
ME 292.1	-	-	-
ME 292.2	-	-	-
ME 292.3	-	-	-

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	-	-	-	2	-	2	2	-	2
CO2	3	3	2	-	-	-	2	-	2	2	-	2
CO3	3	2	2	-	-	-	2	-	2	2	-	2

Course Name: Language Lab
Course Code: HU 291
Contact: 0:0:2
Credit: 1

Pre requisite: Basic knowledge of LSRW skills

Course Outcome:

COs	DESCRIPTIONS
CO1	Able to understand advanced skills of Technical Communication in English through Language Laboratory.
CO2	Able to apply listening, speaking, reading and writing skills in societal and professional life.
CO3	Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
CO4	Able to analyse communication behaviour.
CO5	Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

Course Content:

Module 1: Introduction to the Language Lab
a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book
Module 2: Active Listening
a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating,Note-taking
c. Academic Listening vs Business Listening
d. Listening in Business Telephony
e. Study of Contextualized Examples based on Lab Recordings
Module 3: Speaking
a. Speaking—Accuracy and Fluency Parameters
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice
Module 4: Lab Project Work
a. Making a brief Animation film with voice over (5 minutes)OR
b. Making a brief Documentary film (10 minutes)

References:

1. IT Mumbai**, Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
HU291.1	2	2	2
HU291.2	2	2	2
HU291.3	2	2	2
HU291.4	2	2	2
HU291.5	2	2	2

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	-	-	-	-	-	-	2	-	3	3	-	2
CO2	-	-	-	-	-	-	2	-	3	3	-	2
CO3	-	-	-	-	-	-	2	-	3	3	-	2
CO4	-	-	-	-	-	-	2	-	3	3	-	2
CO5	-	-	-	-	-	-	3	-	3	3	-	2

3rd Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 301	Mathematics-III	3	1	0	4	4
2	ES	M (CS) 301	Numerical Methods	3	0	0	3	3
3	PC	EC 301	Solid State Devices	3	0	0	3	3
4	PC	EC 302	Circuit Theory & Networks	3	0	0	3	3
5	ES	EC 303	Data Structure	3	0	0	3	3
6	HS	HU 301	Values & Ethics in Profession	2	0	0	2	2
Total of Theory							**18**	**18**
B. PRACTICAL								
7	ES	M (CS) 391	Numerical Methods Lab	0	0	3	3	1.5
8	PC	EC 392	Circuit Theory & Networks Lab	0	0	3	3	1.5
9	ES	EC 393	Data Structure Lab	0	0	3	3	1.5
10	PROJ	PR 391	Project-III	0	0	2	2	1
11	PROJ*	PR 392	Innovative activities-II	0	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 381	Behavioural & Interpersonal skills	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**33**	**24**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Mathematics- III
Course Code: M 301
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard calculus, basic probability and differential equations.

Course Outcomes:

On successful completion of the learning sessions of the course, the learner will be able to :

CO1: Recall the underlying principle and properties of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, partial differential equation and ordinary differential equation.

CO2: Exemplify the variables, functions, probability distribution and differential equations and find their distinctive measures using the underlying concept of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, partial differential equation and ordinary differential equation.

CO3: Apply Cauchy's integral theorem and the residue theorem to find the value of complex integration, and compute the probability of real world uncertain phenomena by indentifying probability distribution that fits the phenomena.

CO4: Solve partial differential equation using method of separation of variables and ordinary differential equation using techniques of series solution and special function (Legendre's and Bessel's).

CO5: Find the Fourier series and Fourier transform of functions by organizing understandings of underlying principles and also evaluate the integral using Parseval's identity.

Course Contents:

MODULE I: ***Fourier series and Fourier Transform: (13 Lectures)***

Fourier series: Dirichlet's Conditions; Euler's Formula for Fourier Series; Fourier Series for functions of period 2π; Sum of Fourier series (examples); Theorem for the convergence of Fourier series (statement only); Fourier series of a function with its periodic extension; Half range Fourier series: Construction of half range Sine series and half range Cosine Series; Parseval's identity (statement only) and relatedproblems.
Fourier Transform: Fourier Transform, Fourier Cosine Transforms, Fourier Sine Transforms (problems only); Properties of Fourier Transform: Linearity, Shifting, Change of Scale, Modulation (problems only); Fourier Transform of Derivatives (problems only); Convolution Theorem (statement only), Inverse of Fourier Transform (problems only).

MODULE II: ***Probability Distributions: (11 Lectures)***

Random Variable: Discrete and Continuous (definition & examples); Probability Distribution (definition & examples); Probability Mass Function, Probability Density Functionand Distribution Function for a single random variable only (definition, properties & related problems); Expectation, Varianceand Standard Deviation for a single random variable only (definition, properties & related problems); Binomial Distribution, Poisson Distribution, Binomial Approximation to Poisson Distribution and Normal Distribution (problems only), Mean, Variance and Standard Deviation of Binomial, Poisson and Normal Distribution (problemsonly).

MODULE III: ***Calculus of Complex Variable: (13 Lectures)***

Functions of a Complex Variable (definition and examples); Concept of Limit, Continuity and Differentiability (problems only); Analytic Functions (definition and examples); Cauchy-Riemann Equations (statement only&

related problems); Sufficient condition for a function to be analytic (statement only & related problems).

Concept of Simple Curve, Closed Curve, Smooth Curve & Contour; Some elementary properties of complex integrals (problems only); Cauchy's Theorem (statement only & related problems); Cauchy's Integral Formula(statement only & related problems); Cauchy's Integral Formula for the derivative of an analytic function(statement only & related problems); Cauchy's Integral Formula for the successive derivatives of an analytic function (statement only & related problems); Taylor's series and Laurent's series (problems only).
Zero of an Analytic Function and its order (definition & related problems); Singularities of an Analytic Function: Isolated Singularity and Non-isolated Singularity (definition & related problems); Essential Singularities, Poles (Simple Pole and Pole of Order m) and Removable Singularities (definition & related problems); Determination of singularities and their nature (problems only); Residue (definition & examples); Determination of the residue of a given function; Cauchy's Residue theorem (statement only & related problems).

MODULE IV: ***Partial Differential Equation (PDE) and Series Solution of Ordinary Differential Equation (ODE): (11 Lectures)***

Solution of PDE: Method of Separation of Variables.
Solution of Initial Value & Boundary Value Problem: One Dimensional Wave Equation, One Dimensional Heat Equation, Two Dimensional Laplace Equation.
Series solution of ODE: General method to solve $P_0\,y'' + P_1 y' + P_2 y = 0$ and related problems to Power series method**,** Bessel's Function, Legendre Polynomial.

Text Books:

1. Herman, R. L. *An Introduction to Fourier Analysis*, Chapman and Hall/CRC, 2016.
2. Grafakos, L. *Classical Fourier Analysis*, Springer, India, Private Ltd.
3. Das, N.G. *Probability and Statistics*; The McGraw Hill Companies.
4. Gupta, S. C. and Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
5. Mathews, J. H. and Howell, R. W. *Complex Analysis for Mathematics & Engineering,* Jones & Bartlett Pub, 2006.
6. Chowdhury, B. *Elements of Complex Analysis*, New Age International, 1993.
7. Raisinghania, M .D. *Advanced Ordinary & Partial Differential. Equation*; S. Chand Publication.
8. Ross, S. L. *Differential Equations*, John Willey & Sons.
9. Grewal, B. S. *Higher Engineering Mathematics*, Khanna Pub.
10. Kreyszig, E. *Advanced Engineering Mathematics*, John Wiley & Sons, 2006.

Reference Books:

7. Gray, R. M. and Goodman, J. *Fourier Transforms: An Introduction for Engineers*, Springer, US, 1995.
8. Lipschutz & Lipson, *Schaum's Outline in Probability (2ndEd)*, McGraw Hill Education.
9. Spiegel, M. R. *Theory and Problems of Probability and Statistics (Schaum's Outline Series)*, McGraw Hill Book Co.
10. Goon, A.M., Gupta M .K. and Dasgupta, B. *Fundamental of Statistics*, The World Press Pvt. Ltd.
11. Soong, T. T. *Fundamentals of Probability and Statistics for Engineers*, John Wiley & Sons Inc, 2004.
12. Delampady, M. *Probability & Statistics*, Universities Press.
13. Spiegel, M. R. *Theory and Problems of Complex Variables (Schaum's Outline Series)*, McGraw Hill Book Co.
14. Sneddon, I. N. *Elements of Partial Differential Equations,* McGraw Hill Book Co.
15. Boyce, W. E. and DiPrima, R. C. *Elementary Differential Equations and Boundary Value Problems*, Wiley India, 2009.
16. Rao, B. *Differential Equations with Applications & Programs*, Universities Press.
17. Murray, D. *Introductory Courses in Differential Equations*, Universities Press.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
M 301.1	3	3	3
M 301.2	3	3	3
M 301.3	3	3	3
M 301.4	3	3	3
M 301.5	3	3	3

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	3	-	1	-	-	-	-	2	-	-	3
CO2	3	3	-	-	-	-	-	-	2	-	-	3
CO3	3	3	-	-	-	-	-	-	2	-	-	3
CO4	3	3	-	-	-	-	-	-	2	-	-	3
CO5	3	3	-	-	-	-	-	-	2	-	-	3

Course Name: Numerical Methods
Course Code: M(CS) 301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard number system, algebra and calculus.

Course Outcomes:

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the distinctive principles of numerical analysis and the associated error measures.

CO2: Understand the theoretical workings of numerical techniques.

CO3: Apply numerical methods used to obtain approximate solutions to intractable mathematical problems such as interpolation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.

CO4: Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.

CO5: Analyze the numerical solution of a system using Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation method.

Course Contents:

MODULE I: Error Analysis and Interpolation (10 Lectures)

Approximation in Numerical Computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic.
Interpolation: Difference Operator: Forward and Backward, Shift Operator, Newton forward interpolation, Newton backward interpolation, Lagrange's Interpolation.

MODULE II: Numerical Solution of Linear and Non-linear Equations (12 Lectures)

Numerical Solution of a System of Linear Equations: Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method.
Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Secant Method, Newton-Raphson method.

MODULE III: Numerical Integration and Numerical Solution of Differential Equation (14 Lectures)

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's Rule, Expression for corresponding error terms.
Numerical Solution of Ordinary Differential Equation: Taylor series method, Euler's method, Euler's modified method, fourth order Runge-Kutta method and Milne's Predictor-Corrector methods.
Numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

Text Books:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. *Numerical Methods (Problems and Solution)*. New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books

Reference Books:

1. Balagurusamy, E. *Numerical Methods*, Scitech. TMH.
2. Dutta, N. *Computer Programming & Numerical Analysis*, Universities Press.
3. Guha, S. and Srivastava, R. *Numerical Methods*, Oxford Universities Press.
4. Shastri, S. S. *Numerical Analysis*, PHI.
5. Mollah, S. A. *Numerical Analysis*, New Central Book Agency.
6. Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI.
7. Rao, G. S. *Numerical Analysis*, New Age International.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	-	2	3
CO2	-	2	3
CO3	-	2	3
CO4	-	2	3
CO5	-	2	3

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	3	2	3	-	-	-	-	2	-	-	2
CO2	3	3	2	3	-	-	-	-	2	-	-	2
CO3	3	3	2	3	-	-	-	-	2	-	-	2
CO4	3	3	2	3	-	-	-	-	2	-	-	2
CO5	3	3	2	3	-	-	-	-	2	-	-	2

Course Name: Solid State Devices
Course Code: EC 301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Conductors, Semiconductors and Insulators, electrical properties, band diagrams. Intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P type and N-type semiconductors, drift and diffusion carriers, Diodes and Diode Circuits Formation of P-N junction, energy band diagram, built-in potential, Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics, Biasing and Bias stability, Concept of Field Effect Transistors (channel width modulation),Gate isolation types, JFET Structure and characteristics and CS, CG, CDconfigurations.

Course Outcomes:

CO1: Able to explain charge carrier transport phenomenon and generation-recombination process of intrinsic and extrinsic semiconductor materials with the help of energy band diagram & Fermi-Dirac distribution function.

CO2: Able to illustrate electrical characteristics of rectifier diodes, Zener diode, varactor diode & LED based on properties of PN junction and understand the usages of solar cell as a renewable energy source for societal & environmental benefit.

CO3: Able to explain formation of Ohmic & non-Ohmic contact in metal semiconductor junction and 2D Electron Gas in Heterojunction based on energy band diagram.

CO4: Able to illustrate current flow mechanism, electrical characteristics, and electrical equivalent model of BJT with the help of energy band diagram at forward & reverse biased PN junction.

CO5: Able to determine drain current in linear & saturation region for JFET & MOSFET, MOS capacitances in accumulation, depletion & inversion stages, Pinch off voltage of JFET and threshold voltage of MOSFET with the help of mathematical expressions.

Course Contents:

Module I: Charge Carriers in Semiconductors: 9

Intrinsic & extrinsic semiconductor. Effect of temperature and energy gap on intrinsic concentration, effect of temperature on extrinsic semiconductor, derivation of equilibrium electron and hole concentration in terms of effective density of states and intrinsic level, derivation of electron and hole concentration in a compensated semiconductor, basic concept on optical absorption, photoluminescence, carrier life time, carrier generation and recombination, continuity equation (expression and significance only). Degeneracy and non- degeneracy of semiconductor.
Non-equilibrium condition: Effect of temperature and doping concentration on mobility, Effective mobility due to scattering effect, Drift & diffusion of carriers with simple expressions, High field effect on drift velocity, Hall Effect and piezo electric effect, Generation and re combination, quasi-Fermi energy level (concept only).

Module II: Junction Physics in Semiconductor Devices 10

Semiconductor-Semiconductor Junction: Homo Junction
p-n Diode:
Energy band diagram, creation of depletion region; plotting of junction voltage, depletion layer charge and junction field; current components in forward and reverse biased junction; derivation of inbuilt potential and depletion width; junction capacitance, Varactor diode; derivation of diode current

equation; Zener break down principle, static and dynamic resistance of rectifier diode dynamic resistance of Zener diode, effect of temperature on breakdown voltage.

Photo Devices:

Solar cell – photo-voltaic effect, constructional features of solar cell, conversion efficiency and fill factor; LED;

Semiconductor-Semiconductor Junction: Hetero Junction

Energy band diagram, Classification of Heterojunction; 2D Electron Gas (Isotype Heterojunction),

An- isotype Heterojunction, I-V Characteristics. Numerical Problems.

Metal-Semiconductor Junction:

Metal-Semiconductor Contact: Ohmic and non-Ohmic contact and explanation using energy band diagram; Schottky diode and its application.

Module III: Device Physics of Bipolar Junction Transistor: 8

Physical mechanism, carrier distribution in forward active mode, terminal current equations, common base current gain (α) , common emitter current gain (β),controlling parameters for β, punch-through and avalanche effect , expression for punch through voltage and avalanche breakdown voltage (no derivation), Solution of continuity equation and Poisson's equation for BJT, Eber's Moll model for Static behaviour & Charge controlled model (without derivation) for dynamic behaviour, equivalent circuits, Basic idea about Photo-transistors & Power transistors (only their features Vis-à-vis the ordinary transistors), origin of parameters in hybrid-pi model, time delay factors in BJT, alpha and beta cut-off frequency, idea of photo transistor. Numerical Problems.

Module IV: Field Effect Transistors: 9

Junction Field Effect Transistor (JFET):

Construction, field control action and characteristics (recapitulation), pinch-off voltage derivation. Numerical Problems.

Metal Oxide Field Effect Transistor (MOSFET):

Types of MOSFET , structure of E-MOSFET, MOS structure under external bias -accumulation, depletion and inversion phenomenon with energy band diagram ,threshold voltage and flat band voltage ; working of E-MOSFET with characteristics ;drain current equation for linear and saturation region with condition (expression only); channel length modulation ;derivation of threshold voltage of ideal and non- ideal MOSFET MOSFET Capacitance- Different types of MOSFET Capacitances, MOS capacitance variation with gate to source voltage under low frequency & High Frequency; large and small signal model of MOSFET (explanation with diagram). Numerical Problems.

Text Books :

1. Streetman & Banerjee - Solid State Electronic Devices, PHI
2. S.M. Sze, Physics of semiconductor devices, Wiley

Reference Books :

1. Milman, Halkias–Integrated Electronics – TMH
2. Sedra & Smith-Microelectronic Circuits- Oxford
3. Neamen-Semiconductor Physics and Devices TMH
4. S.M. Kang and Y. Leblebici. -CMOS Digital Integrated Circuits, Tata McGraw-Hill

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	3	2	2
CO5	2	2	2

CO- PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	2	-	-	2
CO2	3	3	3	3	-	-	2	-	2	-	-	3
CO3	3	3	2	3	-	-	-	-	2	-	-	3
CO4	3	2	3	2	-	-	-	-	2	-	-	2

Course Name: Circuit Theory & Networks
Course Code: EC 302
Contact: 3:0:0
Total Contact Hours:
36 Credits: 3

Pre requisites: Properties of series and parallel connections, concept of KCL,KVL , complex algebra , current-voltage phasor diagram ,DC and AC , Charging and discharging of capacitor , Energizing and decaying of inductor

Course Outcomes:

COs	DESCRIPTIONS
CO1	Able to analyses series and parallel resonance circuit based on parameters: resonance frequency, band-width, upper & lower cut-off frequency , quality factor and impedance for the designing of single tuned circuit
CO2	Able to determine current, voltage and power at different branch for DC and AC circuit using networks theorems-superposition, Thevenin's, Norton's, Millman's, Maximum Power Transfer , compensation, and methods- mesh analysis, node analysis, KCL, KVL, Star-Delta transformation.
CO3	Able to solve branch current and branch voltage with the help of planner graph of a circuit using cut-set and tie set matrix.
CO4	Able to apply Laplace Transform technique for the determination of current, voltage and power in a magnetically coupled and transient circuit- RL, RC and RLC.
CO5	Able to estimate parameters of two port network through open circuit & short circuit test for the development of the model of the circuit and conclude whether the circuit is symmetrical or reciprocal or both.

Course Content:

MODULE I: Resonance - Series and Parallel resonance, Impedance & Admittance Characteristics, Properties of resonance, Quality Factor, Half Power Points, Bandwidth, Phasor diagrams, Transform diagrams, Practical resonant circuits, Solution of Problems. [5

]

MODULE II: Network Analysis - Node Voltage and Mesh Current Analysis with DC and AC sources. Network Theorems: Definition and Implication of Superposition Theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Compensation theorem, maximum Power Transfer theorem, Millman's theorem, Star delta transformations, Tellegen's Theorem, Solutions and problems with DC and AC sources, driving point admittance, transfer Admittance, Driving point impedance, Transfer impedance. [8]

MODULE III: Graph Theory - Concept of Tree, Branch, Tree link, Incidence Matrix, Cut Set Matrix, Tie Set Matrix, Formation of incidence, tie set, cut set matrices ofelectric circuits [4

]

MODULE IV: Magnetically Coupled Circuit - Magnetic coupling, Polarity of coils, Polarity of induced

voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Solutionof problems. [4]

MODULE V: Laplace Transform - Concept of Complex frequency, Properties of Laplace Transform, transform of sine, cos, triangular functions, step, gate, impulse, exponential, periodic functions, Initial value theorem and final value theorem, Inverse Laplace Transform using partial fraction method, circuit analysis in s-domain. [5]

MODULE VI: Transient Analysis -Transient analysis of RC, RL, RLC circuit with DC & AC sources, Application of Laplace Transform to transient analysis. [5]

MODULE VII: Two Port Network - Open circuit Impedance & Short circuit Admittance parameter, Transmission parameter, Hybrid Parameter, Conditions of Reciprocity and Symmetry, Interrelation between different parameters, Ladder Network & General Network, Solutionof Problems. [5]

Text Books :

1. A.Chakrabarti - Circuit Theory: Analysis and Synthesis , Dhanpat Rai &Co.
2. Valkenburg M. E. Van, "Network Analysis", Prentice Hall./PearsonEducation
3. Hayt "Engg Circuit Analysis" 6/e TataMcGraw-Hill
4.D. Roy Chowdhury -Networks And Systems, New Age International

Reference Books :

1.B.L. Thereja and A.K. Thereja - A Textbook of Electrical Technology: Basic Electrical Engineering in S. Units (Volume - 1) , S-Chand
2. Sudhakar: Circuits & Networks:Analysis & Synthesis" 2/eTMH
3. D.A.Bell- Electrical Circuits- Oxford
4 P.Ramesh Babu- Electrical Circuit Analysis- Scitech
5. M.S.Sukhija & T.K.NagSarkar- Circuits andNetworks-Oxford
6. Skilling H.H.: "Electrical Engineering Circuits", John Wiley &Sons.
7. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.
8. Kuo F. F., "Network Analysis & Synthesis", John Wiley &Sons.
9. Sivandam- Electric Circuits and Analysis,Vikas

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	2
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	2	-	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3

Course Name: Data Structures
Course Code: EC 303
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Fundamentals of Computer & C Programming

Course Outcome:

COs	DESCRIPTIONS
CO1	Able to understand the Big-O notation and apply arrays and linked list to represent the row major, column major and sparse matrix.
CO2	Able to interpret stack and queue to classify the infix to postfix and prefix notations.
CO3	Able to design binary search tree, threaded binary tree, max & min heap, AVL tree and greedy algorithm to represent and access the data from memory.
CO4	Able to evaluate data using BFS, DFS, Prim's and Kruskal's algorithms.
CO5	Able to apply searching and sorting on the data using Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort, Sequential search, Binary search and Interpolation Search.

Course Content:

Module I: Linear Data Structure [10L]

Introduction (2L):
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code **(1L)**
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations **(1L)**
Array (2L):
Different representations – row major, column major **(1L)**
Sparse matrix - its implementation and usage, Array representation of polynomials **(1L)**
Linked List (6L):
Singly linked list – operations, Doubly linked list – operations **(4L)**
Circular linked list – operations, Linked list representation of polynomial and applications **(2L)**

Module II: Linear Data Structure [6L]

Stack and Queue (4L):
Stack and its implementations (using array and linked list) **(1L)**
Applications (infix to Postfix, Postfix Evaluation) **(1L)**
Queue, circular queue de-queue **(1L)**
Implementation of queue- linear and circular (using array and linked list) **(1L)**
Recursion (2L):
Principles of recursion - use of stack, tail recursion. **(1L)**
Applications - The Tower of Hanoi, Eight Queens Puzzle **(1L)**

Module III: Nonlinear Data structures [12L]

Trees (8L):
Basic terminologies, forest, tree representation (using array and linked list) **(1L)**
Binary trees - binary tree traversal (pre-, in-, post- order) **(1L)**
Threaded binary tree **(1L)**
Binary search tree- operations (creation, insertion, deletion, searching) **(1L)**
Concept of Max-Heap and Min-Heap **(**creation, deletion) **(1L)**

Height balanced binary tree – AVL tree (insertion with examples only) **(1L)**
Height balanced binary tree – AVL tree (deletion with examples only) **(1L)**
m –Way Search Tree, B+ Tree – operations (insertion, deletion with examples only) **(1L)**
Graphs (4L):
Graph theory review**(1L)**
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) **(2L)**
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) **(1L)**

Module IV: Searching, Sorting [8L]

Sorting Algorithms (4L):
Bubble sort, Insertion sort, Selection sort– with notion of complexity **(1L)**
Quick sort, Merge sort – with complexity **(2L)**
Radix sort – with complexity **(1L)**
Searching (2L):
Sequential search – with complexity **(1L)**
Binary search, Interpolation Search– with complexity**(1L)**
Hashing (2L):
Introduction to Hashing and Hashing functions **(1L)**
Collision resolution techniques **(1L)**

Text books:

1. "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Anderson-freed

Reference books:

1. "The Art of Computer Programming" by Donald Knuth
2. "Data Structures, Algorithms, and Software Principles in C" by Thomas A. Standish
3. "Data Structures" by S. Lipschutz
4. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung
5. "Data Structures in C" by Aaron M. Tenenbaum

CO-PSO Mapping

6.

COs/POs	PSO1	PSO2	PSO3
CO1	-	2	3
CO2	-	2	3
CO3	-	2	3
CO4	-	2	3
CO5	-	2	3

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	2	-	-	2
CO2	3	3	3	3	-	-	-	-	2	-	-	3
CO3	3	3	3	2	-	-	-	-	2	-	-	3
CO4	3	3	3	3	-	-	-	-	2	-	-	3
CO5	3	3	3	3	-	-	-	-	2	-	-	2

Course Name: Value and Ethics in Profession
Course Code: HU 301
Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Prerequisites: Ethics in engineering practice is about professional responsibilities of engineers. Professional ethics have been recognized as an important foundation in the practice of engineering for several decades in many industrialized countries. Codes of ethics have been invoked as a basis for professional engineering licensure. Violations of such ethical codes have led to many well-known tragic engineering failures that endangered human life and jeopardized public welfare. As a response to this concern, a new discipline, engineering ethics, is emerging. This discipline will doubtless take its place alongside such well-established fields as medical ethics, business ethics, and legal ethics. Recently, ethics has attracted the attention of several colleges of engineering around the world. In this regard, ethics started merging into engineering curricula for the last two decades. Implementations varied from introducing some ethics case studies into existing courses, to introducing standalone ethics courses.

Course Outcome (CO):

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

CO1: Discuss real-world controversies in a sophisticated fashion, using critical thinking and argument analysis.

CO2: Identify the strengths and weaknesses of philosophical principles applied to everyday moral problems.

CO3: Analyze the coherence in the dynamic relationship between moral principles and moral facts.

CO4: Read, comprehend, and criticize philosophical analyses of the central problems in environmental ethics (including the proper boundaries of moral concern, the scarcity of natural resources, the policy options available to regulators and legislators, etc.

Course Content:

Module: 1. (1L)
Introduction: Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

Module: 2. (3L)
Psycho-social theories of moral development: View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

Module: 3. (3L)
Ethical Concerns: Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society. Nature of values: Value Spectrum of a good life.

Module: 4. (5L)
Ethics of Profession:
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module: 5. (4L)
Self-Development: Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module: 6.(8L)

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome.

Limits of growth: sustainable development

Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics. Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)

Reference Books:

1. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
2. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	-	-	2
CO2		-	2
CO3		-	2
CO4		-	2

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	2	-	-	-	-	-	-	2
CO2	3	3	3	3	2	-	3	-	-	-	-	2
CO3	3	3	2	3	2	-	-	3	-	-	-	3
CO4	3	3	3	2	3	-	-	-	-	3	-	2

Course Name: Numerical Methods Lab
Course Code: M(CS) 391
Contact: 0:0:3
Credit: 1.5

Prerequisite: Any introductory course on programming language (example. C/ Matlab).

Course Outcomes:

On successful completion of the learning sessions of the course, the learner will be able to:

COs	DESCRIPTIONS
CO1	Apply the Newton forward /backward, Lagrange's interpolation, Sterling & Bessel's Interpolation formula, Newton's divided difference Interpolation method to analyse data numerically.
CO2	Analyze the Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule, Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method to find the integration of a function.
CO3	Apply Bisection method, Regula- Falsi method, Secant Method, Newton-Raphson method to find the numerical solution of a function.
CO4	Apply Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method to analyse the differential equation.
CO5	Apply Finite Difference method, Crank–Nicolson method to analyse the partial differential equation solutions for real life challenges.

.

Course Content:

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.
6. Assignments on numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.
7. Innovative Experiments.

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group)/Python.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	3	2	3	2	-	-	-	2	-	-	2
CO2	3	3	2	3	2	-	-	-	2	-	-	2
CO3	3	3	2	3	2	-	-	-	2	-	-	2
CO4	3	3	2	3	2	-	-	-	2	-	-	2
	3	3	2	3	2	-	-	-	2	-	-	2

Course Name: Circuit Theory and Networks Lab
Course Code: EC 392
Contact: 0:0:3
Credit: 1.5

Pre requisites: Theoretical concept on series and parallel connections, concept of KCL, KVL, circuit with electrical components, DC and ACsource.

Course Outcomes:

CO1:	Students able to analyse series & parallel resonance circuit and transient response in RC,RL and RLC circuit using MATLAB tools
CO2:	Students able to validate networks theorems
CO3:	Students able to determine two port parameters, Laplace transform of different time domain functions and partial fraction expansion in s domain
CO4:	Students able to originate periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB

Pre requisites: Theoretical concept on series and parallel connections, concept of KCL, KVL, circuit with electrical components, DC and ACsource.

List of Experiments:

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware.
4. Study the effect of inductance on speed of system response; simulation/Hardware
5. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
6. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
7. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB
8. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in sdomain and cascade connection of second-order systems using MATLAB
9. Determination of Laplace Transform, different time domain functions, and Inverse Laplace
10. Transformation using MATLAB Note: An Institution / college may opt for some other hardware or software simulation wherever possible in place of MATLAB
10. Innovative Experiments

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
	3	3	3	3	3	-	-	-	3	-	-	2

Course Name: Data Structure Lab Course
Code: EC 393
Contact: 0:0:3
Credit: 1.5

Prerequisites: Fundamentals of Computer & C Programming

Course Outcome:

CO1	Apply single and double linked list to represent data
CO2	Apply stack and queue to analyze infix and postfix notation.
CO3	Create binary search tree to represent data for manipulation
CO4	Implement different sorting and searching algorithm selecting appropriate data structures and Realize the insertion, merge, quick, selection sort to implement sorting technique to analyze data sequence.
CO5	Apply the linear and binary search on a sequence to find the location of a data.

Course Content:

Module 1

1. Write a C program that uses functions to perform the following:
a. Create a singly linked list of integers.
b. Delete a given integer from the above linked list.
c. Display the contents of the above list after deletion.
2. Write a C program that uses functions to perform the following:
a. Create a doubly linked list of integers.
b. Delete a given integer from the above doubly linked list.
c. Display the contents of the above list after deletion.
3. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
4. Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.
5. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.

Module 2

6. Write a C program that uses functions to perform the following:
a. Create a binary search tree of characters.
b. Traverse the above Binary search tree recursively in Postorder.
7. Write a C program that uses functions to perform the following:
a. Create a binary search tree of integers.
b. Traverse the above Binary search tree non recursively in inorder.

Module 3

8. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
a. Insertion sort
b. Merge sort
9. Write C programs for implementing the following sorting methods to arrange a list of integers in

ascending order:
a. Quick sort
b. Selection sort

10. Write C programs for implementing the following searching methods:
a. Linear Search
b. Binary Search

Write a C program to implement all the functions of a dictionary (ADT) using hashing.

Module 4

11. Write C programs for implementing the following graph traversal algorithms:
a. Depth first search
b. Breadth first search

TEXT BOOKS:

1. C and Data Structures, Third Edition, P.Padmanabham, BS Publications.
2. C and Data Structures, Prof. P.S.Deshpande and Prof. O.G. Kakde, Dreamtech Press.
3. Data structures using C, A.K.Sharma, 2nd edition, Pearson.

REFERENCE BOOKS

1. Data Structures using C, R.Thareja, Oxford University Press.
2. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand.
3. C Programming and Data Structures, P.Radha Krishna, Hi-Tech Publishers.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	-	2	3
CO2	-	2	3
CO3	-	2	3
CO4	-	2	3
CO5	-	2	3

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	2	-	-	3
CO2	3	3	3	3	2	-	-	-	2	-	-	3
CO3	3	3	3	3	2	-	-	-	2	-	-	3
CO4	3	3	3	3	2	-	-	-	2	-	-	3
CO5	3	3	3	3	2	-	-	-	2	-	-	3

Course Name: Behavioral & Interpersonal Skills
Course Code: MC 381
Contact: 0:0:3

Course Outcome:
CO1: It will equip the student to handle workplace interpersonal communication in an effective manner.
CO2: To enable students with strong oral and written interpersonal communication skills.
CO3: To prepare students to critically analyze workplace situations and take appropriate decisions.
CO4: To make students campus ready through proper behavioral and interpersonal grooming.
CO5: Integration of enhanced skill set to design and frame team based Project Report and Presentation.

MODULE I – INTERPERSONAL COMMUNICATON

1. The skills of Interpersonal Communication.
2. Gender/Culture Neutrality.
3. Rate of Speech, Pausing, Pitch Variation and Tone.
4. Corporate Communication.
5. Branding and Identity.

MODULE II- INTERPERSONAL COMMUNICATION BASED ON WORKPLACE COMMUNICATION

6. Workplace Communication.
7. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.)
8. Communication with Clients, Customers, Suppliers etc.
9. Organizing/Participating in Business Meeting.
10. Note Taking.
11. Agenda.
12. Minutes.

MODULE III – BUSINESS ETIQUETTE AND CORPORATE LIFE

13. Presenting oneself in the Business Environment.
14. Corporate Dressing and Mannerism.
15. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
16. E-mail Etiquette.
17. Activity based Case Study.

MODULE IV – MOVIE MAKING: CORPORATE BUSINESS MEETING

18. Team based Brainstorming.
19. Process Planning and Developing Plot.
20. People management.
21. Documentation and Scripting.
22. Shooting the Movie: Location and Camera.
23. Post Production and Editing.
24. Movie Review: Feedback and Analysis

List of Reference:

1.Interpersonal Communication, Peter Hartley, Routledge, 1993.
2.Workplace Vagabonds: Career and Community in Changing Worlds of Work, Christina Garsten, Palgrave Macmillan, 2008.
3. Transnational Business Cultures Life and Work in a Multinational Corporation, Fiona Moore, Ashgate, 2005.
4. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S. Martin and Lillian H. Chaney, Praeger Publishers, 2006.

5. Making Teams Work: 24 Lessons for Working Together Successfully, Michael Maginn, McGraw-Hill, 2004.
6. Corporate Communications: Convention, Complexity, and Critique, Lars Thøger Christensen, Mette Morsing and George Cheney, SAGE Publications Ltd., 2008.
7. The Business Meetings Sourcebook: A Practical Guide to Better Meetings and Shared Decision Making, Eli Mina, AMACOM, 2002.
8.Moving Images: Making Movies, Understanding Media, Carl Casinghino, Delmar, 2011.

CO-PO Mapping

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	3	-	2
CO2	-	-	-	-	-	-	-	-	-	3	-	2
CO3	-	-	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	-	-	-	-	-	3	-	2
CO5	-	-	-	-	-	-	-	-	-	3	-	2

CO-PSO Mapping

COs\POs	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	2
CO3	-	-	2
CO4	-	-	2
CO5	-	-	2

4th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	PH(ECE) 401	Physics II	3	0	0	3	3
2	PC	EC 401	Signals & Systems	3	0	0	3	3
3	PC	EC 402	Analog Electronic Circuits	3	0	0	3	3
4	PC	EC 403	Digital Electronic Circuits	3	0	0	3	3
5	PC	EC 404	Antenna & wave propagation	3	0	0	3	3
Total of Theory							**15**	**15**
B. PRACTICAL								
6	BS	PH(ECE)491	Physics II Lab	0	0	3	3	1.5
7	PC	EC 492	Analog Electronic Circuits Lab	0	0	3	3	1.5
8	PC	EC 493	Digital Electronic Circuits Lab	0	0	3	3	1.5
9	PC	EC 494	Antenna & wave propagation Lab	0	0	3	3	1.5
10	PROJ	PR 491	Project-IV	0	0	2	2	1
11	PROJ*	PR 492	Innovative activities-III	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 401	Environmental Science	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**32**	**22.5**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Physics –II
Course Code: PH (ECE) 401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:
Knowledge of Physics up B.Tech 1st year Physics-I course

Course Outcome
After completion of this course student will be able to

CO1	Able to understand basic laws of electromagnetism using vector calculus.
CO2	Able to explain the behavior of electromagnetic waves.
CO3	Able to apply Schrodinger equation to solve quantum mechanical problems.
CO4	Able to differentiate between different statistics.
CO5	Able to categorize different types of organic semiconductors and nanomaterials.

Course Content:

Module 1: Electricity and Magnetism: (15L)
Vector Calculus:
Vector operators, Gradient, Divergence, Curl-Physical significance, Scalar and Vector field, Gauss's divergence theorem (statement only), Stoke's theorem (statement only), expression of gradient, divergence, curl in spherical and cylindrical coordinate system.
Electrostatics:
Coulomb's law in vector form, Electrostatic field and its curl, Gauss's law in integral form and conversion into differential form, Equation of continuity, Extend to Poisson's & Laplace's equation, Application to parallel plate, spherical and cylindrical capacitors (equivalent 1D problem).
Magnetostatics:
Biot-Savart law (non existence of magnetic monopole)-application, Magnetic vector and scalar potential. Ampere's circuital law, force on a small current element placed in a magnetic field. force due to parallel and anti-parallel current carrying wire and definition of Ampere, Lorentz force (concept in Hall effect).
Magnetostatics:
Biot-Savart law (non existence of magnetic monopole)-application, Magnetic vector and scalar potential. Ampere's circuital law, force on a small current element placed in a magnetic field. force due to parallel and anti-parallel current carrying wire and definition of Ampere, Lorentz force (concept in Hall effect).
Electro-magnetism & Electromagnetic theory:
Faraday's law-integral and differential form, Concept of displacement current, Maxwell's field equations with physical significance, wave equation in free space, transverse nature of electromagnetic wave.

Module 2: Quantum Mechanics-II: (7L)
Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics-Eigen value, Eigen function, Schrödinger's equation as energy eigen value equation.
Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only E<V0).

Module 3: Statistical Mechanics: (4L)

Concept of energy levels and energy states, phase space, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level.

Module 4: Elements of Solid State Physics: (6L)

Free electron theory (qualitative)-Electronic conduction in solids: Drude's theory, B Wiedemann Frantz Law, Idea of quantization of energy-Somerfield theory.

Band theory of solids: Bloch Theorem-statement only, Kronig-Penny model (qualitative treatment)- Energy-band (E-k) diagram, allowed and forbidden energy bands.

Module 4: Physics of Nanomaterials (4L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Text Books:

Electromagnetic theory & Polarisation:

1. Vector analysis- Murray R Spigel (Schaum's outline)
2. Introduction to Electrodynamics- David J Griffiths (PHI learning Private Ltd.)
3. Barkley Physics course- E M Purcell (McGraw-Hill Book company)
4. Electromagnetic theory & Electrodynamics- Satya Prakash (Kedarnath Ramnath publication)
5. Electricity & Magnetism- D. Chattopadhyay & P.C. Rakshit (Central publication)
6. Optics-Ajay Ghatak (TMH)

Quantum Mechanics-II:

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Elements of Quantum Mechanics-Binayak Dutta-Roy (New Age International Publishers)
3. Quantum Mechanics-Bransden (Pearson Education Ltd.)
4. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
5. Quantum Mechanics- Gupta. Kumar. Sharma (Jai Prakash Nath & Co.)

Statistical Mechanics:

1. Statistical mechanics- R.K.Pathria & Paul D. Beale (Elsevier Ltd.)
2. Fundamentals of Statistical and Thermal Physics – F.Reif (McGraw-Hill Book company)
3. Fundamentals of Statistical Mechanics – B B Laud (New Age International Publishers)

Elements of Solid-State Physics:

1. Solid State Physics-A.J. Dekker, McMillan
2. Solid State Physics-S. O. Pillai

Physics of Organic semiconductors & Nanomaterials:

1. Physics and Technology of Organic Semiconductor Devices: Vol 1115, Marc Baldo, Paul W.M.Blom (Cambridge University Press)
2. Nanostructure & Nanomaterials – B K Parthasarathi
3. Nanomaterials Handbook (Advanced Materials and Technologies)- Yuri Gogotsi (Editor)

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	2	-	-	3
CO2	3	2	-	-	-	-	-	-	2	-	-	3
CO3	3	2	-	-	-	-	-	-	2	-	-	3
CO4	3	2	-	-	-	-	-	-	2	-	-	3
CO5	3	2	-	-	-	-	-	-	2	-	-	3

Course Name: Signals &Systems
Course Code: EC 401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

The candidates should learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks.

Course Outcome:

COs	DESCRIPTIONS
CO1	Able to analyze the signals, systems, sampling and aliasing in continuous and digital time domain using different category of signals, systems.
CO2	Able to compute the output of the system in time domain using linear convolution technique.
CO3	Able to explain systems in the frequency domain using Fourier analysis tools like fourier series, CTFT, DTFT.
CO4	Able to analyze discrete time systems in frequency domain and their region of convergence using Z Transforms.
CO5	Able to describe Random Signal and variables in time domain Probability Distributions, standard Deviation, mean, variance

.

Course Content:

Module I
Introduction to signals and systems: **[13]**
Continuous and discrete time signals: Definition and example of continuous signal, Representation of continuous time signals by its sample, Types of sampling, Sampling theorem, Reconstruction of a Signal from its samples, concept of discrete signal, Definitions and Numerical on Unit step, Unit Impulse, Unit Ramp, Exponential and Sinusoid both for continuous and discrete, Representation of signals using graphical, tabular and sequential form. [6]
Classification and convolution of Signals : Definitions and numerical of Periodic & Aperiodic signals, Even & Odd signals, Energy & Power signals, Deterministic & Random signals, Causal, Anti causal and Non causal signals, Complex exponential and sinusoidal signals, convolution of two signals using graphical and matrix method. [4]
Some operations on signals: Time reversal, Time shifting, Time scaling. [1]
Systems and its classifications: Definition of systems and its representation, Definition and numerical of Linear & Non linear system, Causal & non causal system, Time variant & invariant system, Stability of the system, Systems with memory and without memory, Invertible and noninvertible Systems. [2

Module –II
Fourier series of Continuous-time and Discrete–time Signals [6]
Fourier series analysis & Derivation of Fourier Coefficients Equation(Exponential form only), Fourier Series Properties ,Symmetry Properties of the Fourier Series, Diminishing of Fourier Coefficients, Dirichlet Conditions, Gibbs's Phenomena, Parseval's relation (statement only), Problems on Fourier series & Basic concept of Discrete time Fourier series. [6]

Module III
Signal Transformation [6]

Introduction to Continuous time Fourier Transform (CTFT): Definition, Importance, Relation with Fourier series, Examples. [1]

Computation of Fourier transform of different signals: Exponential, unit step function, Impulse function, sine and cosine wave, rectangular wave and other different waveforms. Computation of magnitude and phase spectrum. [2]

Properties of Fourier Transform

Linearity, Time shifting, Conjugation, Differentiation, Integration, Time scaling, Parseval's theorem, Duality, Convolution. [1]

Discrete time Fourier Transform(DTFT):

Introduction, Definition, Computation of DTFT of different sequences. [1]

Properties of DTFT: Linearity, Time shifting, Frequency shifting, Conjugacy, Time Reversal, Parseval's, Convolution, Multiplication. [1]

Module IV

Z-Transforms [8]

Introduction to Z-Transforms: Definition, Relationship between Fourier transform and Z-transform, Region of convergence (ROC), Properties of ROC, Properties of Z-transform, transfer function, concept of Poles and zeros, Z-transform of different sequences. [5]

Inverse Z-transform:

Inverse Z -transform using residue theorem, power series expansion and partial fraction method. [3]

Module V

Introduction to Random Variables [3]

Definition of Random Signal, Random Variables and Probability Distributions,Examples. [1]

Statistical Properties of Random Signal: Independent and conditional random variables,Standard Deviation,mean,variance,Examples. [1]

Independent and Dependent Random Variables, Arithmetic Mean. [1]

Text Books:

1. Linear Signals and Systems by B.P.Lathi-OXFORD university Press
2. Signals &Systems by A.V.Oppenheim, A.S.Willsky and S.H.Nawab - Pearson
3. Signals and Systems by P.Ramesh Babu & R.Anandanatarajan - Scitech

References:

1. Signals &Systems by A.Anand Kumar-PHI
2. Signals and Systems by S.Haykin & B.V.Veen-John Wiley
3. Signals and Systems by A.Nagoor Kani- McGraw Hill
4. Signals and Systems by S Ghosh- Pearson
5. Digital Signal Processing by M.H.Hays- TMH
6. Signals and Systems by Salivahanan
7. Signals and Systems with MATLAB by Wŏn-yŏng Yang-Springer
8. Signals and Systems by A. Nagoor Kani- McGraw Hill
9. Digital Signal Processing by P.Ramesh Babu & R.Anandanatarajan - Scitech

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO- PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	3	3	-	-	-	-	2	-	-	3
2	3	3	3	3	-	-	-	-	2	-	-	3
3	3	3	3	3	-	-	-	-	2	-	-	3
4	3	3	3	3	-	-	-	-	2	-	-	3
5	3	3	3	3	-	-	-	-	2	-	-	3

Course Name: Analog Electronic Circuits
Course Code: EC 402
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Basic knowledge about components (R, L, C). Network Theorems (Kirchhoff's law, Theremin's theorem, Norton's theorem, Miller theorem etc.). Basic knowledge about the operation of semiconductor devices (Diode, Transistor, JFET, MOSFET, etc.), Basic idea of integrated circuit, Voltage current equations. Basic knowledge of Differentiation, Integration, Differential equation, matrix etc.

Course Outcome:

CO1: Students will be able to design, construct and analyse transistor amplifier circuit in audio frequency range with the help of h-parameter model.
CO2: Students will be able to understand concept of feedback in amplifier and classify amplifiers based on feedback topology.
CO3: Students will be able to design, construct and analyse signal generator circuit in both audio frequency and radio frequency range using transistor.
CO4: Student will be able to design, construct and analyse power amplifier circuit in audio frequency range.
CO5: Students will be able to design, construct and analyse linear and nonlinear electronic circuits using OPAMP (I.C-741).

Course Content:

Module I: 9

SINGLE STAGE TRANSISTOR AMPLIFIER: Biasing techniques, Q-point & its Stability, Self-Bias CE configuration, Bias Compensation techniques, h-parameter model of transistors. Expression for voltage gain, current gain, input and output impedance, power gain, Emitter follower circuit.
MULTISTAGE AMPLIFIER: Different coupling techniques, RC coupled amplifier, functions of all components, derivation of voltage gain, current gain, input impedance and output impedance, High frequency model of transistors (hybrid-π model), frequency response characteristics, Expression for lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

Module II: 6

FEEDBACK AMPLIFIERS: Feedback concept, negative & positive feedback, Transconductance Amplifiers, Trans resistive Amplifiers
OSCILLATORS: Barkhausen criterion, RC Oscillators-Phase shift and Wien bridge oscillators, LC Oscillator-Colpitts, Hartley's, and crystal oscillators.

Module III: 8

POWER AMPLIFIERS: Class A, B, AB, C, Conversion efficiency, Tuned amplifier.
FET AMPLIFIERS: Equivalent circuit of JFET and MOSFET, Common-source, Common gate and source follower amplifiers.
DIFFERENTIAL AMPLIFIERS: BJT and MOS differential amplifiers, Small signal and large signal operations of differential amplifiers.

Module IV: 10

OPERATIONAL AMPLIFIER & IT'S APPLICATIONS: Ideal & Non Ideal OPAMP, Electrical equivalent circuit and transfer characteristics, practical integrator & practical differentiator circuit, Instrumentation Amplifier, Log & Anti-log amplifiers, Precision Rectifier, Comparator& Schmitt Trigger, voltage to current and current to voltage converters, Low pass, high pass and band pass active filters.

Module V:

3

MULTIVIBRATORS: Astable and Monostable operation using I.C-555 timer.

Text Books:

1. Sedra & Smith-Microelectronic Circuits-Oxford Up
2. Millman & Halkais- Integrated Electronics, McGraw Hill.
3. Boylested & Nashelsky-Electronic Devices and Circuit Theory-Pearson/PHI
4. Rashid-Microeletronic Circuits-Analysis and Design- Thomson (Cenage Learning).
5. Franco- design with Operational Amplifiers & Analog Integrated Circuits, 3/e, McGraw Hill.
6. Gayakwad R.A – OpAmps and Linear IC's, PHI

Reference Books:

1. Razavi- Fundamentals of Microelectronics-Wiley
2. J.B. Gupta- Electronic Devices and Circuits- S.K. Kataria & Sons
3. Malvino- Electronic Principles, 6/e, McGraw Hill

CO-PSO Mapping

COs/POs	PSO 1	PSO 2	PSO 3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO- PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	3	2	-	-	-	-	2	-	-	2
CO3	3	3	3	3	-	-	-	-	2	-	-	2
CO4	3	3	3	3	-	-	-	-	2	-	-	2
CO5	3	3	3	3	-	-	-	-	2	-	-	2

Course Name: Digital Electronic & Circuits
Course Code: EC 403
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits, series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchhoff's Law i.e. KVL, KCL, Ampere's Lawetc.

Course Outcome:

The students will be able to:

CO1	Able to acquire knowledge about solving problems related to number systems conversions and Boolean algebra and **design** logic circuits using logic gates to their simplest forms using De Morgan's Theorems; Karnaugh Maps.
CO2	Able to **design** the combinational circuits like adder, subtractor, decoder, multiplexer based on the concept of logic gates (NAND, NOR, AND, OR, NOT).
CO3	Able to **analyze** the timing properties (input setup and hold times, minimum clock period, output propagation delays) and design sequential circuits – flip flop, register, counter using the concept of combinational circuits.
CO4	Able to **demonstrate** the working of ADC and DAC with the help of number system, resolution, speed of response up to 4 bits length data.
CO5	Able to **illustrate** the equivalent circuits of the logic family - TTL, ECL, MOS and CMOS to realize logic function based on the concept of BJT and MOSFET.

Course Content:

Module I: 9

Binary, Octal and Hexadecimal number system representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Hamming Code. Signed binary number representation with 1's, 2's, 9's and 10's complement methods, Binary arithmetic.
Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method, Quine-McCluskey minimization technique (Tabular Method).

Module II: 9

Combinational circuits- Half Adder, Full Adder, Serial & Parallel Adder, Carry Look Ahead Adder, BCD Adder, Half Subtractor, Full Subtractor circuits, Adder-Subtractor Circuit. Encoder, Decoder, Multiplexer, De Multiplexer, Adder & Subtractor Design using decoder & multiplexer, Comparator and Parity Generator-Checker.

Module III:

9

Sequential Circuits- latch & Flip Flops-S-R, J-K, D and T, Conversion of Flip Flops, Various types of Shift Registers-SISO, PISO, SIPO, PIPO, Bidirectional & Universal Shift. Modulus Counters-Synchronous, Asynchronous, Irregular, Self-Correcting Ring & Johnson Counter. Application of Counter (Stepper motor control).

Module IV:

9

Parameters of D/A & A/D Converters. Different types of A/D -Flash Type, Successive Approximation and Dual Slope and D/A -R-2R Ladder & Binary Weighted Resistor Type.
Logic families- TTL, ECL, MOS and CMOS, their operation and specifications. TTL Equivalent Circuit.

Textbooks:

1. A.Anand Kumar, Fundamentals of DigitalCircuits-PHI
2. Morries Mano- Digital Logic Design-PHI
3. S.Salivahanan & S.Arivazhagan, Digital Circuit & Design- BikasPublishing
4. A.K.Maini- Digital Electronics-Wiley-India

Reference:

1. Floyed & Jain- DigitalFundamentals-Pearson.
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc GrawHill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc GrawHill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- PlatinumPublishers
5. Kharate- Digital Electronics-Oxford
6. Tocci, Widmer, Moss- Digital Systems, 9/e-Pearson

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO- PO Mapping*:*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	3	3	-	-	-	-	2	-	-	3
CO3	3	3	3	3	-	-	-	-	2	-	-	3
CO4	3	3	3	3	-	-	-	-	2	-	-	3
CO5	3	3	3	3	-	-	-	-	2	-	-	3

Course Name: Antenna & Wave Propagation
Course Code: EC 404
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
The candidates should learn basic knowledge of vector calculus, electrostatic, magnetostatics.

Course Outcome:
After successful completion of this course, students should be able to:

COs	DESCRIPTIONS
CO1	To understand in-depth study of transmission lines which play an important role in high- speed digital design and signal integrity of PCBs.
CO2	To analyze the fundamentals of antenna theory.
CO3	Understand the different types of antennas and the radiation mechanism.
CO4	Identify the atmospheric and terrestrial effects on radio wave propagation.

Course Content:

Module I [7]
Maxwell equation, Boundary between media interface, Helmholtz's equation, Plane Wave in lossy dielectric, loss-less dielectric, good conductor, free-space; Poynting theorem, power flow, Poynting Vector, Spin Depth, Surface Resistance.

Module II [12]
Concept of lumped parameters, Transmission line equation & their solution, Propagation constant, characteristic Impedance, wavelength, velocity of propagation for distortion less line and loss-less line; Reflection and Transmission coefficients, Standing Wave, VSWR, Input Impedance; Smith Chart; Some impedance techniques- Quarter wave matching, Single stub matching; Reflection in miss- matched load; T-line in time domain, Lattice diagram calculation, Pulse propagation on T-line.

Module III [12]
a) Antenna Characteristics: Radiation Pattern, Beam width, Radiation resistance, Directivity, Gain, Efficiency, Impedance, Polarization, Noise temperature; Friis transmission equation.
b) Radiation characteristics of Herzian dipole antenna; Duality principle.
c) Properties and Typical application:- Half-wave Dipole, Mono pole, Loop antenna, Parabolic &Corner Reflector antenna, Helical antenna, Pyramidal Horn antenna, Micro-Strip patch antenna,Array: Yagi-Uda, Log-Periodic.

Module IV [5]
Reflection of plane wave at Normal and Oblique incidence; Diffraction and Scattering Phenomena, multipath fading and its characteristics.

Text Books

1.Principles of Electromagnetics, 6th Edition, Matthew O H Sadiku, Oxford University Press.
2.Antenna Theory: Analysis & Design, Constantinc A. Balanis; Willcy, 4th Edition.

3.Antenna and Wave Propagation, 1st Edition, S. K. Das and A. Das, Tata-McGraw-Hill EducationPvt. Ltd 2013.

Reference Books

1.Electromagnetics with applications, 5th ed, J. D. Kraus and D. Fleisch, McGraw Hill, 1999.

2.Engineering Electromagnetics, Hayt and Buck, 7th edition, McGraw Hill.

3.Fields & Wave in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, JohnWiley.

4.Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill.

5.Engineering Electromagnetics, 2ed Edition - Nathan Ida, SpringerIndia.

6.Elements of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford UniversityPress.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	2	3	-	-	-	-	-	-	-	-	-	1
CO4	-	-	1	-	-	-	-	-	1	1	-	1

Course Name: Physics –II Lab
Course Code: PH (ECE) 491
Contact: 0:0:3
Credit: 1.5

Pre requisites: Knowledge of Physics up B. Tech. 1st year Physics-I course

Course Outcome:

COs	DESCRIPTIONS
CO1	Able to understand the motion of electrons in crossed electric and magnetic field.
CO2	Compute Able to explain the hysteresis curve for ferromagnetic materials.
CO3	Able to demonstrate the Hall effect in conductors and semi-conductors.
CO4	Able to distinguish between the conductors and semiconductors on the basis of band gap.
CO5	Able to interpret the characteristics of solar cell.

List of Experiments:

***At least 7 experiments to be performed during the semester**

Module 1: Electromagnetic theory & Polarisation

1. Study of dipolar magnetic field behavior.
2. Study of hysteresis curve of a ferromagnetic material using CRO.
3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
4. Measurement of Curie temperature of the given sample.
5. Determination of dielectric constant of given sample (frequency dependent).

Module 2: Quantum Mechanics-II

6. Determination of Stefan's radiation constant.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
8. Measurement of specific charge of electron using CRT.

Module 3: Elements of Solid-State Physics

9. Determination of energy band gap of a semiconductor by four probe method.
10. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor.
11. Study of I-V characteristics of a LED.
12. Study of Intensity (I)-Resistance(R) characteristics of a LDR.
13. Innovative Experiments.

In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Beyond Syllabus Experiments:

1. Determination of thermal conductivity of a bad conductor by Lees and Charlton's method.
2. Determination of thermal conductivity of a good conductor by Searle's method.
3. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	3	2
CO3	3	3	2
CO4	3	3	2
CO5	3	3	2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	2	2	-	3
CO2	3	2	-	-	-	-	-	-	2	2	-	3
CO3	3	2	-	-	-	-	-	-	2	2	-	3
CO4	3	2	-	-	-	-	-	-	2	2	-	3
CO5	3	2	-	-	-	-	-	-	2	2	-	3

Course Name: Analog Electronic Circuits Lab
Course Code: EC 492
Contact: 0:0:3
Credit: 1.5

Prerequisites: A basic course in Electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law.

Course Outcome:

COs	DESCRIPTIONS
CO1	Able to design single stage R-C coupled voltage amplifier, differential amplifier using BJT at audio frequency range.
CO2	Able to design class A and Class B power amplifier circuit using BJT at audio frequency range.
CO3	Able to structure RC oscillator-Wien bridge and phase shift oscillator circuit using BJT for the generation of signal at audio frequency range.
CO4	Able to construct multivibrator circuit at astable and mono-stable mode using IC 555 timer.
CO5	Able to design Integrator, differentiator circuit for the generation of function and low pass, high pass.

List of Experiments:

Any 8 Experiments has to be done

1. Design of RC coupled amplifier in CE mode & study of it's frequency response using BJT.
2. Design of RC Phase shift oscillator using BJT and measurement of its output frequency.
3. Design of Wien bridge oscillator using BJT and measurement of its output frequency.
4. Design of class A & class B push-pull power amplifiers and measurement of its power conversion efficiency.
5. Design of single stage voltage amplifier & study of it's frequency response using JFET.
6. Design of differential amplifier & study of it's frequency response using BJT.
7. Design of practical Integrator using OPAMP (IC-741) and study of its frequency response.
8. Design of practical Differentiator using OPAMP (IC-741) and study of its frequency response.
9. Design of low pass and high pass active filter using OPAMP (IC-741) and study of its frequency response.
10. Design of band-pass active filter using OPAMP (IC-741) and study of its frequency response.
11. Design of Schmitt trigger circuit using OPAMP (IC-741) and study of its voltage transfer characteristic.
12. Design of astable and monostable multivibrator using timer (IC-555) and measurement of its duty cycle.
13. Innovative Experiments

Text Books:

1. Sedra & Smith-Microelectronic Circuits-Oxford Up
2. Millman & Halkais- Integrated Electronics, McGraw Hill.
3. Boylested & Nashelsky-Electronic Devices and Circuit Theory-Pearson/PHI
4. Rashid-Microeletronic Circuits-Analysis and Design- Thomson (Cenage Learning).

5. Franco- design with Operational Amplifiers & Analog Integrated Circuits, 3/e, McGrawHill.
6. Gayakwad R.A – OpAmps and Linear IC's, PHI

Reference Books:

1. Razavi- Fundamentals of Microelectronics-Wiley
2. J.B. Gupta- Electronic Devices and Circuits- S.K. Kataria & Sons
3. Malvino- Electronic Principles, 6/e, McGraw Hill

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO- PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

Course Name: Digital Electronic Circuits Lab
Course Code: EC 493
Contact: 0:0:3
Credit: 1.5

Prerequisites: A basic course in Electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law.

Course Outcome:

CO1: Able to understand the fundamental concepts and techniques used in digital electronics.
CO2: Able to understand and examine the structure of various number systems, de-morgan's law, boolean algebra and its application in digital design.
CO3: Able to understand, analyse the timing properties (input setup and hold times, minimum clock period, output propagation delays) and design various combinational and sequential circuits using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.
CO4: Able to understand different digital circuits using programmable logic devices.
CO5: Able to know how to interface digital circuits with adc & dac.

List of Experiments:

1. Realization of basic gates using Universal logic gates.
2. Realization of logic gates using TTL.
3. Design the circuit of Grey to Binary and vice versa.
4. Design a circuit for BCD to 7-segment display.
5. Four-bit parity generator and comparator circuits.
6. Construction of simple Encoder & Decoder circuits using logic gates.
7. Construction of simple Multiplexer & De Multiplexer circuits using logic gates.
8. Design of Half Adder & Full Adder Circuit using Logic Gates.
9. Design Half Subtractor & Full Subtractor Circuit using Logic Gates.
10. Realization of RS, D, JK and T flip-flops using logic gates.
11. Realization of Register using flip-flops and logic gates.
12. Realization of Up/Down counters
13. One Innovative design of Digital Circuits.
14. Innovative Experiment

Textbooks:

1. A.Anand Kumar, Fundamentals of Digital Circuits-PHI
2. Morries Mano- Digital Logic Design- PHI
3. S.Salivahanan & S.Arivazhagan, Digital Circuit & Design- BikasPublishing
4. A.K.Maini- Digital Electronics- Wiley-India

Reference:

1. Floyed & Jain- Digital Fundamentals-Pearson.
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Kharate- Digital Electronics- Oxford
6. Tocci, Widmer, Moss- Digital Systems, 9/e- Pearson

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO- PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

Course Name: Antenna & Wave Propagation Lab
Course Code: EC 494
Contact: 0:0:3
Credit: 1.5

Prerequisite:
The candidates should learn basic knowledge of vector calculus, electrostatic, magnetostatics.

Course Outcome:
After successful completion of this course, students should be able to:
CO1: To understand theory of transmission lines in which EM wave propagates.
CO2: To analyze the fundamentals of antenna theory.
CO3: Understand the different types of antennas and the radiation mechanism.
CO4: Identify the different signals in hardware setup.

List of Experiments:
[At least 3 experiments from Module I and 4 experiments from Module II]

Module I:
1. Familiarization of basic elements of Transmission Line.
2. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.
3. Unknown load Impedance of a terminated transmission line using shift in minima technique.
4. Study of application of Smith chart by using characteristic of transmission line.
5. Study Single stub impedance matching technique.

Module II:
6. Familiarization of basics of Antennas.
7. Radiation Pattern of dipole antenna and Mono-pole with ground plane.
8. Radiation Pattern of a folded-dipole antenna.
9. Radiation pattern of a Log-Periodic Antenna.
10. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna – Comparative study.
11. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.
12. Measurement of signal power, bandwidth, harmonics, Adjacent channel power ratio using Spectrum Analyzer.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	1	-	-	-	1	-	-	-	1
CO2	3	2	-	1	-	-	-	-	-	-	-	2
CO3	2	3	-	-	1	-	1	-	-	-	-	1
CO4	-	-	1	-	-	-	-	-	1	1	-	1

Course Name: Environmental Science
Course Code: MC 401
Contact: 3:0:0
Credit: 0

Prerequisite: Basic knowledge of Chemistry

Course Outcome:

CO1: To understand the natural environment and its relationships with human activities.
CO2: To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CO3: To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
CO4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Content:

Module I: General **11 L**

Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy

Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography

Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)

Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web,

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems

Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

Module II: Air pollution and control **10L**

Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant

Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion

Control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury).

Module III: Water Pollution **9L**

Classification of water (Ground & surface water)

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.

Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD

Lake: Eutrophication [Definition, source and effect].

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)

Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride

Layout of waste water treatment plant (scheme only).

Module IV: Land Pollution **3L**

Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste
Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).
Waste management: waste classification, waste segregation, treatment & disposal

Module V: Noise Pollution **3L**

Definition of noise, effect of noise pollution on human health,
Average Noise level of some common noise sources
Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18 hr Index) .
Noise pollution control.

Text Books:

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited

References Books:

2. Environmental Studies, Dr. J P Sharma, University Science Press
3. Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	3	-	-	-	-	2
CO2	-	-	-	-	-	-	3	-	-	-	-	2
CO3	-	-	-	-	-	-	3	-	-	-	-	2
CO4	-	-	-	-	-	-	3	-	-	-	-	2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	2
CO3	-	-	2
CO4	-	-	2

5th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	HS	HU 502	Economics for Engineers	2	0	0	2	2
2	PC	EC 501	Analog & Digital Communication Systems	3	0	0	3	3
3	PC	EC 502	Microprocessor & Micro Controller	3	0	0	3	3
4	PC	EC 503	Digital Signal Processing	3	0	0	3	3
5	PE	EC 504	A. Information Theory & Coding B. Renewable Energy Sources & Applications C. Nano Electronics	3	0	0	3	3
Total of Theory							**14**	**14**
B. PRACTICAL								
6	PC	EC 591	Analog & Digital Communication Systems Lab	0	0	3	3	1.5
7	PC	EC 592	Microprocessor & Micro Controller Lab	0	0	3	3	1.5
8	PC	EC 593	Digital Signal Processing Lab	0	0	3	3	1.5
10	PROJ	PR 591	Project-V	0	0	2	2	1
11	PROJ*	PR 592	Innovative activities-IV	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 501	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**31**	**20**

* Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Economics for Engineers
Course Code: HU 502
Contact: 2:0:0
Contact Hours: 24
Credit: 2

Pre requisites: NIL

Course Outcome:

CO1 : To Identify various uses for scares resources
CO2 : To understand key economic concepts and implement in real world problems
CO3 :To apply critical thinking skills to analyze financial data and their impacts.
CO4 :To evaluate business performance through cost accounting principles

Course contents:

Module - 1. Introduction to Economics : Meaning, Nature and Scope of Economics **2L**

Module - 2. Theory of Demand and Supply: Concept of demand, Determinants of demand, Individual and Market Demand, Exception to the law of demand. Concept of Supply, Shift in Demand and Supply Curve, Movement along the demand and supply curve, Determinants of equilibrium price and quantity, Elasticity of Demand and Supply. **4L**

Module - 3. Theory of Production and Costs: concept of Production function, types pf Production function, Laws of return to scale and variable Proportion, Cost Function, Types of Cost Function, Different Cost curves, Relation between Average and marginal cost, Relationship between Short Run costs and Long Run costs, Profit maximization **6L**

Module-4. Macroeconomic Aggregates and Concepts : GDP, GNP. Concepts of National Income. Concept of Business Cycle. **3L**

Module -5. Inflation: Concept, Causes and Remedies of Inflation. **2L**

Module -6. Accounting: Basic concept of Journal, Preparation of Income Statement and Balance Sheet. **4L**

Module – 7. Cost Volume Profit Analysis: Contribution, P/V Ratio, Break-Even Point, Margin of Safety, Short term decision making: Make or Buy, Shut-down point, Export Pricing, Opportunity and Sunk cost. **3L**

Reference Books:

Sl no	Name	Author	Publisher
1.	Economics	Lipsey and Chrystal	Oxford university Press
2	Modern Economic Theory :	K.K. Dewett.	S.Chand
3.	Principle of Economics	H.L. Ahuja	S. Chand
4.	Engineering Economics:	R.PaneerSeelvan:	PHI
5.	Modern Accountancy	Hanif &Mukherjee	TMH
6.	Economics for Engineers:	Dr. Shantanu Chakra borty Nilanjana singharoy.	&Dr.Law Point Publication

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	-	-	-	-	-	-	-	-	2	-
CO2		-		-	-	-	3	-	-	-	-	2	-
CO3	-	-	-	2	2	3	-	-	-	-	-	2	2
CO4	-	-	-	3		-	-	-	-	-	-	3	2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	-	-	**2**
CO2	-	-	**2**
CO3	-	-	**2**
CO4	-	-	**2**
CO5	-	-	**2**

Course Name: Analog & Digital Communication Systems
Course Code: EC 501
Contact: 3:0:0
Total Contact Hours: 36
Credit: 3

Prerequisite: Trigonometric Fourier series, Exponential Fourier series, Fourier transform and its properties, Energy and power signal, Probability & Statistics.

Course Outcome:

CO1: Able to analyze the amplitude modulation and frequency modulation techniques and determine the effect of modulation index.

CO2: Able to apply the knowledge of probability and statistical calculations to analyse the performance of a digital communication system.

CO3: Able to analyze the concepts of sampling, Pulse Modulation techniques and their comparison.

CO4: Able to analyze signal vector representation of various digitally modulated signals by creating the signal constellation.

CO5: Able to analyze various digital modulation techniques and compute the bit error performance and compare their advantages and limitations.

Course Content:

MODULE-I: Introduction: [6]
Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation and Demodulation Systems- DSB, SSB and VSB modulations. Angle Modulation and Demodulation Systems - Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

MODULE-II: Random Processes: [6]
Review of probability and random process. Gaussian and white noise characteristics, Rayleigh's energy theorem, Parseval's theorem, Fourier transform pair Power spectral density vs Autocorrelation likelihood functions, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

MODULE-III: Pulse modulation: [3]
Sampling theorem. Pulse modulation techniques PAM, PWM, PPM. Pulse code modulation (PCM), Line coding, Regenerative repeater, differential pulse code modulation. Delta modulation, Noise analysis, Time Division multiplexing.

MODULE-IV: Signal Vector Representation: [8]
Analogy between signal and vector, distinguishability of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point , signal constellation, geometric interpretation of signals, Schwartz inequality, Gram- Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and Type-II errors.
Optimum detection of signals in noise, matched Filter, Inter symbol Interference and Nyquist criterion.

MODULE-V: Digital Modulation Techniques: [13]
Types of Digital Modulation, coherent and non-coherent ASK, FSK and PSK, Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. DPSK and DEPSK, Concept of M-ary Communication,

M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset (OQPSK) vs. Non-offset (NOQPSK) Quadrature Phase shift keying, Coherent Frequency Shift Keying(FSK),Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Quadrature Amplitude Shift keying (QASK), Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying (GMSK), basic concept of OFDM.

Text Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering", John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

Reference Books:

1. Carlson—Communication System,4/e , Mc-Graw Hill
2. Communication Systems, A. Bruce Carlson, Paul B. Crilly TMH Education
3. Digital Communication, A. Bhattacharya, TMH Publishing Co.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	3	3	-	-	-	-	2	-	-	3
CO3	3	3	3	3	-	-	-	-	2	-	-	3
CO4	3	3	3	3	-	-	-	-	2	-	-	3
CO5	3	3	3	3	-	-	-	-	2	-	-	3

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Microprocessor and Microcontroller
Course Code: EC 502
Contact: 3:0:0
Total Contact Hours:
36 Credit: 3

Prerequisites: Knowledge in Digital Electronics

Course Objective:

To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.

Course Outcome:

CO1	Able to demonstrate the architecture of 8085 Microprocessor considering the function of each pin for compiling Assembly language programs and interfacing with peripheral devices.
CO2	Able to write Machine language programming with the help of mnemonic- Opcode & Operand using8085 Microprocessor for arithmetical, logical,data transfer, branching and machine control operation.
CO3	Able to organize peripheral operation based on the concept of the microprocessor 8085 block diagram,pin details, modes of operation and control word format of 8255,8253 and 8251.
CO4	Able to illustrate the architecture of microprocessor 8086 considering pin diagram, memory segmentation,addressing mode and simulate assembly language program for arithmetical ,logical, data transfer, branching and machine control operation.
CO5	Based on the concept of architecture of 8051, it is able to write assembly language programs for data transfer operation,logical operation, arithmetic operation, JUMP operation, and Interrupt operation.

Course Contents:

Module 1: 8085 Microprocessor: [6]

Introduction to Microcomputer based system, Evolution of Microprocessor and microcontrollers and their advantages and disadvantages, Architecture of 8085 Microprocessor, Address / Data Bus multiplexing and demultiplexing, Status and Control signal generation, Instruction set of 8085 Microprocessor, Classification of instructions, addressing modes, timing diagram of the instructions, Memory interfacing , IO interfacing, ADC / DAC interfacing, Stack and Subroutine, Delay Calculation, Interrupts of 8085 processor, classification of interrupts, Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085.

Module 2: Assembly language programming with 8085:[2]

Addition, Subtraction, Multiplication, Block Transfer, ascending order, descending order, Finding largest & smallest number, Look-up table etc. Programming using interrupts (programming using INTR is not required).

Module 3: 8086 Microprocessor: [8]

8086 Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts & Direct Memory Access, Memory interfacing, ADC / DAC interfacing.

Module 4: Assembly language programming with 8086: [3]

Addition, Subtraction, Multiplication, Block, Transfer, ascending order, descending order, Finding largest & smallest number etc.

Module 5: 8051 Microcontroller:[7]

8051 architecture, hardware, input/output pins, ports, internal and external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts, Memory interfacing, ADC / DAC interfacing.

Module 6: Assembly language Programming using 8051:[4]

Moving data: External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges; Logical operations: Byte-level, bit-level, rotate and swap operations; Arithmetic operations: Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: Jump and call program range, jumps, calls and subroutines, interrupts and return.

Module 7: Support IC chips:[6]

8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format. Interfacing of support IC chips with 8085, 8086 and 8051.

Module 8:

Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout.

Text Books:

1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar, Penram International
2. The 8051 microcontroller - K. Ayala, Thomson
3. Microprocessors & interfacing – D. V. Hall, Tata McGraw-hill
4. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
5. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley, Pearson
6. An Introduction to Microprocessor and Applications –Krishna Kant,Macmillan

References:

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford university press
2. 8086 Microprocessor –K Ayala, Cengage learning
3. The 8051 microcontrollers – Uma Rao and Andhe Pallavi, Pearson

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	3	3	-	-	-	-	2	-	-	2
CO3	3	3	3	3	-	-	-	-	2	-	-	2
CO4	3	3	3	3	-	-	-	-	2	-	-	2
CO5	3	3	3	3	-	-	-	-	2	-	-	2

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Paper Name: Digital Signal Processing

Course Code:
EC503

Contacts: 3:0:0
Contact Hours: 36
Credits: 3

Course Objectives:

To study the z-transform, convolution, correlation and applications of z -transform.

To introduce students with transforms for analysis of discrete time signals and systems.

To understand the digital signal processing, sampling and aliasing.
To use and understand implementation of digital filters.
To study filter design techniques.
To study Discrete Fourier Transforms.
To study Fast Fourier Transforms.
To study fixed point and floating point digital signal processors.

PREREQUISITE:

Prerequisites for Digital signal Processing are required a thorough understanding of various signals, systems, and the methods to process a digital signal and also the knowledge of arithmetic of complex numbers and a good grasp of elementary calculus. The questions reflect the kinds of calculations that routinely appear in Signals. The candidates are expected to have a basic understanding of discrete mathematical structures. The candidates required the concept of Z-transform, Relation between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Initial value theorem and final value theorem, stability considerations for LTI systems using Z-transform, Perseval's relation, Inverse Z-transform by Residue method, power series & partial-fraction expansions.

Course Outcomes:

CO1: Able to **determine** and describe signals in frequency domain using DFT and IDFT, Twiddle factors, circular convolution concentric method and matrix method, DFT/IDFT using matrix methods, filtering of long data sequences using Overlap-Save and Overlap-Add methods.

CO2: Able to **compute** signals in frequency domain using FFT, Butterflies, Bit reversal, Radix-2 algorithm, Decimation-In-Time, Decimation-In-Frequency algorithms and signal flow graphs.

CO3: Able to **analyze** signal error quality using quantization error, product quantization error, quantization error, Zero- input Limit cycle Oscillations and limit cycle Oscillations.

CO4: Able to **design** and implement n^{th} order IIR and FIR filters using impulse invariant and bilinear transforms, approximation method, analogue Butterworth filter, linear phase FIR filters, Rectangular and Hamming and Blackman windows.

CO5: Able to **apply** digital signal processing techniques in speech analysis in a group using DSP processor.

MODULE – I: Discrete Fourier Transform and Fast Fourier Transform: [13]

Definition of DFT and IDFT, Twiddle factors and their properties, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, aliasing

error, filtering of long data sequences using Overlap-Save and Overlap-Add methods.
Difference between DFT and FFT. Radix-2 algorithm, Decimation-In-Time, Decimation-In-Frequency algorithms, signal flow graphs Butterflies, Bit reversal.

MODULE – II: Filter Design: [12]

Basic concepts of IIR and FIR filters, difference equations, Realization of Filters using Direct form –I, II & Cascade Form Design of IIR Filter using impulse invariant and bilinear transforms, approximation & Design of analog Butterworth Filter, Design of linear phase FIR filters, Concept of Symmetric & anti- Symmetric FIR Filter , Various kinds of Window :Rectangular, Hamming and Blackman windows.

MODULE – III: Finite word Length Effects in Digital Filters: [5]

Input Quantization error, Product Quantization error, Coefficient, Quantization error, Zero- input Limit cycle Oscillations, Dead band, limit cycle Oscillations.

MODULE – IV: Application of DSP: [6]

Introduction to DSP Hardware TMS320C 5416/6713 processor. Concept of Sub-band coding, Speech analysis etc.

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
4. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.

REFERENCE BOOKS:

1. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
2. Texas Instruments DSP Processor user manuals and application notes.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	3	3	-	-	-	-	2	-	-	3
CO3	3	3	3	3	-	-	-	-	2	-	-	3
CO4	3	3	3	3	-	-	-	-	2	-	-	3
CO5	3	3	3	3	-	-	-	-	2	-	-	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Information Theory & Coding
Course Code: EC 504A
Contacts: 3:0:0
Contact hours: 36
Credits: 3

Prerequisite: Digital Electronics, Probability & statistics

Course Objective:

This course provides a basic understanding of the fundamental theories and laws of information theory and coding theory and the construction of both source codes and error-detection-correction codes and application in digital communication systems

Course outcome:

CO1 Able to interpret source coding with the help of Huffman coding, Shannon - Fano coding techniques for the generation of variable length codewords and calculation of efficiency of the code.

CO2 Able to apply channel capacity and channel coding for controlling error in a digital communication system on the basis of channel modelling information capacity theorem, Shannon limit.

CO3 Able to analyse error detection and correction in digital communication channel based on different error control codes like linear block code, cyclic code, convolution code.

CO4 Able to evaluate BCH code for error correction in channel coding using linear algebra, concept of Galois field, conjugate roots, minimal polynomial.

CO5 Able to design the encoder and decoder logic circuit in the transmitter and receiver section of the digital communication system for error detection and correction of the transmitted message word using respective encoding and decoding process of block code, cyclic code, convolution code

Course Content:

Module 1: Source Coding [6]

Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes. Shannon - Fano Coding.

Module 2: Channel Capacity and Coding [4]

Channel models, channel capacity, channel coding, Kraft Inequality, information capacity theorem, The Shannon limit.

Module 3: Linear and Block Codes for Error Correction [6]

Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block, Standard array and syndrome detection code, perfect codes, Hamming codes.

Module 4: Cyclic Codes [6]

Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, decoding cyclic codes, Encoding and Decoding circuit, Golay codes.

Module 5: BCH Codes [6]

Set, group, fields, Galois field Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Module 6:Convolutional Codes : Encoding, state diagram,[8]

Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, Viterbi decoding, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Module 7: Other Codes: [8]

Convolutional Codes: Encoding, state diagram,
Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, Viterbi decoding, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

TEXT BOOKS:

1.Information theory, coding and cryptography - Ranjan Bose; TMH.
2.Introduction to Error Control Codes - Salvatore Gravano, Oxford

REFERENCE BOOKS:

1.Information and Coding - N Abramson; McGraw Hill. 2.Introduction to Information Theory - M Mansurpur; McGraw Hill. 3.Information Theory - R B Ash; Prentice Hall.
4.Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.
5.Todd K Moon,- Error Correction Coding: Mathematical Methods and Algorithms, John Wiley &Sons

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	2	-	-	2
CO2	3	3	3	2	-	-	-	-	2	-	-	2
CO3	3	3	3	3	-	-	-	-	2	-	-	2
CO4	3	3	3	3	-	-	-	-	2	-	-	2
CO5	3	3	3	3	-	-	-	-	2	-	-	2

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Renewable Energy Sources & Applications
Course Code: EC 504B
Contacts: 3:0:0
Total Contact Hours: 36
Credit: 3

Prerequisite: Renewable energy resources, Technical applications, Advantage and Disadvantage.

Course Outcomes:

CO1: Able to Explain the importance of renewable energy over conventional energy up to the level of application.

CO2: Able to Analyze the process of using solar, wind, hydel, biomass, energy up to the level of using conventional energy based on the availability of resources.

CO3: Able to Analyze the process of using geothermal energy, energy from ocean, magneto hydrodynamic power generation at per using conventional energy depending on feasibility of application.

Course Content:

MODULE 1: INTRODUCTION TO ENERGY SOURCES: [2]

Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development & economic growth; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.

MODULE 2: SOLAR ENERGY: [9]

SOLAR ENERGY: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length.
SOLAR THERMAL COLLECTORS & HEATING: Flat plate collectors, Concentrating collectors, Solar air heaters-types, storage of solar energy-thermal storage, solar water heaters, solar distillation, solar cooker, solar heating & cooling of buildings,
SOLAR PHOTOVOLTAIC SYSTEMS: Theory of solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Concept of module, array. Classification of PV systems, Advantages and disadvantages. Efficiency and cost of PV systems & its applications.

MODULE 3: WIND ENERGY: [6]

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output from wind turbine; wind data and importance of site selection, characteristics of different types of wind generators used with wind turbines. Merits & demerits.

MODULE 4: HYDEL ENERGY: [2]

Electricity generation from micro hydel plants, location, auxiliaries and associated problems. Advantages & disadvantages.

MODULE 5: BIOMASS ENERGY: [5]

Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages,

constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas, Biodiesel.

MODULE 6: GEOTHERMAL ENERGY: [2]

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo- pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

MODULE 7: ENERGY FROM OCEAN: [2]

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Ocean Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

MODULE 8: MAGNETO HYDRODYNAMIC POWER GENERATION: [2]

Principle of MHD power generation, Classification of MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.

MODULE 9: HYDROGEN ENERGY: [2]

Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.

MODULE 10: FUEL CELL: [2]

Introduction, principle of operation of fuel cell. Types of fuel cells, efficiency of fuel cell, application of fuel cells, limitations.

MODULE 11: HYBRID SYSTEMS: [2]

Introduction to hybrid systems, Need for Hybrid Systems, Different type of Hybrid systems like Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems.

Text Books

1. Non Conventional Energy Resources by S Hasan Saeed, D K Sharma, S.k. Kataria & Sons
2.NON CONVENTIONAL RESOURCES OF ENERGY, G. S. SAWHNEY, EasternEconomyEdition
3.Non Conventional Energy Resources, B.H Khan, McGraw Hill Education(Chennai)
4.Non Conventional Energy Resources, N.K.Bansal , Vikas.

Reference Books

1.Non Conventional Energy Resources, Shobh Nath Singh , PEARSON.
2.Non Conventional Energy Resources AndUtilisation. Er R.K Rajput, S Chand Publishers.
3.Rai G.D., “Non – Conventional Energy Sources”, Khanna Publishers, 1993.
4.Rai G.D., “Solar Energy Utilisation”, Khanna Publishers, 1993.

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	2	-	2	2	2	2	3
CO2	3	2	2	1	2	3	-	2	2	1	2	3
CO3	3	2	1	3	-	3	1	3	1	1	1	3

Course Name: Nano Electronics
Course Code: EC 504C:
Contacts: 3:0:0
Total Contact hours: 36 Credits: 3

Prerequisite:
The candidates should have the basic knowledge of materials physics and charge transport phenomena in electronic devices.

Course Outcome:
After successful completion of this course, students should be able to:

CO1: Able to Explain the importance of NanoElectronics and level of application.

CO2: Able to Analyze the recent trends of microelectronics and nano-electronics.

CO3: Able to Analyze nanodots, wire and nanowell design level and behavior

CO4: Able to Explore nanostructure levels and design

CO5: Able to Develop the fabrication and analytical techniques of nanomaterials

Course Content:
Module I [8]
Introduction to nano-electronics, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics. Mesoscopic physics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence. Classification of Nano structures, Low dimensional structures: Quantum wells, wires and dots, Density of states and dimensionality. Basic properties of two-dimensional semiconductor nanostructures, carbon nano tube and graphene.

Module II [8]
Introduction to methods for fabrication of nano-layers, different approaches, physical vapor deposition, chemical vapor deposition. Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide- dry and wet oxidation methods. Fabrication of nano particle- grinding with iron balls, laser ablation, reduction methods, sol gel, self-assembly, precipitation of quantum dots. MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition etc.

Module III [6]
Introduction to characterization of nanostructures, tools used for of nano materials' characterization, Microscope- optical and electron microscope. Principle of operation of Scanning Tunneling Microscope, Atomic Force Microscope, Scanning Electron microscope, Specimen interaction. Transmission Electron Microscope. X-Ray Diffraction analysis, UV-Vis spectroscopy, Particle size analyzer.

Module IV [8]
Introduction to MEMS and NEMS, working principles, as micro sensors (acoustic wave sensor, biomedical and biosensor, chemical sensor, optical sensor, capacitive sensor, pressure sensor and thermal sensor), micro actuation (thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Piezoresistivity, Piezoelectricity and thermoelectricity,

Module V [6]
Introduction – Scaling of physical systems – Geometric scaling & Electrical system scaling. The Single-Electron Transistor: Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube

Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Coulomb Blockade in a Nanocapacitor, Hot electro transistors, Molecular SETs and Molecular Electronics.

Text Books

1. Stephen D. Sentaria, Microsystem Design, Kluwer Academic Press
2. Marc Madou, Fundamentals of microfabrication & Nanofabrication.
3. T. Fukada & W.Mens, Micro Mechanical system Principle & Technology, Elsevier.
4. Julian W.Gardnes, Vijay K. Varda, Micro sensors MEMS & Smart Devices.

Reference Books

1.Nano Terchnology and Nano Electronics – Materials, devices and measurement Techniques by WR Fahrner – Springe
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; Tata Mc.Graw Hill.
3. Nanotechnology: Synthesis to Applications by Roy, Ghosh and Sarkar, CRC Press, 2017.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	1	1	3	1	1	-	-	-	1	2	3
CO2:	3	2	2	3	1	-	2	1	1	1	1	3
CO3:	2	3	1	2	1	1	1	2	-	-	1	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3

Course Name: Analog & Digital Communication Systems Lab
Course Code: EC 591
Contact: 0:0:3
Credit: 1.5

Prerequisites: Knowledge of signals and systems

Course Outcomes:

CO1 Able to demonstrate the Amplitude Modulation & Demodulation by measuring and verifying the output power with varying modulation index.

CO2 Able to demonstrate the FM signal and measure the modulation index, frequency deviation and bandwidth.

CO3 Able to design a PLL to measure the lock frequency using VCO.

CO4 Able to demonstrate the generation of PCM, delta modulation, adaptive delta modulation techniques using the concepts of sampling.

CO5 Able to demonstrate the various Digital modulation techniques ASK, BFSK, BPSK, QPSK and develop insight into the input and output signals in various stages of a transmitter and a receiver.

List of Experiments:

1. Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB).
2. Measurement of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
3. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
4. Design a PLL using VCO & to measure the lock frequency.
5. Study of pulse amplitude modulation (PAM) and demodulation.
6. Study of PCM and demodulation.
7. Study of delta modulator and demodulator
8. Study of ASK modulator and demodulator
9. Study of BPSK modulator and demodulator
10. Study of BFSK modulator and demodulator.
11. Study of QPSK modulator and demodulator.
12. Innovative project: Breadboard realization of digital communication circuit for voice communication

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	1	1	-	-	2	3	3	3	2
CO2	3	3	-	3	3	-	2	-	-	1	3	3	2
CO3	3	3	3	3	2	2	-	-	1	3	3	3	2
CO4	3	-	3	2	3	-	2	-	-	2	3	3	2
CO5	3	2	-	3	3	2	-	-	-	3	3	3	2

Course Name: Microprocessor and Microcontroller Lab
Course Code: EC592
Contacts: 0:0:3
Credits: 1.5

Prerequisites: Knowledge in Digital Electronics

Course Objective:
To apply ALP Programming for arithmetic-logical solutions and also to interpret the interfacing programming by conducting experiments.

Course Outcome:

CO	Statement
CO1	Able to apply assembly language programming in 8085 & 8086 Trainer Kits using arithmetic and Logical operations of the instruction sets.
CO2	Able to develop assembly language programming in 8051trainer kits using arithmetic, logical and bit manipulation instructions.
CO3	Able to design the interfacing program of 8085 with 8255 in glowing LEDs accordingly, stepper motor rotation control, interfacing Seven Segment Display and displaying string etc based on Subroutine Call and IN/OUT.
CO4	Able to design the interfacing program of 8086 with 8255 in glowing LEDs accordingly, stepper motor rotation control, interfacing Seven Segment Display and displaying string etc based on Subroutine Call and IN/OUT.
CO5	Able to analyze Timer/Counter and Interrupt handling in 8051 interfacing using timer and interrupt control instructions.

List of Experiments:

1. Familiarization with 8085 register level architecture, the basic instruction sets (data transfer, arithmetic, logical, branching) and the trainer kit components including the memory map.
2. Familiarization with the process of storing, executing and viewing the contentsof memory as well as registers in the trainer kit 8085 and simulator through small assignments.
3. Programming using 8085 kit and simulator for:

   Addition, Subtraction, Multiplication by repeated addition method, Square, Complement, Look up table, Copying a block of memory, Shifting ,Packing and

   unpacking of BCD numbers, Addition of BCD numbers, Binary to ASCII conversion, Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method.

4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, glowing of seven segment display.
5. Program for serial communication between two trainer kits.
6. Interfacing of 8255: Keyboard, Stepper motor rotation.

7. Study of 8051 Micro controller kit and writing programs.

Additional Programs

1. Read a character from a keyboard and display it on Screen
2. Display a string on screen
3. To check for a Password

CO-PO Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Digital Signal Processing Lab.
Course Code: EC593
Contacts: 0:0:3
Credits: 1.5

Course Objectives:

To develop and Implement DSP algorithms in software using a computer language such as MATLAB.
To analyze and Observe Magnitude and phase characteristics of different signals.
To analyze and observe Magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.

Course Outcomes:

CO1	Able to analyze generation and operation of various discrete sequences using MATLAB tools.
CO2	Able to compute the system output using circular,linear and sectioned convolution methods using MATLAB tools.
CO3	Able to Calculate DFT, FFT, IDFT using MATLAB
CO4	Able to analyze Magnitude and phase characteristics (Frequency response Characteristics) of digital IIR Butterworth using MATLAB tools.

CO5	Able to Develop and Implement DSP algorithms in software using a computer language such as C with TMS320C6713 floating point Processor.

List of Experiments:

1. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.

2. Systems (Causal and Non_causal, Time-Invarient and Time-varient etc.) verification using MATLAB.

3. Z-transform of various sequences – verification of the properties of Z-transform.

4. DFT using twiddle factors.

5. DFTs / IDFTs using matrix multiplication and also using commands.

6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.

7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.

8. Butterworth filter design with different set of parameters.

9. FIR filter design using rectangular, Hamming and Blackman windows.

10. Frequency responses of anti-imaging and anti-aliasing filters.

11. Develop and Implement DSP algorithms in software using a computer language such as C with TMS320C6713 floating point Processor, TMS 5416 kit and ASM along with C.

CO-PO Mapping

COs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	3
CO2	3	3	2	3	3	-	-	-	3	-	-	3
CO3	3	3	3	3	3	-	-	-	3	-	-	3
CO4	3	3	3	3	3	-	-	-	3	-	-	3
CO5	3	3	3	3	3	-	-	-	3	-	-	3

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Constitution of India
Course Code: MC 501
Contact: 3:0:0
Total Contact Hours: 32

Prerequisite: NA

Course Outcome: Student will be able to:
CO1: Develop human values, create awareness about law ratification and significance of Constitution
CO2: Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.
CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions.
CO4: Familiarize with distribution of powers and functions of Local Self Government.
CO5: Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

Course content:
1. Meaning of the constitution law and constitutionalism (2L)
2. Historical perspective of the Constitution of India (2L)
3. Salient features and characteristics of the Constitution of India (1L)
4. Scheme of the fundamental rights (2L)
5. The scheme of the Fundamental Duties and its legal status (2L)
6. The Directive Principles of State Policy – Its importance and implementation (2L)
7. Federal structure and distribution of legislative and financial powers between the Union and the States (3L)
8. Parliamentary form of Government in India – The constitution powers and status of the President of India (2L)
9. Amendment of the Constitutional Powers and Procedure (2L)
10. The historical perspectives of the constitutional amendments in India (2L)
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency (3L)
12. Local Self Government – Constitutional Scheme in India (3L)
13. Scheme of the Fundamental Right to Equality (2L)
14. Scheme of the Fundamental Right to certain Freedom under Article 19 (2L)
15. Scope of the Right to Life and Personal Liberty under Article 21. (2L)

Text Books:
1. Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2. The Constitution of India, PM Bhakshi, Universal Law

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	2	3	-	-	-	2
CO2	-	-	-	-	-	3	2	3	-	-	-	2
CO3	-	-	-	-	-	3	2	3	-	1	-	2
CO4	-	-	-	-	-	3	2	3	-	1	-	2
CO5	-	-	-	-	-	3	2	3	-	1	-	2

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	2
CO3	-	-	2
CO4	-	-	2
CO5	-	-	2

6th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	PC	EC 601	VLSI & Microelectronics	3	0	0	3	3
2	PC	EC 602	Control System	3	0	0	3	3
3	PC	EC 603	RF & Microwave Engineering	3	0	0	3	3
4	PE	EC 604	A. Mobile Communication & Network	3	0	0	3	3
			B. Advanced Microprocessor & Microcontroller					
			C. Introduction to Python					
5	OE	EC 605	A. Object Oriented Programming using JAVA	3	0	0	3	3
			B. Computer Communication & Network Security					
			C. Artificial Intelligence & Robotics					
	Total of Theory						**15**	**15**
B. PRACTICAL								
6	PC	EC 691	VLSI & Microelectronics Lab	0	0	3	3	1.5
7	PC	EC 692	Control System Lab	0	0	3	3	1.5
	PC	EC 693	RF & Microwave Engineering Lab	0	0	3	3	1.5
8	PE	EC 694	A. Mobile Communication & Network Lab	0	0	3	3	1.5
			B. Advanced Microprocessor & Microcontroller Lab					
			C. Python Programming Lab					
9	OE	EC 695	A. Object Oriented Programming using JAVA Lab	0	0	3	3	1.5
			B. Computer Communication & Network Security Lab					
			C. Artificial Intelligence & Robotics Lab					
10	PROJ	PR 691	Project-VI	0	0	2	2	1
11	PROJ*	PR 692	Innovative activities-V	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 681	Technical Lecture Presentation & Group Discussion-I	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**32**	**24**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: VLSI & Microelectronics
Course Code: EC601
Contacts: 3:0:0
Total Contact Hours: 36
Credit: 3

Prerequisite:

Concept of courses Solid State Devices (EC301) , 3rd Sem ; Analog Electronic Circuit (EC402) , 4th Sem ; Digital Electronic and Circuit (EC403),4th Sem.

Course Objective:

Objective of the course VLSI & Microelectronics, Code : EC702 is to motivate students to design VLSI circuits in the area of digital , analog and also to encourage for the design of IC with low power and high speed .

COs	CO Statement
CO1	Able to illustrate scale of integration – SSI, MSI,LSI,VLSI, Moor's Law ,scaling , short channel effect ,VLSI design flow, FPGA architecture and construct gate level circuit with PAL & PLA concept.
CO2	Able to analyze voltage transfer characteristics of CMOS inverter with the parameters – VIL, VIH , VOL , VOH , Vth and able to construct schematic of combinational , sequential circuit , SRAM , DRAM cell using circuit design methodology – CMOS , Pass transistor , TG , DCVSL , dynamic logic ,NORA Logic.
CO3	Based on the fundamental concept of MOSFET characteristics and model, able to determine value of resistance of current source, MOS diode , current of current mirror circuit , voltage of references (voltage divider , threshold voltage and band gap), resistance of switch capacitor circuit , gain of switch capacitor integrator and 1st order switch capacitor filter and value of parameters to design CMOS differential amplifier and two stage OP-AMP.
CO4	Able to illustrate fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on lambda and micron design rules.
CO5	Able to estimate gate delay, dynamic power, short circuit power and leakage power and total power consumption across CMOS inverter circuit based on the mathematical expression.

Course Content:

Module –I: Introduction to IC (6L)

Integrated Circuits – Advantages, disadvantages, limitations; Scale of Integration – SSI, MSI, LSI, VLSI, ULSI; Moor's Law; Scaling of MOSFET-Constant field scaling and constant voltage scaling, Short Channel Effects; VLSI design flow, Y-Chart, IC Classification –Standard IC and ASIC, PAL, PLA, FPGA Architecture.

Module-II: Digital VLSI Circuit Design (11L)

Inverter Characteristics (2L):

Resistive load inverter – Voltage transfer characteristics (VTC, significance of parameters (only expression, no derivation) –V_{IL} , V_{IH} , V_{OL}, V_{OH} , V_{th} ; CMOS inverter - VTC , Noise margin and aspect ratio of symmetric CMOS inverter.

Combinational Logic Circuit Design (6L):

Circuit design using Static CMOS style – basic gates , design of circuit for product of sum(POS) and sum of product (SOP) expression, Complex logic circuit , full adder ; Circuit design using pseudo NMOS logic, DCVSL Logic , TG Logic , Pass Transistor Logic , Complementary pass transistor logic , Dynamic logic , domino logic , NORA logic .

Sequential Circuit and Semiconductor Memory Design (3L):

Bistable Circuit -Design of CMOS S-R & J-K Latch, CMOS Clocked SR & JK Latch /Master –slave JK Flip-flop, CMOS D Flip-flop; 6T SRAM cell and 3T DRAM cell design.

Module-III: Analog VLSI Circuit Design (10L)

Small Signal model of MOSFET; Analog sub-circuits -MOS Switch , Active resistors/MOS Diode , Current source and Sink ,Current Mirror ; Current and voltage references-voltage divider , MOS equivalent of P-N junction Voltage reference , Threshold voltage reference , Band gap reference (Basic Principle) ; Switch- Capacitor Circuit – resistance emulation of series , parallel and series-parallel circuit , Switch capacitor integrator and filter (1^{st} order only) ;CMOS differential amplifier – design parameters ;Output amplifier (basic circuit) ; Two-Stage CMOS OP-AMP design .

Module –IV: Layout Design Rules and Fabrication Steps of ICs (6L)

Micron and lambda design rules; Stick diagram and Layout - CMOS Inverter, NAND and NOR gate; Fabrications steps of IC – Wafer preparation, Oxidation, photolithography, etching, diffusion, ion- implantation, metallization and packaging. CMOS N-Well Process, overview of P-well and twin-tub process.

Module-V: Introduction to Low Power and High-Speed VLSI Circuit Design (3L)

Dynamic power, short circuit power and leakage power in CMOS Inverter; Timing parameters (concept only) –Critical path, arrival time, slack, skew, set-up time, hold time, gate delay and path delay, delay time expression of CMOS inverter (expression only), Adiabatic logic (basic concept)

Text Books:

1. Digital Integrated Circuit , J.M.Rabaey, Chandrakasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuits Analysis and Design , S.M.Kang & Y.Leblebici,TMH.
3. CMOS Analog Circuit Design , Allen & Holberg , Oxford
4. Design of Analog CMOS Integrated Circuits , Behzad Razavi , TMH .

Reference Books:

1.Microelectronic Circuits , Sedra & Smith , Oxford
2.Introduction to VLSI Circuits and System , Uyemura ,
Wiley 3.VLSI Design , Debaprasad Das , Oxford
4.VLSI Design and EDA Tools , Angsuman Sarkar , Swapnadip De , C.K. Sarkar , Scitech
5.VLSI Design Techniques for Analog and Digital Circuits , Geiger , Allen , Strader , TMH

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	-	-	-	-	2	-	-	3
CO2	3	3	3	3	-	-	-	-	2	-	-	3
CO3	3	3	3	2	-	-	-	-	2	-	-	2
CO4	3	3	3	3	-	-	-	-	2	-	-	3
CO5	3	3	3	3	-	-	-	-	2	-	-	2

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	3
CO3	3	3	3
CO4	3	3	3
CO5	2	3	2

Course Name: Control Systems
Course Code: EC 602
Contacts: 3:0:0
Total Contact Hours: 36
Creditd:3

Pre requisite:

(1) Concepts in electrical circuits (Studied in Basic Electrical).

(2) Fundamental concepts on Laplace Transformation (studied in Mathematics)

Course Objectives:

1. To familiarize the students with concepts related to the operation analysis and stabilization of control systems.
2. To understand feedback systems (open loop and closed loop) and system modelling.
3. To understand time domain and frequency domain analysis of control systems required for stability analysis.
4. To understand the recompense technique that can be used to stabilize control systems.

Course outcome:

CO1	Able to implement different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis using block diagram reduction and signal flow graph procedure between open loop and closed loop control systems.
CO2	Able to analyse the time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and to identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.
CO3	Able to analyse the stability of control systems in S-domain using RH criterion, Root-locus.
CO4	Able to examine the relative stability of control systems using frequency domain analysis using Polar plot, Nyquist plot, Bode plot.
CO5	Able to identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system and design accordingly using P, PI, PD, PID technique to desired performance specifications.

Course Content:

Module I: INTRODUCTION TO CONTROL SYSTEMS & MODELLING [7L]

Basic Elements of Control System, Linear, Non-Liner and Discrete Time System (Introduction & Concept) Open loop and Closed loop systems – Differential equation – About transfer function and its generation technique, Modelling of Electrical and mechanical systems - Block diagram reduction Techniques - Signal flow graph, mason's gain formula.

Module II: TIME RESPONSE ANALYSIS [7L]

Time response analysis –Different input deterministic test response – Order and Type of the systems incorporation with time response-First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors and others characteristics – P, PI, PD and PID Compensation.

Module III: STABILITY ANALYSIS [6L]

Routh -Hurwitz Criterion, Root Locus Algorithm, Construction of Root Locus, Effect of addition of pole and zero on the root locus, Application of Root Locus Diagram.

Module IV: FREQUENCY RESPONSE ANALYSIS [10L]

Concept of Frequency Response of a system, Bode Plot Computational Algorithm, Construction of Bode diagram, Polar Plot, Phase and gain margin Nyquist Plot, Interpretation of Bode and Nyquist plot, Frequency Domain specifications from the plots and Computational Algorithm - Lead, Lag, and Lead Lag Compensators.

Module V: STATE SPACE ANALYSIS OF CONTINUOUS TIME SYSTEMS [6L]

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability. Concept of state feedback.

Text Books:

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John Wiley and son's,
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.
3. Control Systems –by Ramesh Babu

Reference Books:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	3	3	-	-	-	-	2	-	-	2
CO3	3	3	3	3	-	-	-	-	1	-	-	2
CO4	3	3	3	3	-	-	-	-	1	-	-	2
CO5	3	3	3	3	-	-	-	-	2	-	-	2

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: RF & Microwave Engineering
Course Code: EC 603
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: EM Theory & Antenna, Field theory, Analog Electronics

Course Objective:

1. Distinguish the RF & Microwave spectrum, Planar transmission lines and High frequency circuit elements.
2. Determine the Microwave passive components and Scattering matrix representation.
3. Illustrate the Microwave tubes, Semiconductor Microwave Devices.
4. Justify the microwave applications and typical microwave test bench.

Course Outcomes:

CO1	Able to implement different types of system and **identify** a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to **construct** equivalent electrical models for analysis using block diagram reduction and signal flow graph procedure between open loop and closed loop control systems.
CO2	Able to **analyse** the time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and to **identify** the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.
CO3	Able to **analyse** the stability of control systems in S-domain using RH criterion, Root-locus.
CO4	Able to **examine** the relative stability of control systems using frequency domain analysis using Polar plot, Nyquist plot, Bode plot.
CO5	Able to **identify** the needs of different types of controllers and compensator to ascertain the required dynamic response from the system and **design** accordingly using P, PI, PD, PID technique to desired performance specifications.

Course

Content:

Module I:

[11L]

Introduction RF & Microwave Spectrum, Typical applications of RF and Microwave-RADAR & Missile, Safety considerations.

Microwave Waveguide and Waveguide Resonator Rectangular Waveguide- Design consideration, TE & TM

modes, TE10 mode analysis, cut-off frequency, propagation constant, intrinsic wave impedance, phase and group velocity, power transmission, attenuation, waveguide excitation, wall current; Introduction of circular waveguide; Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor, excitation. Planar Transmission line Micro-strip lines, Coplanar waveguide, Slot line-design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above-mentioned lines.

Module II: [12L]

High frequency Circuit Elements Difference in High frequency and relatively low frequency behavior of Lumped circuit components. Miniaturization and Design of Lumped components at High RF. Realization of reactive elements as Waveguide and Planar Circuit components.

Waveguide Passive Components and their S-matrix Representation N-port networks-Properties of S matrix, Transmission matrix & their relationships; Microwave passive components and their S matrix representation: Attenuators, Phase shifter, Directional coupler, Bethe-hole coupler, Magic tee, hybrid ring, Circulators, Isolators; Design procedure of filter (maximally flat and equal ripple) using insertion loss method-specification, lowpass prototype design, scaling and conversion, implementation.

Module III: [9L]

Microwave Tubes Electron beam & Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron, Magnetron) and non-resonant (TWT &BWO) microwave active devices: Typical characteristics & applications (only physical explanation is required, no mathematical derivation required). [4] Semiconductor M icrowave devices TED (Gunn diode) & Avalanche Transit Time (IMPATT) device, Schottky diode, PIN diode characteristics & applications; Microwave bipolar transistor, Microwave field effect transistor (MESFET).

Microwave Amplifier Design Basic consideration in the design of RF amplifier- Transistor S-parameter, Stability, matching network, noise figure; Matching network design using lumped elements and L-Section. Brief introduction to NBA, LNA.

Module IV: [4]

Typical Microwave Test Bench & measurement VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Network analyzer, Measurement of VSWR – low, medium and high, Measurement of power: low, medium and high, Frequency measurement. [4]

Text Books:

1. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata Mc Graw Hill Inc., 3rd Edn.2015.
2. Samuel Y Liao, “Microwave Devices & Circuits” , Prentice Hall of India, 2006.
3. D.M.Pozar, “Microwave Engineering.”, John Wiley & sons, Inc., 2006.

Reference Books:

1. Robert E.Colin, 2ed “Foundations for Microwave Engineering”, McGraw Hill, 2001M.
2. M.Radmanesh, RF & Microwave Electronics Illustrated, Pearson Education, 2007.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	2	3	-	-	-	-	2	-	-	2
CO3	3	3	3	2	-	-	-	-	2	-	-	2
CO4	3	2	2	3	-	-	-	-	2	-	-	2
CO5	3	2	3	2	-	-	-	-	2	-	-	2

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	3
CO3	3	3	3
CO4	3	3	3
CO5	2	3	2

Course Name: Mobile Communication and Network Course Code: EC 604A
Contacts: 3:0:0
Total Contact hours:
36 Credits: 3

Prerequisite: Analog & Digital Communication

Course Outcomes:

CO1: Describe the evolution and History of Wireless Technology.

CO2: Explain cellular concept for mobile communication.

CO3: Learn radio signal propagation issues and different technological advancement of mobile communication, Wireless and Radio channels.

CO4: Compare 3G Cellular telephone data transfer rates with those over Wireless LAN and core networks associated with 3G Cellular networks.

CO5: Describe mobile IP allocation and function of the station roaming.

Course Content:

Module I: INTRODUCTION [2L]

Evolution of mobile radio communications, mobile radio systems around the world, trends in cellular radio and personal communication, first generation (1G), second generation (2G), third generation (3G) mobile cellular networks.

Module II: CELLULAR CONCEPT [10L]

Limitations of conventional mobile system, Introduction to mobile cellular communication, concept of frequency reuse, cluster size, cellular system architecture, channel assignment strategies, call handoff strategies
- hard handoff and soft handoff, prioritizing handoff; interference and system capacity, improving capacity in cellular systems – cell splitting, sectoring, microcell zone concept, Co-channel interference, Propagation effects - scattering, ground reflection, fading.

Module III: DIFFERENT MOBILE COMMUNICATION SYSTEMS [8L]

GSM services and features, system architecture, GSM radio subsystem, GSM channel types, location updating and call setup, WAP, SCSD, GPRS, EDGE, 3G W-CDMA; CDMA digital cellular standard, comparison between GSM and CDMA, 3G cdma2000, IMT-2000

Module IV: WIRELESS NETWORKS [8L]

Advantages and applications of Wireless LAN, WLAN technology – RF and IR wireless LAN, diffuse, quasi-diffuse and point-to point IR wireless LAN, IEEE802.11, IEEE802.11 architecture, Introduction to WI-FI, HIPERLAN2, Bluetooth – Bluetooth architecture.

Module V: MOBILE NETWORK [8L]

Introduction to Mobile IP, requirements, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimization, Reverse tunneling; Mobile ad-hoc networks – Routing, Destination sequence distance vector, Dynamic source routing and Alternative metrics, Future of mobile communication – 3G to 4G. 4G Introduction and vision, Multi antenna Technologies: MIMO; software defined radio, adaptive multiple antenna techniques, radio resource management, QOS requirements.

Text Books:

1.Theodore S. Rappaport, Wireless communications: principles and practice, PHI / Pearson education.
2.J. Schiller, Mobile communications, Addison-Wesley.
3.William C. Y. Lee, Mobile cellular telecommunication – analog and digital systems, McGraw Hill,2nd ed.

Reference Books:

1.Wang, Wireless communication System, Pearson Education
2.Talukdar, Mobile computing, TMH
3.J.W.Mark, W. Zhuang, Wireless Communication and Networking, PHI
4.A. Santamaria et al, Wireless LAN systems, Artech House.
5.Stallings, Wireless Communication & Networks, Pearson Education.

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	3
CO3	3	3	3
CO4	3	3	3
CO5	2	3	2

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	2	3	-	-	-	-	2	-	-	2
CO3	3	3	3	2	-	-	-	-	2	-	-	2
CO4	3	2	2	3	-	-	-	-	2	-	-	2
CO5	3	2	3	2	-	-	-	-	2	-	-	2

Course Name: Advanced Microprocessor & Microcontroller

Course Code: EC 604B
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Pre requisite: Concepts in 8085 ,8086 Microprocessor and MCS51 series of Microcontroller.

Course Outcomes:

CO1: Understand the features, architecture of ARM7 and its applications.

CO2: Analyse and understand the instruction set and development tools of ARM

CO3: Get comprehensive knowledge on features, architecture, pin diagram, input-output configuration, the interrupts and timers of PIC microcontroller

CO4: Understand the significance of input-output device interface with PIC microcontroller.

CO5: Work on different projects making use of the ARM & PIC microcontroller

Course Content:

Module 1: ARM Processor Fundamentals: [7L]

The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics.

Module 2: ARM Instruction Set Duration: [6L]

Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status Register instruction.

Module 3: Introduction ARM Programming: [5L]

General Structure of ARM assembly module, Assembler directives- AREA, ENTRY, END, SPACE, DCD, DCB, DCW, DCI, DCQ, EQU, EXPORT, ALIGN, CODE16, CODE32, DATA. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan.

Module 4: Exception and Interrupt handling schemes Duration: [6L]

Exception handling- ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency, IRQ and FIQ exceptions with example- code for enabling and disabling IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design.

Module 5: Introduction to PIC Microcontroller: [6L]

PIC 18F4550 Microcontroller – Hardware Architecture & GPIOs ((Pin Diagram, Memory Organization, SFRs description, Program Counter, Accumulator (or Working Register), Reset, Clock Cycle, Machine Cycle, Instruction Cycle, Interrupts, SFRs & GPRs, Stack, Stack Pointer, Stack Operation, Timers and serial communication in PIC 16F877A). Microcontroller PIC Assembly Language, Programming in Embedded C, Introduction to programming software, Examples programs for PIC.

Module 6: Interfacing PIC 16F877A With Input Output Devices: [6L]

LED Display,7-Segment, DIP Switch, Intelligent LCD Display, Matrix Keyboard, Stepper Motors and Types of Stepper Motors, Serial Communication Concepts, Practices on interfacing circuits, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, USB, Bluetooth, Practices of ICP, ADC, EEPROM, Opto-Isolators, Relay, I2C, SPI Protocol, Serial Memory, On chip Peripherals PWM.

Text Books:

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley
2. Microchip's PIC microcontroller is rapidly becoming the microcontroller of choice throughout the world, Myke Predco
3. PIC Microcontroller – Mazidi and Mazidi

Reference books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
2. ARM Architecture Reference Manual
3. PIC programming-Gaonkar, Penram Publishing.

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	3
CO3	3	3	3
CO4	3	3	3
CO5	2	3	2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	2	3	-	-	-	-	2	-	-	2
CO3	3	3	3	2	-	-	-	-	2	-	-	2
CO4	3	2	2	3	-	-	-	-	2	-	-	2
CO5	3	2	3	2	-	-	-	-	2	-	-	2

Course Name: Introduction to Python
Course Code: EC 604C
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Students are expected to be able to open command prompt window or terminal window, edit a text file, download and install software, and understand basic programming concepts.

Course Outcomes:

CO1: Able to develop the skill based on the variable,basic operators to acquire programming skills in core python.

CO2: Able to understand object oriented skills in python based on the knowledge of decision making & loops.

CO3: Able to describe the skill of python programming with the help of string,list,tuples,dictionary in python.

CO4: Able to write the program of python with the help of the knowledge of functions.

CO5: Able to develop the ability to write the programming based on the packages in python.

Course Contents:

Module-I [Introduction]:[2]
History of python, python features, identifier, keywords, lines and indentation, multiline statements, quotation in python, command line arguments

Module-II [Variable types, Basic operators]:[6]
Assigning Values to Variables, Multiple Assignment, Standard Data Types, Numbers, Strings, Lists, Tuples, Dictionary, data type conversion, Arithmetic, comparison, assignment, bitwise, logical, membership, identity, operators' precedence

Module-IV [Decision making & Loops]:[2]
If statement, if-else, elif, while loop, for loop, iteration by sequence index, nested loops, break & continue statement, pass statement

Module-V [String, List, Tuples, Dictionary]:[10]
String: Access values in string, updating string, escape characters, String special operators, triple quotes
List: creating list, accessing values, update list, deleting list elements, basic list operations, index, slicing and matrixes, built-in list functions
Tuples: Creating tuples, updating tuples, deleting tuples, basic tuples operations, indexing, slicing, built-in tuples functions
Dictionary: Creating dictionary, updating, delete elements, properties of dictionary keys, built-in dictionary functions

Module-VI [Functions]:[4]
Defining a function, calling function, passing by reference Vs passing by value, function arguments, required arguments, keyword arguments, default arguments, variable length arguments, anonymous function, return statement, scope of variables

Module-VII [Numpy & Matplotlib Modules]:[10]
Overview, Installation, import statement, from…import statement, Arrays, Array mathematics, Array iteration,

Basic array operations, Array item selection and manipulation
Vector and matrix mathematics, Statistics, Random numbers, Data visualization

Module-VIII [Files I/O]:[1]

Reading keyboard input, read and write different file types

Text Book:

"Learning with Python" by Allen Downey, Jeff Elkner, and Chris Meyers, Green Tea Press.
Core Python Programming, 2ed (Kindle Edition),by Dr. R. Nageswara Rao, Dreamtech Press

Reference Books:

Python Programming (Edit): An Introduction to Computer Science, by John Zelle (Author), Michael Smith (Author)
Programming Python, y Mark Lutz , O'Reilly Publications

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	-	-	2	1	3	3
CO2	3	3	3	3	3	2	-	-	2	1	3	3
CO3	3	3	3	2	3	2	-	-	2	1	3	2
CO4	3	3	3	2	3	2	-	-	2	1	3	3
CO5	3	3	3	2	3	2	-	-	2	1	3	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	2	2	-
CO2	2	2	-
CO3	2	2	-
CO4	2	2	-
CO5	2	2	-

Course Name: Object Oriented Programming using Java Course Code: EC 605A
Contacts: 3:0:0
Total Contact Hours: 36 Credit: 3

Pre requisites: Basic knowledge of computers, basic knowledge of programming.

Course Objective: The Objective of the course is Understand basic of Object Oriented Programming Understanding the features of Java.
Enable students to write Java program and develop projects.

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

EC 604A.1: Understand the key concepts of object-oriented programming and have an ability to design OO programs and appreciate the techniques of good design;
EC 604A.2: Understand advanced features of Java like Class Members-Local variable, instance variable, class variable, Primitive and Reference variable, Constructor, this keyword, finalize and garbage collection, Array- Declaring and defining array.
EC 604A.3: Analyze complex programming problems and optimize the solutions.
EC 604A.4: Apply an understanding of ethical principles to problems which commonly arise in the Information Technology Industry.
EC 604A.5: Analyse the reusability properties using super class & subclasses, dynamic method dispatch.

Course Content:

MODULE I: Object oriented design [3L]
Concepts of object-oriented programming language, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation

MODULE II: Object oriented concepts [3L]
Class, object, message passing, inheritance, encapsulation, polymorphism, Difference between OOP and other conventional programming – advantages and disadvantages.

MODULE III: Understanding Java programming language [2L]
History of Java Programming languages, Purpose of invention of Java. Structure of a basic Java Program, Component of Java Development Kit-API, JRE, Understanding the steps to run a complete Java Program.

MODULE IV: Basic Components of Java Program [2L]
Java Tokens-Literals, identifier, keywords, operator, separator, Data types, variables, constant, Type casting-defining type casting, requirement of type casting, implicit and explicit type casting. Control structure. Access specifier.

MODULE V: Class & Object proprieties [6L]
Defining class and object, Class Members-Local variable, instance variable, class variable, Primitive and Reference variable, Constructor, this keyword, finalize and garbage collection, Array-Declaring and defining array, accessing array elements, length properties, 2D array, anonymous array, array of Objects. Understanding method- method returning object, passing objects, method passing and returning arrays, use of method overloading. Static-Static block and non static block, static variable, static method. nested & inner classes.

MODULE VI: Reusability properties [6L]

Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member
access for packages.

MODULE VII: String Handling [2L]

Basic string handling concepts- String (discuss charAt() , compareTo(),equals(), equalsIgnoreCase(), indexOf(), length(), substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() ,trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(),length(), setCharAt(), setLength(), substring(), toString() methods),concept of mutable and immutable string, command line arguments

MODULE VIII: Exception handling & Multithreading [5L]

Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

MODULE IX: Basic IO Operation and File Handling [3L]

Understanding unformatted and formatted IO. Reading and writing files.

MODULE X: Swing Programming [4L]

Swing Origins, Components and containers, Difference between AWT and swing, small swing programs, swing apps, concept of delegation event model and listener.

MODULE XI: Applet Programming (using swing) [4L]

Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets.

Text books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH

Reference Books:

4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	-	-	2	1	3	2
CO2	3	3	3	3	3	2	-	-	2	1	3	2
CO3	3	3	3	2	3	2	-	-	2	1	3	2
CO4	3	3	3	3	3	2	-	-	2	1	3	3
CO5	3	3	3	2	3	2	-	-	2	1	3	2

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	2	2	-
CO2	2	2	-
CO3	2	2	-
CO4	2	2	-
CO5	2	2	-

Course Name: Computer Communication and Network Security
Course Code:EC605B
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Knowledge of Communication

Course Outcomes:

CO1: Analyze various protocols in Data Communication

CO2: Design Networking structure in Data communication

CO3: Identify some of the factors driving the need for network security, classify particular examples of attacks and physical points of vulnerability in simple networks.

CO4: Identify compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.

Course Outcomes:

Module I: Overview of Data Communication and Networking: [2L]

Introduction; network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Module II: Network Layers: [14L]

Physical Level: Transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus
Data link Layer: Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC
Medium Access sub layer: Point to Point Protocol, Token Ring; Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief);
Network layer: Internetworking & devices: Repeaters, Hubs, Bridges(Basic Idea), Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Source and Hop-by-Hop routing (Dijkastra, Bellman Ford Algorithm),Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6
Transport layer: Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets (Concept); Leaky bucket algorithm, Token bucket algorithm,
Application Layer: Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW;

Module III: Security in Computing Environment: [1L]

Need for Security, Security Attack, Security Services, Information Security, Methods of Protection.

Module IV: Basics of Cryptography: [8L]

Terminologies used in Cryptography, Substitution Techniques, Transposition Techniques.

Encryption and Decryption: Characteristics of Good Encryption Technique, Properties of Trustworthy Encryption Systems, Types of Encryption Systems, Confusion and Diffusion, Cryptanalysis.

Symmetric Key Encryption: Data Encryption Standard (DES) Algorithm, Double and Triple DES, Security of the DES, Advanced Encryption Standard (AES) Algorithm, DES and AES Comparison. Public Key Encryption: Characteristics of Public Key System, RSA Technique, Key Exchange, Diffie-Hellman Scheme, Cryptographic Hash Functions, Digital Signature, Certificates, Certificate Authorities.

Module V: Network Security: [2L]

Network Concepts, Threats in Networks, Network Security Controls.

Module VI: IP Security: [2L]

Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.

Module VII: Web Security: [2L]

Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Module VIII: Electronic Mail Security: [2L]

Threats to E-Mail, Requirements and Solutions, Encryption for Secure E-Mail, Secure E-Mail System.

Module IX: Firewalls: [1L]

Firewalls – Types, Comparison of Firewall Types, Firewall Configurations.

Module X: Modern topics: [2L]

ATM, DSL technology, Architecture & Operation in brief Wireless LAN: IEEE 802.11(WSN), Introduction to blue-tooth, Zigbee

Text Books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Shay, Understanding Data Communication & Network, Vikas
7.John E. Canavan, " The Fundamentals of Network Security," Artech House, February 2001, 350 pages
8.Uyless D. Black, " Internet Security Protocols: Protecting IP Traffic," Prentice Hall, July 2000, 286 pages.

Reference Books:

1. Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Warwick Ford, Michael S. Baum, " Secure Electronic Commerce: Building the Infrastructure for Digital
5.Signatures and Encryption (2nd Edition)," Prentice Hall
6.Gilbert Held, Kent Hundley, " Cisco Security Architectures," McGraw-Hill

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	1	-	3	3	1	1
CO2	2	2	3	3	2	2	-	-	3	3	3	3
CO3	2	2	2	2	2	1	-	-	3	3	1	3
CO4	3	2	2	2	2	3	-	-	3	3	2	3

Course Name: Artificial Intelligence and Robotics
Course Code: EC 605C
Contacts: 3:0:0
Total Contact Hours: 36

Prerequisites:
Linear algebra and probability theory. Basic understanding of control systems and computing.
.

Course Outcomes:

CO1: Able to Understand the natural environment and its relationships with human activities.
CO2: The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CO3: Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
CO4: Acquire skills for scientific problem-solving related to air, water,
CO5: Acquire skills for scientific problem-solving related noise & land pollution.

Course Content:

Module-I: Introduction: [2L]
Foundations and History of Artificial Intelligence & Robotics, Turing Test, Intelligent Agents, classification and usage of robots.

Module-II: Searching and Problem Solving: [5L]
Problem formulation with suitable examples, -8 puzzle problem, Tower of Hanoi, Data driven and goal driven search, Uninformed search strategies -Breadth-first search, Depth first search, Bidirectional search, Hill climbing, simulated annealing.

Module-III: Knowledge Representation and Reasoning: [5L]
Introduction to data, information and Knowledge, Propositional logic, first order predicate logic (FOPL), Rule of inference, Inference engine, knowledge representation technique, Forward and Backward reasoning, Bayes' rule and Bayesian Networks.

Module-IV: Learning: [6L]
General model of learning agents, Inductive learning, learning decision trees, decision trees as performance elements, induction decision trees from example, Neural Networks (Network structures, Single layer feed-forward neural network, Multilayer feed-forward neural network, learning weights), classification & clustering concept.

Module-V: Elements of robots: [6L]
Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo motors, Purpose of sensors– tachometers, strain gauge-based force-torque sensors, proximity sensors and vision.

Module-VI: Kinematics of robots: [8L]

Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Degrees of- freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators.

Module-VII: Motion planning and control: [4L]

Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall.
2. Robotics: Fundamental Concepts and Analysis, Ashitava Ghosal, OXFORD University Press.
3. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.

REFERENCE BOOK:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers
2. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	2	3	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	2	-	-	3
CO4	3	2	2	3	-	-	-	-	2	-	-	3
CO5	3	2	3	2	-	-	-	-	2	-	-	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	3
CO3	3	3	3
CO4	3	3	3
CO5	2	3	2

Course Name: VLSI & Microelectronics Lab
Course Code: EC 691
Contacts: 0:0:3
Credit: 1.5

Course Objective: Objective of the course VLSI & Microelectronics Lab , Code EC792 is to motivate students for the design and analyze circuit performance in the domain of digital , analog using SPICE tools. Also to mentor students to design layout and design using VHDL for FPGA based system design.

Course Outcomes:

CO1	Able to measure VIL, VIH,VOL,VOH,noise margin.CMOS inverter gate delay and average power consumption of CMOS inverter for VDD≤1.2V and with the nano dimension challenging of MOS transistors through transient analysis using SPICE.
CO2	Able to design combinational circuit - CMOS AND/NAND, OR/NOR, XOR/XNOR gate, CMOS full adder circuit, sequential circuit-CMOS SRlatch, clocked SRlatch & D flip-flop at schematic level for functional verification with the help of SPICE tools.
CO3	Able to construct layout of CMOS inverter, CMOS NAND, CMOS NOR gate using layout design tools of SPICE based on design rules.
CO4	Design of combinational circuits-logic gates, Fulladderusinghalfadder,4:1MUXusing2:1 MUX, Sequential circuits-S-R Flip-Flop, 8-bit synchronous counter, 8 Bit bi-directional register with tri-stated input output using VHDL and 4:1 MUX using FPGA
CO5	Design of CMOS differential amplifier with active load and biased with current mirror for given specification using SPICE tools at schematic level.

List of Experiments:

1. SPICE simulation of CMOS inverter to plot voltage transfer characteristics (VTC) for different values of $\frac{k_n}{k_p}$ ratio for V_{DD}=1 V and nano dimensional channel length
   a) Measurement of critical voltages V_{IL} , $V_{IH,}$ V_{OL} , V_{OH} from VTC .
   b) Calculation of noise margin from critical voltages.

2. Functional verification, gate delay and average power consumption analysis of CMOS inverter circuit for $V_{DD} \leq$ 1.2 V and with the nano dimensional channel length of MOS transistor through SPICE simulation.

3. Design and testing of functionality of the following gate and combinational circuit with the help of SPICE tools at schematic level.
   a) CMOS AND/NAND, OR/NOR, XOR/XNOR gate
   b) CMOS full adder circuit

4. Layout design and functional verification of CMOS inverter, CMOS NAND, CMOS NOR gate using layout design tools of SPICE based on design rules.

5. Design and examination of functionality of the sequential circuits - CMOS SR latch, clocked SR latch & D flip-flop at schematic level using SPICE tools.

6. Design and simulation with the help of VHDL applying suitable modelling style (structural, behavioural, dataflow, mixed) for the following combinational circuits
a) Logic gates b) Full adder using half adder c) 4:1 MUX using 2:1 MUX

7. Design using VHDL for the following Sequential circuits
a) S-R Flip-Flop
b) 8-bit synchronous counter
c) 8 Bit bi-directional register with tri-stated input output

8. Familiarity with FPGA based system design and realization of 4:1 Mux using FPGA.

9. Design of CMOS differential amplifier with active load and biased with current mirror for given specification using SPICE tools at the level of schematic.

10. Innovative experiment.

CO-PO Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	2	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	3
CO5	3	3	3	3	3	-	-	-	2	-	-	2

CO-PSO Mapping

COs/Pos	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Control Systems Lab
Course Code: EC 692
Contacts: 0:0:3
Creditd:1.5

Course Outcome:

CO1	Able to familiarize with the Control System toolbox and Simulink using MATLAB/Scilab tools.
CO2	Determine Transient and Steady State behaviour of different types of systems using standard test signals using MATLAB/Scilab tools.
CO3	Able to determine the importance of gain, location of poles and zeros to design a system using MATLAB/Scilab tools
CO4	Able to check the stability of the systems using the concept of different stability criterion using MATLAB/Scilab tools.
CO5	Gain experience using modern software tools to design the systems according to the desired specifications or requirements using different types of controllers using MATLAB/Scilab tools.

List of Experiments:

SL. No.	Name of the Experiment	Periods
1.	Familiarization with MATLAB and Control System tool Box.	3
2.	Introduction to SIMULINK tool box.	3
3.	Determination of step response for 1^{st} order, 2^{nd} order & 3^{rd} order system with unity feedback & calculation of control system specifications (Evaluation of steady-state error, peak time, rise time, setting time, percentage peak overshoots) – using MATLAB programming and SIMULINK tool box.	3
4.	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB.	3
5.	Determination of root locus and effect of addition of poles and zeros to the systems.	3
6.	Determination of Bode-plot and computation of gain crossover frequency, phase cross over frequency, gain margin and phase margin using MATLAB.	3
7.	Study of closed loop stability using Nyquist plot and computation of gain crossover frequency, phase cross over frequency, gain margin and phase margin.	3
8.	Determination of PI, PD, and PID controller action on 1st order simulated process.	3
9.	Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin and phase margin with addition of lead compensator in forward path transfer function using MATLAB.	3
10	Study of position control system using servomotor	3
11.	Study Tuning of controller.	3
12	Project implementation of control system.	3

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: RF & Microwave Engineering Lab
Course Code: EC 693
Contacts: 0:0:3
Credits: 1.5

Course Outcome: After successful completion of this course, students should be able to:

CO1: Define, identify and list out special type transmission line, its characteristics in microwave frequencies and concept of load.

CO2: Categorize, arrange and implement suitably the various microwave passive devices with the utilization of engineering mathematics.

CO3: Analyze and use the various sources of microwave energy and the characters of its operation.

CO4: Use, and apply various hardware, software tools and measuring instruments in the field of Radio Frequencies.

CO5: Compute and solve, in the field of Radio Frequencies, for the betterment of communication engineering, medical science, various domestic and commercial engineering.

List of Experiments:

1. Determination of phase and group velocities in a waveguide carrying TE_{10} Wave from Dispersion diagram [$\omega-\beta$ Plot].

2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench

3. Study of the characteristics of a Reflex Klystron oscillator

4. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.

5. Measurement of coupling factor, Directivity, Insertion loss and Isolation of

a Directional coupler using X-band waveguide test bench setup.

6. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
7. Experimental/Simulation Study of filter (LPF, HPF, BPF) response.
8. Measuring of dielectric constant of a material using waveguide test bench at X-band.

Reference Books

1. ML Sisodia & GS Raghuvanshi Basic Microwave Techniques and Laboratory Manual; Wiley Eastern Limited 1987
2. EL Gintzton Microwave Measurements, McGraw-Hill Book Co.
3. M Sucher and J Fox, Handbook of Microwave Measurements, Vol I, Wiley-Interscience Inc.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Mobile Communication and Network Lab
Course Code: EC 694A
Contacts: 0:0:3
Credits: 1.5

Course Outcome:

Students will be able to:

CO1:	Understand the path Loss.
CO2:	Analyze the Horizontal & vertical Beam Pattern of a Base station Antenna.
CO3:	Understand the concept of co-channel interference and hence Signal to Interference and Noise Ratio.
CO4:	Understand the impact of many different parameters influence the downlink C/I ratio like Cell radios, Tx power of B.S, Frequency reuse, Sectoring, Shadowing effect, B.S. height, Path loss exponent, Vertical beam tilt.
CO5:	Study the effect of handover threshold and margin on SINR and call drop probability and handover probability.

List of experiments:

1. Calculation of received signal strength as a function of distance of separation, antenna height and carrier frequency.

2. To understand the impact of: -Transmitter Power, Pathloss exponent, Carrier frequency, Receiver antenna height, Transmitter antenna height.

3. To calculate pathloss exponent and variance of shadow fading from measurements and hence find the large-scale propagation's statistical characteristics.

4. To find the 3dB Bandwidth of a Base station Antenna.

5. To calculate the probability that the received signal level crosses a certain sensitivity level.

6. To understand the concept of co-channel interference and hence Signal to Interference and Noise Ratio:
Downlink:
To calculate & plot SINR vs. distance at the MS for adaptation of the following parameters: Shadowing effect, Vertical Beam Pattern, Tilt Angle variation.
Uplink:
To calculate & plot SINR vs. distance at the MS for adaptation of the following parameters: Shadowing effect, Vertical Beam Pattern, Tilt Angle variation.

7. To understand the cellular frequency reuse concept fulfilling the following objectives: Finding the co-channel cells for a particular cell, Finding the cell clusters within certain geographic area.

8. To study the effect of handover threshold and margin on SINR and call drop probability and handover probability

9. To study the outage probability, LCR & ADF in SISO for Selection Combining and MRC.

10. To study the effect of delay spread on frequency selectivity.

11. Evaluate (by computer simulations) and make analysis of the performance of various digital modulations as follows:

Task	Modulation Types	Channel Model	Analysis	Theoretical / Simulation	Points of Analysis
1	4.8.16.32.64 PSK	AWGN, Fading	BER vs. Eb/No for each channel	Both	The impact of different modulation rate
2	4.8.16.32.64 QAM	AWGN	BER vs. Eb/No	Both	The impact of different modulation rate
3	M-PSK vs. M-QAM	AWGN	BER vs. Eb/No	Both	The impact of different modulation type
4	8-QAM*	AWGN	BER vs. EB/No	Sim	The impact of different constellation

12. Design cellular FDMA/TDMA systems to achieve a certain grade of service in terms of coverage and blocking probability.

13. design cellular FDMA/TDMA systems to achieve a certain grade of service in terms of coverage and blocking probability.

14. Characterization of radio Attenuation by means of propagation Models.

CO-PSO Mapping:

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

Course Name: Advanced Microprocessor & Microcontroller Lab
Course Code: EC 694B
Contacts: 0:0:3
Credits: 1.5

Course Outcomes:

CO1: Understand the features, architecture of ARM7 and its applications.

CO2: Analyse and understand the instruction set and development tools of ARM

CO3: Get comprehensive knowledge on features, architecture, pin diagram, input-output configuration, the interrupts and timers of PIC microcontroller

CO4: Understand the significance of input-output device interface with PIC microcontroller.

CO5: Work on different projects making use of the ARM & PIC microcontroller

List of Experiments:

PIC based experiment

1.Familiarization of PIC kit.

2.Interface and control a LED, LCD, Keyboard, ADC & DAC using PIC.

3.Connect two PIC kit and transfer data serially.

4.Design a Digital watch based on PIC.

5.Control a stepper motor and display temperature from a temperature sensor on a LCD.

6. Pulse width modulation using CCP Module.

7. DC Motor control by PIC.

8. Read /Write into a internal EEPROM.

ARM based experiment

9.Familiarization with ARM evaluation system

10.Familiarization with Raspberry Pi

11.Interface and control a 8 Bit LED, Switch, Buzzer Relay and Stepper Motor, ADC and Temperature sensor LM 35.

12.Time delay program using built in Timer / Counter feature

13.I2C Interface – 7 Segment display & Serial EEPROM

14.Transmission from Kit and reception from PC using Serial Port

15.Generation of PWM Signal

16.Interfacing with a real time clock using a serial port to display time.

17.Interface a Keyboard and display the keystrokes on a LCD, LED.

18.Familiarization of image processing using ARM

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	3	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

Course Name: Python Programming Lab
Course Code: EC 694C
Contacts: 0:0:3
Credits: 1.5

Course Outcomes:

CO1: Able to apply Variable, Basic operators

CO2: Able to evaluate decision making & loops to solve problems.

CO3: Able to compile string, list, tuples, dictionary for data structure.

CO4: Able to write functions for recursive problems.

CO5: Able to apply packages in python

List of experiments

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton ‘s method)
3. Exponentiation (power of a number)
4. Fine the Fibonacci series using python dictionary
5. Check the palindrome number and string
6. Find the maximum of a list of numbers
7. Linear search and Binary search
8. Selection sort, Insertion sort
9. Merge sort
10. Find first n prime numbers
11. Multiply matrices with and without Numpy module
12. Find the most frequent words in a text read from a file
13. Write python program to store data in list and then try to print them
14. Write python program to do basic trim and slice on string.
15. Write python program to print list of numbers using range and for loop
16. Write python program in which a function is defined and calling that function prints Hello World
17. Write python program in which a function (with single string parameter) is defined and calling that function prints the string parameters given to function.
18. Read and write a csv file using Numpy module
19. Find matrix determinant using numpy module
20. Solve simultaneous equation
21. Solve quadratic equation
22. Visualize sinewave, square wave
23. Plot three exponential function with variable exponent and plot in a single figure with different color.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	-	-	-	3	-	-	3
CO2	3	3	3	3	3	-	-	-	3	-	-	3
CO3	3	3	3	2	3	-	-	-	3	-	-	2
CO4	3	3	3	2	3	-	-	-	3	-	-	3
CO5	3	3	3	2	3	-	-	-	3	-	-	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	2	2	-
CO2	2	2	-
CO3	2	2	-
CO4	2	2	-
CO5	2	2	-

Course Name: Object Oriented Programming using Java Lab
Course Code: EC 695A
Contacts: 0:0:3
Credit: 1.5

Pre requisites: Basic concepts to handle computers
Keyword familiarization
May be known how to write code.

Course Objective: The objective of the course is to
Enable students to use basic object oriented features in coding Enable students to develop small projects

Course Outcomes: After the completion of the course students will be able to
CO1: Apply object-oriented programming concepts in designing programs
CO2: Analyze different dimensions of a problem and provide optimal solutions.
CO3: Apply the advance features of JAVA in designing of projects
CO4: Apply I/O technique to read and write from file.
CO5: Apply swing and applet technique to create GUI.

List of Experiments:

MODULE I:
Writing simple java program, compiling and running.
Understanding the main () method.

MODULE II:
Using basic java token, control structures.

MODULE III:

Illustrating class objects, constructor, final, finalize. Understanding Arrays and hands on application using array. Understanding and writing methods.
Static and non-static concepts.

MODULE IV:
Class Relationship. Using
inheritance
Creating abstract classes, interfaces.

MODULE V:
String Handling

MODULE VI:
Illustrating exception handling Illustrating multi-threading applications.

MODULE VII:
Basic IO and File IO operation

MODULE VIII:
AWT and Swing applications

MODULE IX:
Applet programming.

CO –PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	3	-	-	3
CO2	2	2	3	2	-	-	-	-	3	-	-	3
CO3	3	3	3	2	-	-	-	-	3	-	-	3
CO4	3	3	3	2	-	-	-	-	3	-	-	3
CO5	3	3	3	2	-	-	-	-	3	-	-	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	2	2	-
CO2	2	2	-
CO3	2	2	-
CO4	2	2	-
CO5	2	2	-

Course Name: Computer Communication and Network Security
Lab Course Code:EC695B
Contacts: 0:0:3
Credits: 1.5

Course

Outcomes:

CO1: Understand details and functionality of layered network architecture underlying principles of computer networking.

CO2: Analyze the packet /file transmission between nodes and performance of various communication protocols.

CO3: Analyze and evaluate the network security needs of an organization

CO4: Determine and analyze vulnerabilities and security solutions to reduce the risk of exploitation.

List of Experiments:

Computer

Communication:

1.Connect the computers in Local Area Network.

2.Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP

Configuration). 3.Establish Peer to Peer network connection using two systems using Switch and

Router in a LAN.

4.Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.

5.Configure a Network topology using packet tracer

software. 6.Configure a Network topology using packet

tracer software.

7.Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Network Security:

9.Design and implementation of a simple client/server model and running application using sockets and TCP/IP.

10.Isolating WLAN Traffic using Separate Firewall for VPN

Connection 11.Create a Virtual Private Network (VPN) over WAN

12.Evaluate application response time in the presence and absence of a firewall.

13.Study of different wireless network components and features of any one of the Mobile 14.Security Apps. 14.Study of the features of firewall in providing network security and to set Firewall Security in windows.

15.Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome) 16.Study of different types of vulnerabilities for hacking a websites /Web Applications 17.Analysis the Security Vulnerabilities of E-commerce services

18.Analysis the security vulnerabilities of E-Mail Application

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**
CO2	**3**	**3**	**3**
CO3	**3**	**3**	**3**
CO4	**3**	**3**	**3**

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	1
CO2	2	2	2	2	2	-	-	-	3	-	-	3
CO3	2	2	2	2	2	-	-	-	3	-	-	3
CO4	3	3	3	3	3	-	-	-	3	-	-	3

Course Name: Artificial Intelligence and Robotics Lab
Course Code: EC 695C
Contacts: 0:0:3
Credit: 1.5

Prerequisites: Basic programming skill and knowledge of hardware

Course outcomes:

CO1: Able to analyse logical reasoning using Prolog.

CO2: Able to evaluate searching algorithm.

CO3: Able to create robotic arm.

CO4: Able to apply robots to solve practical problems.

List of Experiments:

AI part:

A. Using Prolog

- Familiarization of Prolog
- Study of facts, objects, predicates and variables in PROLOG.
- Study of Rules and Unification in PROLOG.
- Study of "cut" and "fail" predicate in PROLOG.
- Write a prolog program to maintain family tree.
- Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.

B. Using any programming language

- Write a program to solve the Tower of Hanoi problem.
- Write a program to solve 4-Queen problem.
- Write a program to solve 8-puzzle problem.
- Write a program to solve traveling salesman problem.
- Write a program to solve water jug problem
- Write a program to simulate breadth first search and depth first search
- Write a program to solve the Monkey Banana problem.
- Write a program to simulate hill climbing and simulated annealing

Robotics part:

- Demonstration of robot with 2 DOF, 3 DOF, 4 DOF
- Study and selection of Gripper.
- Programming exercise of robots for Pick and Place activity.
- Setting robot for any one industrial application
- Design of line follower and obstacle avoidance robot

Course Name: Technical Lecture Presentation & Group Discussion-I Course Code: MC 681
Contacts: 0:0:3
Credit: 0

Course Outcome:

CO1: Learn how to use non-verbal communication to create the impression of credibility and to feel confident.

CO2: Learn methods for organizing your thoughts and ideas into a compelling

presentation.

CO3: Demonstrate interpersonal skills by way of Group discussions in a healthy

environment

CO4: Develop confidence and life skills to handle engineering assignments

Course Content:

Technical Lecture Presentation

Note:
The concerned Course Coordinator will give/ assign/ approve the topic/ subject/ area of the information and data to be searched and prepared through websites, magazines, books etc.
A HAND WRITTEN or PRINTED report with PPT presentation in a specified format is to be submitted to the Course coordinator.

Criteria for Evaluating Presentations

Some of the criteria that might be used to assess presentations include:
a) Focus of the presentation
b) Clarity and coherence of the content
c) Thoroughness of the ideas presented and the analysis
d) Clarity of the presentation
e) Effective use of facts, statistics and details
f) Lack of grammatical and spelling errors
g) Design of the slides
h) Effective use of images
i) Clarity of voice projection and appropriate volume
j) Completion of the presentation within the allotted time frame

The following topics are the suggested topics:

1.Surveillance Camera Control
System 2.Biometric Voting Machine
3.Secure Symmetric Authentication For RFID
Tags 4.Plastic Solar cell technology
5.Wireless power Transmission
Technology 6.Sensor Technology
7.Nanotechnology in Electronics
8.Latest Technology in Embedded

System 9.System On chip Design
Challenges
10.Plastic Solar Cells: Implementation of Nanorod and Screen-Printing
Technology 11.Optical Computers (Future of Technology)
12.The Bio-Chip
Technology 13.Space Solar
Power

14.The evolution and implement of the "ARM" Architecture
15.Multi-core processors and its advantages
16.Haptic Technology
17.Next Generation Wireless Communication
18.Window Based Embedded System
19.Iris Recognition as A Biometric Technique
20.Speech Signal Analysis and speaker signal recognition by signal processing
21.Wireless Technologies
22.Weapon Detection System Using Digital Image Processing
23.Sniffer Mobile Phones
24.VLSI Logic Circuits Using a Silicon Transistor
25.Electronic Wireless Body Scanning System
26.Zigbee Wireless Mesh Networking
27.Accident Detection System using Mobile Phones
28.Internet Broad band over Electronic Lines
29.Electronic Based Satellite Communication System
30.How Night Vision Work Digital Image Processing
31.Diamond-The Ultimate Semiconductor
32.Ultra-Wide Band Technology Creating a Wireless World
33.Bluray and HD technologies
34.3G Mobile Communication Technology
35.Brain Finger Print Technology
36.Smart Antenna Technology
37.Smart Cord Security System
38.Zigbee Wireless Communication
39.WI-MAX Technology
40.Compressed Image Processing
41.Radio Frequency Identification
42.Satellite For Amateur Radio
43.3D integrated Circuits
44.Wireless Smart Cars in Embedded System
45.Wireless Optical Communication
46.Artificial Hand Using Embedded System
47.Embedded NDE With Piezo Electric Wafer Active Sensors In Aerospace Application
48.. ANY other relevant topic

Group Discussion

Note:
1. The concerned Course Coordinator will give/ assign/ approve the topic/ subject/ area of Group discussion for a group of 5 students (2 Groups)
2. The Course coordinator will give method and rules to carry out group discussion.
3. Time duration will be decided.
4. An additional faculty of the institute will be invited as Moderator/ Referee/Supervisor.
5. A HAND WRITTEN or PRINTED brief summary in a specified format is to be submitted to the course

coordinator.
6. Students will obtain signature of the Moderator on their report for this particular activity with hisremarks.

Criteria for Evaluating Group Discussion Performance

Some of the criteria that might be used to assess Group Discussion Performance include:
a) Knowledge of the Subject....
b) Listening. ...
c) Communication skills. ...
d) Body language and Appearance. ...

e) Leadership Skills.

The following topics are the suggested topics

1. Conscription should be made compulsory not a choice
2. Public relation of students through service to the society
3. Social responsibilities of students.
4. Polythene bags must be banned!
5. Do we really need smart cities?
6. E – Books or Printed books – what's your choice?
7. Will India really be the superpower of 21st century?
8. Managerial skills learnt in the classroom
9. Educated Indians lack national commitment.
10. E-Learning is good for the education system and society
11. Mobile phones - requirement of the day.
12. Compulsorily Rain water harvesting in Metro cities
13. Practice of safety in work environment.
14. Misuse of electric power.
15. Inter personal and public communication.
16. Misuse of mobile phones or electronic gadget.
17. Students lost in the internet forest. Is it advantageous?
18.Crisis in the Automobile Industry
19.Is Technology making us less human?
20.Data Localisation – Benefits & Challenges
21.How can we utilize technology to tackle Financial crimes?
22.Electric vehicles in India
23.Factors that contributed to the growth of MNCs
24.Are corporate jobs a new form of slavery?
25.75% attendance is too much for engineering students
26.Can Artificial intelligence replace Human intelligence?
27.The Future of Cryptocurrencies
28.NYAY – Can it eliminate poverty?
29.Black or Grey – Abstract GD Topic
30.Is India ready for 5G?
31.Open economy – Role of MNCs in India
32.Challenges in the IT industry
33.Innovation vs Invention – What is more important?
34.Impact of Technology on jobs
35.Industrial Revolution 4.0
36.Blockchain Technology – Pros & Cons
37.Will artificial intelligence take away jobs?
38.Use of Renewable energy in India
39.Impact of 'Internet of Things (IoT)' on our lives
40.Role of engineers in disaster management
41.Artificial intelligence – Pros and Cons
42.How can we deal with increasing Cyber Crimes?
43.Is India prepared enough to handle cyber attacks?
44.Is Technology rising Unemployment rates?
45.. ANY other relevant topic

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	3
CO2	3	3	3	3	3	-	-	-	3	-	-	3
CO3	3	3	3	3	3	-	-	-	3	-	-	3
CO4	3	3	3	3	3	-	-	-	3	-	-	3

CO-PSO Mapping

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	2
CO2	-	-	2
CO3	-	-	2
CO4		-	2
CO5	-	-	2

7th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	HS	HU 704	Principles of Management	2	0	0	2	2
2	PE	EC 701	A. Satellite & Optical Communication	3	0	0	3	3
			B. Digital Image & Video Processing					
			C. Remote Sensing & GIS					
3	OE	EC 702	A. Data Base Management Systems	3	0	0	3	3
			B. Machine Learning					
			C. Internet of Things (IOT)					
Total of Theory							**8**	**8**
B. PRACTICAL								
4	PE	EC 791	A. Satellite & Optical Communication Lab	0	0	3	3	1.5
			B. Digital Image & Video Processing Lab					
			C. Remote Sensing & GIS Lab					
5	OE	EC 792	A. Data Base Management Systems Lab	0	0	3	3	1.5
			B. Machine Learning Lab					
			C. Internet of Things (IOT) Lab					
6	PROJ	PR 791	Project-VII	0	0	0	6	3
7	PROJ*	PR 792	Innovative activities-VI	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
8	MC	MC 781	Technical Lecture Presentation & Group Discussion-II	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**23**	**14.5**

*Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head / Event Coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Principles of Management
Course Code: HU 704
Contact hour: 2:0:0
Total contact hour- 24
Credits: 2
Prerequisites: NIL

Course Objective:
To understand and apply management principles in to manufacturing organization.
To understand concepts of work study, method study, and Quality control method to improve performance of any organization.

Course outcome:
On completion of the course students will be able to
CO1: To recall and identify the relevance of management concepts.
CO2: To apply management techniques for meeting current and future management challenges faced by the organization
CO3: To compare the management theories and models critically to solve real life problems in an organisation.
CO4: To apply principles of management in order to execute the role as a manager in an organisation.

Course Content:
Module-1:
Management Concepts: Definition, roles, functions and importance of Management, Evolution of Management thought-contribution made by Taylor, Fayol, Gilbreth, Elton Mayo, McGregor, Maslow (4L)

Module - 2:
Planning and Control: Planning: Nature and importance of planning, -types of planning, Levels of planning - The Planning Process. –MBO,SWOT analysis,McKinsey's7S Approach. Organizing for decision making: Nature of organizing, span of control, Organizational structure line and staff authority. Basic control process -control as a feedback system – Feed Forward Control – Requirements for effective control – control (4L)

Module - 3:
Group dynamics: Types of groups, characteristics, objectives of Group Dynamics.
Leadership: Definition, styles & functions of leadership, qualities for good leadership, Theories of leadership (4L)

Module – 4:
Work Study and work measurement: Definition of work study, Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives,, Use of stopwatch procedure in making Time Study. Performance rating, allowances and its types. Calculation of Standard Time. Work sampling (4L)

Module - 5:
Marketing Management: Functions of Marketing, Product Planning and development, Promotional Strategy (2L)

Module - 6:
Quality management: Quality definition, Statistical quality control, acceptance sampling, Control Charts – Mean chart, range chart, cchart, pchart, np chart, Zero Defects, Quality circles, , Kaizen & Six Sigma , ISO -9000 Implementation steps, Total quality management (6L)

Text Books:
Essentials of Management, by Harold Kooritz& Heinz Weihrich TataMcGraw
Production and Operations Management-K.Aswathapa,K .ShridharaBhat,Himalayan Publishing House
References:
, Organizational Behavior, by Stephen Robbins Pearson Education, NewDelhi
New era Management, Daft, 11th Edition, CengageLearning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	-	3	2	3	3	3
CO2	3	3	3	3	3	2	-	3	2	3	3	3
CO3	3	3	3	3	3	2	-	3	2	3	3	3
CO4	3	3	3	3	3	2	-	3	2	3	3	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	2
CO3	-	-	2
CO4		-	2
CO5	-	-	2

Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearsonpublication Paper
Name: Satellite & Optical Communication Paper
Code: EC701A
Total Contact Hours: 36
Credit: 3

OBJECTIVES:
To study about the various optical fibre modes, configuration and transmission characteristics of optical fibbers
To learn about the various optical sources, detectors and transmission techniques To explore various idea about optical fibre measurements and various coupling techniques To enrich the knowledge about optical communication systems and networks
To Describe the electronic hardware systems associated with the satellite subsystem and earth station.
To Describe the various applications of satellite with the focus on national satellite system.
To Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.

Course Outcomes:

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes
			On completion of the course students will be able to
7th	Satellite & Optical Communication (EC701A)	CO. EC701A.1	Able to learn the dynamics of the satellite and the design of satellite links.
		CO. EC701A.2	Able to understand the communication satellite design and how analog and digital technologies are used for satellite communication networks.
		CO. EC701A.3	Apply the fundamental principles of optics and light wave to design optical fiber communication systems.
		CO. EC701A.4	Design optical fiber communication links using appropriate optical fibers light sources, detectors.
		CO. EC701A.5	Explore concept of designing and operating principles of modern optical systems and networks.

Course Content:

Module-I: Satellite Orbital Mechanics and Luncher (7L)

Origin of Satellite communication, Current state of satellite communication.

Orbital aspect of satellite communication: Orbital mechanism, equation of orbit, locating satellite in orbit, orbital elements, orbital perturbation, look angle, orbital period and velocity, azimuth and orbital inclination, coverage angle slant range, placement of satellite in geostationary orbit.

Space craft subsystem: Attitude and orbit control system, Telemetry tracking and command power system, and communication subsystem. 2L

Satellite link design:

Basic link analysis, interference analysis, attenuation due to rain, link with and without frequency reuse. System noise temperature and T / T ratio, down link design, domestic satellite system, uplink design, design of satellite link for specified (C / N). 1L

Satellite Subsystems:

Communication, telemetry, ranging & command, power, altitude control, tracking, antenna subsystems.

1L

Satellite transponder:

Transponder model, transponder channelization, frequency plans, processing transponders. 1L

Earth Station Technology:

Earth Station design; Earth station antenna, gain, pointing loss, G/T variation and it's measurement, antenna tracking, LNA, HPA, RF multiplexing, up converter, down converter, transponder hopping, polarization hopping, redundancy configuration, factors affecting orbit utilization, tracking, equipment for earth station. 2L

Module-II: Multiple Access Techniques (4L)

Frequency Division Multiple Accesses: SPADE, FDM-FM-FDMA, Companded FDM-FM-FDMA and SSB-AM-FDMA, inter modulation products in FDMA, optimized carrier-to-inter modulation plus noise ratio. Time division Multiple Access: Principle, TDMA frame structure, TDMA Burst structure, TDMA Super frame structure, Frame acquisition and synchronization. Satellite position determination. TDMA timing. Demand Assignment Multiple Access and Digital Speech interpolation. ERLANG B Formula. Type of demand assignment, DAMA characteristics, Real time frame reconfiguration, DAMA interfaces, SCPC-DAMA, Digital Speech interpolation. Satellite packet communication. 3L

Module-III Propagation on satellite (8L)

Earth's path – propagation effects, atmospheric absorption, Scintillation effects, Land and Sea multipath, Rain and ice effects, Rain drop distribution, calculation of attenuation. Rain effects on Antenna noise temperature. 3L

Encoding and forward error correction:

Error detection and correction, channel capacity, error detecting codes, linear block codes, error correction with linear block codes, performance of block error correction codes, convolution codes, cyclic codes, BCH and codes, error detection on satellite links. 2L

Introduction to VSAT systems:

Low earth orbit and non-geostationary satellite systems. Direct broadcast Television and Radio. Satellite Navigation and the global positioning system. Network configuration, multi access and networking, network error control poling VSAT network. 2L

Mobile satellite network:

Operating environment. MSAT network concept, CDMA MSAT relink. Worldwide timing by satellite relay. 1L

Module IV: Introduction to Optical Fibers (3L)

Introduction-general optical fibber communication system- basic optical laws and definitions, optical modes and configurations -mode analysis for optical propagation through fibbers modes in planar wave guide-modes in cylindrical optical fibber-transverse electric and transverse magnetic modes- fibber materials-fibber fabrication techniques-fibber optic cables classification of optical fiber-single mode fiber- graded index fiber

ModuleV: Transmission Characteristics of Optical Fibre (6L)

Attenuation-absorption–scattering, losses-bending, losses-core and cladding losses-signaldispersion– inter symbol interference and bandwidth-intra model dispersion-materialdispersion-waveguide dispersion-polarization mode dispersion-lintermodal dispersionoptimization of single mode fiber-characteristics of single mode fiber-R-I Profile cut-off wave length-dispersion calculation-mode field diameter.

ModuleVI: Optical Sources and Detectors (6L)

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures,surface emitting LED-Edge emitting LED-quantum efficiency and LED power-light sourcematerials modulation of

LED-LASER diodes-modes and threshold conditions-Rateequations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation temperature effort. Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects, comparisons of photo detectors.

Module VII: Optical Receiver, Measurements and Coupling (6L)

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Frontend amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit. Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibbers-Fiber Splicing, Optical Fiber connectors.

Text Books:

1) Timothy Pratt, Charles Bostian, Teremy Allnutt, Satellite Communication, John Wiley & Sons.
2) " Satellite Communication", D. C. Agrawal, Khanna Publishers
3) "Satellite Communication", Dennis Roddy , 4th Edition, McGraw- Hill International edition, 2006
4) MONOJIT MITRA : Satellite communications , Prentice Hall of India
5) P Chakrabarti, "Optical Fiber Communication, McGraw Hill Education (India)Private Limited, 2016 (Unit I, II,III)
6) Gred Keiser,"Optical Fiber Communication, McGraw Hill Education (India) Private Limited. Fifth Edition. Reprint 2013. (Unit I, IV, V)

Reference Books:

1) "Satellite Communication", T. T. Hai., Mc.Graw Hill Publications
2) Satellite Communication Systems Engineering, W. L. Pitchand, H. L. Suyderhoud,
R. A. Nelson, 2nd Ed., Pearson Education., 2007.
3) Satellite Communication, Mark R Chartrand, Cenage Learning
4) J. J. Spilker, Jr., Digital Communication by Satellite, Prentice Hall.
5) 4. Bruce R. Elbert, Satellite Communication Applications Hand Book, Artech House.
6) Optical Fiber Communications: Principles and practice, J Senior, Prentice Hall.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	-	-	2	1	3	2
CO2	3	3	3	3	3	2	-	-	2	1	3	2
CO3	3	3	3	2	3	2	-	-	2	1	3	2
CO4	3	3	3	3	3	2	-	-	2	1	3	3
CO5	3	3	3	2	3	2	-	-	2	1	3	2

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Subject Name: Digital Image & Video Processing Subject Code: EC 701B
Contact hour:
3:0:0 Total contact hour-
36 Credits: 3

Course Objective:

To become familiar with digital imagefundamentals, Transform of Digital Images and itsapplications, simple image enhancement techniques in both spatial and frequency domain.To become familiar with image compression, recognition, restoration segmentation and representationtechniques.To study the Edge detection & Security in Digital ImageProcessing. To become familiar with basic steps of Video Processing. To become familiar with 2D motion Estimation of Objects in Video Processing.

Course Outcome:

CO1: Identify the structure of human eye, image formation , Brightness, sensing, acquisition, storage, Communication, Sampling, quantization, spectrum analysis using image Enhancement, image transformations, Histogram processing both in the Spatial and Frequency Domain.

CO2: Elaborate image compression, recognition, restoration, segmentation and representation techniques with the help of DCT,wavelet, inverse filtering,watershed algorithms applicable to the Spatial and Frequency Domain.

CO3: Explain the importance of Edge detection and security using morphological operation, security, encryption techniques in the scope of mathematical interpretation.

CO4: Develop the basic steps of Video Processing using data compression, redundancy, 3D motion , sampling, filtering for realtime and offline applications

CO5: Estimate optical flow in 2D motion of objects both in still image and Video based using block matching, mesh based, region based, multiresolution motion algorithm applicable to computer vision.

Course Content:

Module I: 5L

Digital Imaging Fundamentals: Basic idea of Digital image, Image formation in human eye, Pixel, Mathematical operation of Digital Image, Sampling, Quantization, application of digital Image Processing.
Transform of Digital Images: Importance of Digital Image Transform, Fourier Transform of Digital Image (DFT), Inverse Fourier Transform (IDFT), Fast Fourier Transform, Inverse Fast Fourier Transform, Application of Digital Image Transform in different area

Module II: 8L

Digital Image Enhancement: Importance of Digital Image enhancement, enhancement in spatial and frequency domain, Bit plane slicing, Histogram, Histogram Equalization, Mean and Median filtering in Digital Images, Frequency domain filtering in Digital Images – LPF, HPF and BPF
Digital Image Compression: Importance of Digital Image Compression, Types of Image Compression, example of lossless and lossy compression, Image compression standards, Compression in spatial domain, compression using Huffman coding, DCT and Wavelet based Digital image compression.

Module III: 5L

Digital Image Restoration: Application and Importance of Digital Image Restoration, Reason for Image degradation, Inverse filtering.

Segmentation of Digital Images: Importance and applications of Digital Image Segmentation, Detection ofdiscontinuities, Edge linking and Boundary detection, Thresholding, Segmentation based on Region Growing, Watershed algorithm.

Module IV: 5L

Edge detection in Digital Image Processing: Importance of Edge detection in Digital Image Processing, Types of Edge Detection, Mathematical Equation of each operator. Security in Digital Image Processing: Importance of Digital Image Security, Watermarking, Image encryption in spatial and frequency domain, Steganography.

Module V: 6L

Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations.

Module VI: 7L

2-D Motion Estimation: Optical flow, general methodologies, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TEXT BOOK:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education,2010.
2. S. Annadurai, R. Shanmugalakshmi, “Fundamentals of Digital Image Processing”, Pearson Education,2006
3. Digital Video processing, A Murat Tekalp, Prentice Hall
4. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang,Pearson Education

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd.,2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, “Digital Image Processing”, John Willey,2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition,
PHI Learning Pvt. Ltd.,2011.

Handbook of Image and Video processing”, Al Bovik, Academic press, second Edition

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	-	-	2	1	3	3
CO2	3	3	3	3	3	2	-	-	2	1	3	3
CO3	3	3	3	2	3	2	-	-	2	1	3	3
CO4	3	3	3	3	3	2	-	-	2	1	3	3
CO5	3	3	3	2	3	2	-	-	2	1	3	3

CO-PSO Mapping

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Remote Sensing &
GIS Course Code: EC701C
Contacts: 3:0:0
Total Contact Hours:
36 Credit: 3

Course Objectives:
The objectives of this course are:
i) To build the knowledge and understanding of propagation of radio wave.
ii) To acquire knowledge regarding principles of remote sensing and remote sensing systems.
iii) Develop knowledge on conversion of data from analogue to digital and working with GIS software. iv)To enable students to know about spatial and temporal thinking on Remote Sensing.

Course Outcomes:
CO1. Able to recognize the principles of aerial and satellite remote sensing. CO2. Able to understand the basic concept of GIS and its applications.
CO3. Able to know different types of data representation in GIS. CO4. Able to develop models for GIS spatial Analysis
CO5. Able to apply knowledge of GIS software and able to work with GIS software in various application fields.
CO6. Apply basic procedures of digital image processing for RS image enhancement analysis. Pre-Requisite: Analog & Digital Communication
Course Content

Module I: 4
Basic Radio propagation mechanism: Short distance & long distance propagation cases. Free space Propagation models. Diffraction, Reflection and Scattering.

Module II: 8
Concept of Remote Sensing: Remote Sensing, Data, Sources of Energy, Interaction withAtmosphere and Target, Recording of Energy, Application of Remote Sensing, Types of RemoteSensing, Sensors and Cameras: Optical and infrared detectorsand filters, Optical and infrared cameras; Microwave and Millimeter wave radiometers; Scanning systems, Mechanical and Electronic systems; Scatter meter; Altimeter.

Module III: 6
Variation of the earth's reflectivity with angle ofincidence, wavelength and geographical location; Seasonal variation of reflectivity; Solar radiation reflected from the earth; Absorption of solar radiation by the earth; Thermal radiation from the earth; Thermal radiation from the atmospheric constituents; Thermal emission from cloud, rain, snow and fog; Radio noise and interference at satellite heights.

Module IV: 10
Radar Imaging GPS: Requirement of Ground Truth Data, Parameters of Ground Truthing Atmospheric Condition, Surface Water, Factors of Special Measurement—Sun Angle, Aerosol, Haze, Water Vapor. Interpretation of Sensing Data: Photo-interpretation, image and pattern recognition; Spectral interpretation of remote sensing imagery; Interpretation of thermal maps; Color coding and enhancement; Computer interpretation of images.
Module V: 11

Remote Sensing of Atmosphere and Sea State: Passiveand active remote sensing; Side Looking Airborne Radar (SLAR); Synthetic Aperture Radar (SAR); Along Track Scanning Radiometer (ATSR), Laboratory measurements of remote sensing parameters; Tropical rainfall measurements; Microwave sensing of sea surface.

Text Books:

1. R.P.Gupta 1990: Remote Sensing Geology. Springer
2. J.R. VerlagJensen, 2000: Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall.
3. Anji Reddy,M. 2004: Geoinformatics for Environmental Management.B.S. Publications

Reference Books:

1.Jensen. 2000:Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall.
2. Joseph George, 2003: Fundamentals of Remote Sensing. Universities
Press. 3.Satellite Communication, D. C. Agarwal, and Khanna publisher.

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**
CO2	**3**	**3**	**3**
CO3	**3**	**3**	**3**
CO4	**3**	**3**	**3**
CO5	**3**	**3**	**3**
CO6	**3**	**3**	**3**

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
7th	Remote Sensing & GIS (EC 701C)	CO1									3		3	
		CO2						2		3	3		3	3
		CO3	3								2		3	3
		CO4						2			3		3	
		CO5		2		2				2	3		3	
		CO6	3					3				2		

Course Name: DATABASE MANAGEMENT SYSTEM
Course Code: EC702A
Contacts: 3:0:0
Total Contact Hours: 36
Credit: 3

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. To learn the data models, conceptualize and depict a database system
2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. To understand the internal storage structures using different file and indexing techniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure.

Course Outcomes

1. Apply the knowledge of Entity Relationship (E-R) diagram for an application.
2. Create a normalized relational database model
3. Analyze real world queries to generate reports from it.
4. Determine whether the transaction satisfies the ACID properties.
5. Create and maintain the database of an organization.

Module 1:
Introduction [3L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:
Entity-Relationship and Relational Database Model [11L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

Module 3:
SQL and Integrity Constraints [6L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module 4:
Relational Database Design [8L]
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF , Case Study

Module 5:

Internals of RDBMS [9L]

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.

Module 6:

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text Books:

Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.GrawHill.

ElmasriRamez and NovatheShamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.

Ramakrishnan: Database Management System ,McGraw-Hill

Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan KauffmanPublishers.

Ullman JD., "Principles of Database Systems", GalgottiaPublication.

Reference:

Jain: Advanced Database Management SystemCyberTech

Date C. J., "Introduction to Database Management", Vol. I, II, III, AddisonWesley.

"Fundamentals of Database Systems", RamezElmasri, ShamkantB.Navathe, Addison Wesley PublishingEdition

"Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	2	3	-	-	-	-	-	-	-	2
CO3	3	3	3	2	-	-	-	-	2	-	-	3
CO4	3	2	2	3	-	-	-	-	2	-	-	2
CO5	3	2	3	2	-	-	-	-	2	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	2	2
CO3	3	2	2
CO4	3	2	2
CO5	2	3	2

Course name: Machine Learning
Course Code: EC 702B
Contacts: 3:0:0
Total contacts: 36
Credits: 3

Prerequisite:
Knowledge of basic computer science principles and skills
Familiarity with the basic probability theory
Familiarity with the basic linear algebra

Course objectives:
By the end of the course, students should be able to:

- Develop an appreciation for what is involved in learning models from data.
- Understand a wide variety of learning algorithms.
- Understand how to evaluate models generated from data.
- Apply the algorithms to a real-world problem

Course outcomes:

CO1: Able to apply regression, classification, dimensionality reduction, clustering based on requirement of problem to achieve minimum error in prediction.

CO2: Able to infer the importance of feature selection and extraction depending on quality of application upto more than available maximum performance.

CO3: Able to use k-means, hierarchial clustering, gausian estimation to achieve silhouette index on the basis of performance of prediction.

CO4: Able to develop suitable model based on application upto achievable minimization of performance error.

CO5: 1. Able to develop algorithm depending on prediction of real time happening upto 95% prediction accuracy.

Course Content:

Module-I (Introduction) [2L]
overview of machine learning, related areas, software tools,concept of supervised, unsupervised learning,

Module-II (Regression) [6L]
Linear regression in one variable, multiple variables, least square method, SSE, gradient descent, over fitting, under fitting and just fit in terms of bias and variance.

Module-III (Dimensionality reduction) [6L]
Feature selection: Concept of regularization, filter method, wrapper method. Feature extraction: PCA, LDA

Module-IV (Classifier) [8L]
Logistic regression (binary classification), Decision trees, Naïve Bayes Classifier, KNN, SVM.

Module-V (Clustering) [6L]
K-Means, Hierarchical clustering, Gaussian mixture density estimation, Cluster validation index

(silhouette).

Module-VI (ANN) [8L]

Compare Biological Neurons and Artificial neurons, model of neuron-activation function, McCulloch- Pitts model, Feed forward & Feedback network, Single layer perception, implementation of logical AND & OR, Multilayer perception, implementation of XOR, Back propagation algorithm, importance of training, test and validation data.

Text books:

Pattern recognition and machine learning by Christopher M. Bishop, Springer

Understanding Machine Learning by Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press

Pattern Classification by Richard O Duda, Peter E. Hart & David G. Stock, John Wiley.

Pattern Recognition by Konstantinos Koutroumbas, SergiosTheodoridis, Elsevier

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	2	3	-	-	-	-	-	-	-	2
CO3	3	3	3	2	-	-	-	-	2	-	-	3
CO4	3	2	2	3	-	-	-	-	2	-	-	2
CO5	3	2	3	2	-	-	-	-	2	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	2
CO4	3	3	3
CO5	2	3	2

Course Name: Internet of Things (IoT)
Course Code: EC702C
Contacts: 3:0:0
Total Contact Hours: 36
Credit:3

Prerequisite: Sensors, System Integration Cloud and Network Security

Course Outcome:
After learning the course, the student will be able:
CO1: Understand internet of Things and its hardware and software components
CO2: Interface I/O devices, sensors & communication modules
CO3: Remotely monitor data and control devices
CO4: Develop real life IoT based projects

Course Content:
Module 1: Introduction to IoT (9 L)
Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

Module 2. Elements of IoT (9 L)
Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Module 3: IoT Application Development (12 L)
Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

Module 4. IoT Case Studies (6 L)
IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

TEXTBOOKS AND REFERENCE BOOKS
1.Vijay Madisetti, Arshdeep Bahga, İnternet of Things, "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	2	3	-	-	-	-	-	-	-	2
CO3	3	3	3	2	-	-	-	-	2	-	-	3
CO4	3	2	2	3	-	-	-	-	2	-	-	2
CO5	3	2	3	2	-	-	-	-	2	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	2
CO4	3	3	3
CO5	2	3	2

Course Name: Satellite & Optical CommunicationLab
Course Code: EC791A
Contacts: 0:0:3
Credit: 1.5

Course outcome:

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes
			On completion of the course students will be able to
7th	Satellite & Optical Communication (EC701A)	CO. EC701A.1	Able to learn the dynamics of the satellite and the design of satellite links.
		CO. EC701A.2	Able to understand the communication satellite design and how analog and digital technologies are used for satellite communication networks.
		CO. EC701A.3	Apply the fundamental principles of optics and light wave to design optical fiber communication systems.
		CO. EC701A.4	Design optical fiber communication links using appropriate optical fibers light sources, detectors.
		CO. EC701A.5	Explore concept of designing and operating principles of modern optical systems and networks.

Lab Experiments:

Satellite Communication: Any Four
1. To Study Satellite Trainer kit.
2. To set up an active satellite link and demonstrate link fail operation.
3. To communicate voice signal through satellite link.
4. To establish analog /digital Communication link and transmit and receive three Signals (audio, video, tone) simultaneously using satellite communication trainer.
5. To transmit and receive PC data through satellite link.
6. To find the link C/N Ratio
7. Evaluation of SNR in Satellite Links
8. To observe effect of Fading margin of received signal in satellite link
9. To Study Analysis of Link Power Budget Equation.

Optical Communication: Any Four
Demonstration and study of different types of Optical Fibers.
To Establish analog link using optical fiber cable
To Establish Digital link using optical fiber cable
To measure propagation or attenuation loss in optical fiber.
To Study Bending Loss in fiber optic communication
To Measure The Numerical Aperture (N.A.) Of The Fiber Optic Cable.
Demonstration and study of different types of Optical fiber connectors.
To implement Frequency Modulation technique with fiber optic
To implement Pulse Width Modulation technique with fiber optic
Setting up of Fiber Optics voice link using Intensity Modulation

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	3	-	-	3
CO2	3	3	2	3	2	-	-	-	3	-	-	2
CO3	3	3	3	2	2	-	-	-	3	-	-	2
CO4	3	2	2	3	2	-	-	-	3	-	-	2
CO5	3	2	3	2	2	-	-	-	3	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	2
CO4	3	3	3
CO5	2	3	2

Course Name: Digital Image & Video Processing Lab
Course Code: EC 791B
Contacts: 0:0:3
Credit: 1.5

Course Objective:

To become familiar with digital image fundamentals, Transform of Digital Images and its applications, simple image enhancement techniques in both spatial and frequency domain.
To become familiar with image compression, recognition, restoration segmentation and representation techniques.
To study the Edge detection & Security in Digital Image Processing.
To become familiar with basic steps of Video Processing
To become familiar with 2D motion Estimation of Objects in Video Processing

Course Outcome:

Sem No.	Course Title	CO Codes	Course Outcomes
7th	Digital Image & Video Processing Lab (EC 791B)	EC791B.1	Have a clear idea on digital image fundamentals, Transform of Digital Images and its applications, simple image enhancement techniques in both spatial and frequency domain
		EC791B.2	Understanding the importance of image compression, recognition, restoration segmentation and representation techniques.
		EC791B.3	Explaining the Edge detection & Security in Digital Image Processing
		EC791B.4	Demonstrate the basic steps of Video Processing
		EC791B.5	Familiarize with 2D motion Estimation of Objects in Video Processing

List of Experiments:
Convert RGB Digital Images into Grayscale Images and showresult.
Transform a grayscale image into frequency domain and show its magnitude and phase angle.
Display histogram of a digital image and equalized theimage.
Apply LPF and HPF in a Grayscale Digital Image and displayresult.
Apply Mean and Median filtering in a Grayscale Digital Image and displayresult.
Compress and reconstruct a Grayscale Digital Images in spatialdomain.
Compress and reconstruct a Grayscale Digital Image in frequencydomain.
Apply segmentation technique (any one) in a Digital Image and displayresult.
Apply Edge detection technique in a Digital Image and displayresult.
Apply any cryptography or watermarking technique for image encryption anddisplay result.
Experiment on Frequency domain motion estimation
Experiment on Kernel based tracking
Experiment on video short boundary detection
Innovative experiment

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	3
CO2	3	3	2	3	3	-	-	-	3	-	-	2
CO3	3	3	3	2	3	-	-	-	3	-	-	2
CO4	3	2	2	3	3	-	-	-	3	-	-	2
CO5	3	2	3	2	3	-	-	-	3	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	2
CO4	3	3	3
CO5	2	3	2

Course Name: Remote sensing and GIS Lab
Course Code: EC 791C
Contacts: 0:0:3
Credit: 1.5

Prerequisite:
The candidates should have the basic experimental knowledge of wave propagation & antenna.

Course Outcome:
After successful completion of this course, students should be able to:
CO1: understand the basic fundamentals of remote sensing and GIS.
CO2: demonstrate the practical applications of remote sensing and GIS.
CO3: learn different types of remote sensors and GIS components and their characteristics.

List of Experiments:
Study of aerial photos and satellite image to demonstrate elements and techniques of visual interpretation
Study of satellite image annotation, Demarcation of contours & watershed using top sheets
Study of Remote sensing applications on geo-science: features extractions from remote sensing data, image interpretation and analysis
Study of Remote sensing applications on agriculture or forestry: features extractions from remote sensing data, interpretation and analysis
Study of understanding of spectral response pattern of different landforms.
Familiarization with GIS softwares, Geo-referencing & Projection
Spatial data entry, editing & topology creation, linking spatial & non-spatial data entry
One innovative experiment to demonstrate importance of remote sensing and GIS in emergency situations like natural disaster

Course Name: DATABASE MANAGEMENT SYSTEM LAB
Course Code: EC 792A
Contact: 0:0:3
Credits: 1.5

Prerequisite:
Logic of programming language
Basic concepts of data structure and algorithms

Course Objectives
To learn the data models, conceptualize and depict a database system
To learn the fundamental concepts of SQL queries.
To understand the concept of designing a database with the necessary attributes.
To know the methodology of Accessing, Modifying and Updating data & information from the relational databases
To learn database design as well as to design user interface and how to connect with database.

Course Outcome(s)
On completion of the course students will be able to
CO1: Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database

facilities including concurrency control, backup and recovery.
CO2: Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.
CO3: Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.
CO4: Analyze database system concepts and apply normalization to the database.
CO5: Apply and create different transaction processing and concurrency control applications.

Experiment Details:
Structured Query Language
Creating Database Creating a Database
Creating a Table Specifying Relational Data Types Specifying Constraints Creating Indexes
Table and Record Handling INSERT statement
Using SELECT and INSERT together DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements
Retrieving Data from a Database The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using Aggregate Functions
Combining Tables Using JOINS Sub-queries
Database Management Creating Views
Creating Column Aliases Creating Database Users Using GRANT and REVOKE
PL/SQL
Database design using E-R model and Normalization
Design and implementation of some on line system [Library Management System]

Text Book:
SQL, PL/SQL by Ivan Bayross, BPB Publications
Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	3
CO2	3	3	2	3	3	-	-	-	3	-	-	2
CO3	3	3	3	2	3	-	-	-	3	-	-	2
CO4	3	2	2	3	3	-	-	-	3	-	-	2
CO5	3	2	3	2	3	-	-	-	3	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	-	2	2
CO2	-	2	2
CO3	3	2	2
CO4	-	2	2

CO5	2	2	2

Paper name: Machine Learning Lab
Code: EC 792B
Contact: 0:0:3
Credits: 1.5

Prerequisites:
Basic programming knowledge and algorithm

Course outcomes:
Able to analyse different learning techniques.
Able to evaluateimportant features from data.
Able to apply classify &cluster data.
Able to evaluate models generated from data.

List of Experiments:
To perform the following experiments it is recommended to get the data from the open source UCI Machine Learning Repository.
Link: https://archive.ics.uci.edu/ml/index.php
Take a suitable dataset and study the linear regression with one variable and multiple variable.
Study the effect of bias and variance in linear regression.
Take a suitable dataset and select the good features using filter and wrapper method.
Take a suitable dataset and extract the features using PCA and LDA
Take a suitable dataset and design a classifier using
Logistic regression
Decision trees
Naïve Bayes Classifier
KNN
SVM
Take a suitable dataset and cluster the data using
K-means
Hierarchical clustering
In a given dataset, estimate the number of possible clusters using Silhouette method
Take a suitable dataset, design ANN based classifier and study the followings:
effect of single layer, multilayer
effect of number of nodes in a layer

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	3
CO2	3	3	2	3	2	-	-	-	3	-	-	2
CO3	3	3	3	2	3	-	-	-	3	-	-	2
CO4	3	2	2	3	3	-	-	-	3	-	-	2
CO5	3	2	3	2	3	-	-	-	3	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	-	3	3
CO2	-	3	3
CO3	-	3	2
CO4	-	3	3
CO5	-	3	2

Course Name: Internet of Things (IoT) Lab
Course Code: EC792C
Contacts: 0:0:3
Credit:1.5

Prerequisite: Sensors, System Integration Cloud and Network Security

Course Outcome:
After learning the course, the student will be able:
CO1: Understand internet of Things and its hardware and software components
CO2: Interface I/O devices, sensors & communication modules
CO3: Remotely monitor data and control devices
CO4: Develop real life IoT based projects

List of Experiments:
1. Define and Explain Eclipse IoT Project.
2. List and summarize few Eclipse IoT Projects.
3. Sketch the architecture of IoT Toolkit and explain each entity in brief.
4. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.
5.Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
6. Describe gateway-as-a-service deployment in IoT toolkit.
7. Explain application framework and embedded software agents for IoT toolkit.
8. Explain working of Raspberry Pi. Connect Raspberry Pi with your existing system components.
9. Give overview of Zetta.
10. Design based Problems (DP)/Open Ended Problem: 1. How do you connect and display your Raspberry Pi on a Monitor Or TV? 2. Create any circuitry project using Arduino.

Major Equipment: Raspberry pi, Arduino

List of Open Source Software/learning website:

- https://github.com/connectIOT/iottoolkit
- https://www.arduino.cc/
- http://www.zettajs.org/
- Contiki (Open source IoT operating system)
- Arduino (open source IoT project)
- IoT Toolkit (smart object API gateway service reference implementation)
- Zetta (Based on Node.js, Zetta can create IoT servers that link to various devices and sensors)

11. Case Study: Intelligent Traffic systems (case study), Smart Parking (case study), Smart water management (case study), Any other innovative experiment

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	3	-	-	3
CO2	3	3	2	3	2	-	-	-	3	-	-	2
CO3	3	3	3	2	2	-	-	-	3	-	-	2
CO4	3	2	2	3	2	-	-	-	3	-	-	2
CO5	3	2	3	2	2	-	-	-	3	-	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	2
CO4	3	3	3
CO5	2	3	2

Course Name: Technical Lecture Presentation & GD II
Course Code: MC 781
Contacts: 0:0:3
Total Contact Hours: 36
Credit: 0

Prerequisite:
English language proficiency, Slide design technique

Course Outcome:
CO1: Understand the importance of a clear purpose and organization in effective presentations.
CO2: Develop techniques for analyzing audiences and adapting presentationsaccordingly.
CO3: Gain experience in working collaboratively and constructively with peers to produce quality work in a timely fashion
CO4:Practice and strengthen your skills in developing and delivering persuasive arguments in a professional setting.
CO5:Gain confidence in both verbal and nonverbal skills of extemporaneous speech delivery and able Participate in a group discussion

Course Content:
Module I
General Introduction: 8L
Aims of course. Evaluation procedure. Overview of Oral Presentations: Importance of oral presentations. Types of oral presentations. Considerations when preparing an oral presentation - audience, purpose, organization. Introductory-Presentation: Experiencing the problems of talking in front of people. Introductory-Presentation: Understanding body language

Module II
Presentation Delivery: 12L
Presentation delivery approaches, Importance of visual aids and problems with using slides , Designing effective slides (PowerPoint tutorial) , Speed, stress, intonation, and pronunciation

Overview of Presentation, Topic of general interest, General design and format for Presentation.
Guidelines for preparing presentations and completing evaluation reports.
Case Study:
Presentation 1–Topic of general interest in science and engineering (5-10 minute presentation + 2 minute question/answer session)
Presentation 2 - Topic of general interest in science and engineering (5-10 minute presentation + 2 minute question/answer session).
Discussions and Feedback

Module III 8L

Language of presentations:
Explaining the title, outline, and summary. Explaining the background, problem, materials, methods, and processes. Explaining and discussing data in the form of figures and tables. Understanding and answering questions from the audience

Module IV 8L

Group Discussion:Introduction, Outlook of Company/Company's Perspective, Aspects of constituting of group debate

How to engage efficiently in group discussions, Tips to participate successfully in a work selection discussion group, preparing for an interview, Appearing for an interview
Suggested Link:
https://www.youtube.com/watch?v=lQrj_7xkeNI
https://www.youtube.com/watch?v=GmWC6RsSsqM
https://www.youtube.com/watch?v=HKw8tZHw0vc
https://homes.cs.washington.edu/~mernst/advice/giving-talk.html
https://www.ssim.ac.in/blog/how-to-prepare-for-group-discussion/

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	2
CO3	-	-	-	-	-	-	-	-	3	3	-	2
CO4	-	-	-	-	-	-	-	-	3	3	-	2
CO5	-	-	-	-	-	-	-	-	3	3	-	3

CO-PSO Mapping:

COs/PSOs	PSO1	PSO2	PSO3
CO1	-	-	2
CO2	-	-	2
CO3	-	-	2
CO4	-	-	2
CO5	-	-	2

8th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	PE	EC 801	A. Adaptive Signal Processing	3	0	0	3	3
			B. Wireless Sensor Network					
			C. Embedded System					
2	OE	EC 802	A. Cloud Computing	3	0	0	3	3
			B. Data Science					
			C. Block Chain					
3	OE	EC 803	A. Biomedical Electronics & Imaging	3	0	0	3	3
			B. Automotive Electronics					
			C. Physical Design, Verification & Testing					
Total of Theory							**9**	**9**
B. PRACTICAL								
4	PE	EC 891	A. Adaptive Signal Processing Lab	0	0	3	3	1.5
			B. Wireless Sensor Network Lab					
			C. Embedded System Lab					
5	PROJ	PR 891	Project-VIII	0	0	0	6	3
C. MANDATORY ACTIVITIES / COURSES								
6	MC	MC 801	Essence of Indian Knowledge Tradition	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**21**	**13.5**

Course Name: Adaptive Signal Processing
Course Code: EC 801A
Contacts: 3:0:0
Total contact hours: 36
Credit: 3

Prerequisite: Discrete and continuous signals and systems, and introductory linear algebra.

Course Outcomes:
After completion of the course, the student is able to
CO1: Comprehend design criteria and modelling adaptive systems and theoretical Performance evaluation.
CO2: Design a linear adaptive processor.
CO3: Apply mathematical models for error performance, stability adaptive modelling systems for real time applications
CO4: Comprehend the estimation theory for linear systems and modelling algorithms.
CO5: Design based on Kalman filtering and extended Kalman filtering.

Course Content:
Module 1: Adaptive Filter and Applications
Adaptive Systems - Definition and characteristics – Properties, Correlation matrix, Applications and examples of an adaptive system- Adaptive Modelingand System Identification, Inverse Adaptive Modeling, Adaptive Interference Cancelling, telecommunications adaptive equalization, Adaptive Arrays and Adaptive Beam-Forming.

Module 2: Wiener Filter
Wiener filters - Linear optimum filtering - Minimum mean-square error - Wiener- Hopf equations - Multiple linear regression model - Steepest-descent algorithm - Linear prediction - Forward linear prediction, Levinson-Durbin algorithm.

Module 3: LMS and RLS algorithm
Least-Mean-Square (LMS) adaptive filters - LMS algorithm, LMS adaptation algorithm, method of steepest descent and its convergence criteria, LMS versions: normalized LMS, leaky, sign, variable step size, transform domain LMS algorithm using DFT and DCT. Block LMS (BLMS) algorithm: frequency domain BLMS (FBLMS),Method of Least Squares - Normal equations and linear least square filters, Recursive least squares (RLS) algorithm.

Module 4: Lattice Filters
Forward Linear Prediction, Backward Linear Prediction, Prediction Error Filters, derivation of the Lattice Structure, All-pole Lattice Structure, Pole-Zero Lattice Structure, Adaptive Lattice Structure, Autoregressive modelling.

Module 5: Kalman Filtering
Statement of Kalman Filtering Problem, Estimation of State Using Innovation, Variance of Kalman Filtering, Extended Kalman Filtering.

TEXTBOOKS

Simon Haykin, “Adaptive Filter Theory”, Pearson Education, Fifth Edition, 2013.
Bernard Widrow and Samuel. D. Stearns, “Adaptive Signal Processing”, Pearson Education, 2001

REFERENCE BOOKS

Farhang-BoroujenyB.,"Adaptive Filters Theory and Applications", John Wiley & Sons, 1st Ed.,1998.
John. R. Triechler, C. Richard Johnson (Jr), Michael. G. Larimore, “Theory and Design of Adaptive Filters”, Prentice Hall India Private Limited, 2004
Ali H. Sayed,"Fundamentals of Adaptive Filtering", Wiley, 1st Ed., 2003.
Todd K. Moon, Wynn C. Stirling, “Mathematical Methods and Algorithms for Signal Processing” Prentice Hall, First edition, 1999.

CO-PO mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	3	3	-	-	-	-	2	-	-	2
CO3	3	3	3	3	-	-	-	-	2	-	-	3
CO4	3	3	3	3	-	-	-	-	2	-	-	3
CO5	3	3	3	3	-	-	-	-	2	-	-	2

CO-PSO mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Wireless Sensor Network
Course Code: EC 801B
Contacts: 3:0:0
Total contact hours: 36
Credit: 3

Course Outcome:
After successful completion of this course, students should be able to:
CO1: Understand the fundamentals of wireless sensor networks and its application.
CO2: Study the various protocols at various layers and its differences with traditional protocols.
CO3: Realize the issues pertaining to sensor networks and the challenges.

Prerequisite:
The candidates should have the basic knowledge of communication and networks.

Course Content:

Module I [6L]
Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

Module II [8L]
Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

Module III [8L]
MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

Module IV [8L]
Routing Protocols: Issues in designing a routing protocol, classification of necessary routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical and power aware routing protocols

Module V [6L]
QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

Reference Books
C. Siva Ram Murthy&B. S. Manoj, "AdHoc Wireless networks ", Pearson Education
Feng Zhao and LeonidesGuibas, "Wireless sensor networks ", Elsevier publication
Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition
William Stallings, "Wireless Communications and Networks ", Pearson Education

CO-PSO mapping

COs/POs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC801B.1	3	1	2	3	2	1	2	3	2	1	1	1
EC801B.2	3	2	1	2	3	3	2	1	2	1	2	2
EC801B.3	2	3	2	3	2	1	1	2	3	2	1	1

Course Name: Embedded system
Course Code: EC 801C
Contacts: 3:0:0
Total Contact: 36
Credits: 3

Prerequisite: Digital Electronics, Microprocessor & Microcontroller, Programming Concept & Concept of Communication

Course Outcome:
CO1: Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO2: Become aware of the architecture of the embedded processors
CO3: Become aware of interrupts, peripherals and Different types of Communication protocols.
CO4: Design real time embedded systems using the concepts of RTOS.

Course Content:

Module I: Introduction (4L)
Basics of Embedded computer Systems, Microprocessor and Microcontroller difference, Hardware architecture and software components of embedded system List of various applications [Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc.], Difference between embedded computer systems and general-purpose computer Systems. Characteristics of embedded systems, Classifications of embedded system. Design challenge -optimizing design metrics, Processor technology (General-purpose processors, Single-purpose processors, Application-specific processors), IC technology (Full-custom/VLSI, Semi-custom ASIC, PLD), Design Technology (Compilation/Synthesis, Libraries/IP, Test/Verification), Tradeoffs- Design productivity gap.

Module II: Hardware Software Co- Design: (6L)
Co-Design Types: Microprocessors/Microcontrollers/DSP based Design, FPGA / ASIC /pSOC based Design, Hybrid Design. Methodology: i) System specifications ii) co-specifications of hardware and software) iii) System Design Languages (capturing the specification in a single Description) iv) System modeling /simulation v) Partitioning (optimizing hardware/software partition) vi) Co-verification (simulation interaction between custom hardware and processor) vii) Co-implementation viii) Embedded Systems Design development cycle. Programming concepts and embedded programming in C.

Module III: Custom Single-purpose processors: Hardware (6L)
Combinational Logic (Transistors and logic gates, Basic combinational logic design, RT-level combinational components), Sequential logic (Flip-flops, RT-level sequential components, Sequential logic design), Custom single-purpose processor design, RT-level custom single-purpose processor design, Optimizing custom single-purpose processors (Optimizing the original program, FSMD, data path, FSM)

Module IV: General-purpose processors: Software (6L)
Basic architecture (Datapath, Control unit, Memory), Operation (Instruction execution, Piplelining, Superscalar and VLIW architectures), Programmer's view (Instruction set, Program and data memory space, Registers, I/O, Interrupts, Operating Systems), Development environment (Design flow and tools, Testing and debugging), ASIP's-Application-specific instruction-set processors (Microcontrollers, Digital signal processors, Less-general ASIP environments), General-purpose processor design

Module V: Standard single-purpose processors: Peripherals (5L)
Timers, counters, and watchdog timers, UART, Pulse width modulator, LCD controller, Keypad controller, Stepper motor controller, ADC, DAC, Real-time clocks, Memory (RAM-SRAM, , PSRAM, NVRAM; DRAM-FPM DRAM,EDO DRAM,RDRAM, S&ESDRAM; ROM-EPROM & EEPROM; Flash memory, Cache memory & MMU)

Module VI: Interfacing (5L)
Communication basics (Basic terminology, Basic protocol concepts), Microprocessor interfacing (IO port Interfacing, Interrupt & DMA), Arbitration (Priority arbiter, Daisy-chain arbitration, Networked-oriented arbitration methods), Multi-level bus architectures, Parallel Communication, Serial Communication & Wireless Communication, Serial Protocols (I2C bus, CAN bus, FireWire bus, USB), Parallel protocols (PCI bus, ARM bus), Wireless protocols (IrDA, Bluetooth, IEEE 802.11)

Module VII: Real Time Operating System (RTOS) (4L)
Introduction, Types, Process Management, Memory Management, Interrupt in RTOS, Task scheduling, Basic design using RTOS; Basic idea of Hardware and Software testing in Embedded Systems

Text Books:
Frank Vahid and Tony Givargis, 'Embedded System Design: A Unified Hardware/Software Introduction', John Wiley & Sons
K. Shibu, "Introduction to Embedded Systems", TMH
Embedded Systems - Raj Kamal

Reference books:
Jack Ganssle, "Art of Designing Embedded Systems", Newnes Pub.
Embedded system Design: Peter Marwedel, Springer

CO-PSO mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC801C.1	3	3	2	-	1	-	-	-	1	1	-	1
EC801C.2	3	2	2	-	-	-	-	1	2	1	-	1
EC801C.3	3	2	1	2	1	1	-	-	2	1	-	-
EC801C.4	3	2	2	1	1	1	-	1	2	1	0	1

Course Name: Cloud Computing
Course Code: EC802A
Contact: 3:0:0
Credits: 3
Lectures: 36

Prerequisites:
Should have the basic knowledge of Operating Systems and Virtualization Technologies
Should aware of the fundamental concepts of Networking
Should have knowledge of heterogeneous systems and resource management.

Course Outcome:

CO1: Articulate the business model concepts, architecture and infrastructure of cloudcomputing, including cloud service models and deployment models.
CO2: Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
CO3: Explore some important cloud computing driven commercial systems such asGoogle Apps, Microsoft Azure and Amazon Web Services and other businesses cloudapplications.
CO4: Analyze the core issues of cloud computing such as security, privacy,interoperability, and its impact on cloud application.

Course Content:
Module 1: Definition of Cloud Computing and its Basics [9L]
1. Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models –Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing [4]
2. Cloud Architecture: Cloud Infrastructure, Architecture of each component, Virtualization versus Traditional Approach, and Virtualization Model for Cloud Computing. [2]
3. Services and Applications by Type[3]
IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos
PaaS – Basic concept, tools and development environment with examples
SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Module 2: Use of Platforms in Cloud Computing [6L]
1. Concepts of Abstraction and Virtualization [2]
Virtualization technologies: Types of virtualization, Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing; Classification of Virtualization Environment: Scheduling-based Environment, Load-Distribution-Based Environment, Energy Aware-Based Environment, Operational-Based Environment, Distributed Pattern-Based Environment, Transactional-Based Environment
2. Mention of The Google Cloud as an example of use of load balancing Hypervisors: [2]
Virtual machine technology and types, VMware vSphere Machine imaging (including mention of Open Virtualization Format – OVF)
Porting of applications in the Cloud: The simple Cloud API and App Zero Virtual Application appliance
3. Concepts of Platform as a Service [2]

Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com andForce.com), Application development. Use of PaaS Application frameworks

Module 3: Cloud Service Models [6L]
1. Use of Google Web Services [2L]
Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Ad words, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief),major features of Google App Engine service.
2. Use of Amazon Web Services [2L]
Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon Simple DB and Relational Database Service
3. Use of Microsoft Cloud Services [2L]
Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4: Cloud Infrastructure [10L]
Types of services required in implementation – Consulting, Configuration, Customization and Support
1. Cloud Management [3L]
An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack –an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)
2. Live Migration of Virtual Machines: [2L]
Need of Live Migration of Virtual Machine, A Designing Process of Live Migration, and Security Issues during live migration
3. Concepts of Cloud Security [3L]
Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security, Identity and Access Management
4. Auditing and Compliance in Cloud Environment: [2L]
Data Security in Cloud Computing Environment, Need for Auditing in Cloud Computing Environment, Third Party Service Provider, Cloud Auditing Outsourcing Lifecycle Phases, Auditing Classification.

Module 5 : Concepts of Services and Applications [5L]
1. Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs [1]
2. Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs [2]
3. Cloud-based Storage: Cloud storage definition – Manned and Unmanned. [1]
4. Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows LiveHotmail, Yahoo mail, concepts of Syndication services [1]

Text Books:
1.MasteringCloudComputingbyRajkumarBuyya,ChristianVecchiola,S.ThamaraiSelvi,McGrawHill Education (India)PrivateLimited,2013
2. Fundamentals of Cloud Computing by P. K. Pattnaik, S. Pal, M. R. Kabat, Vikas Publications, 2014.

Reference Books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd,2013
Cloud computing: A practical approach, Anthony T.Velte, TataMcgraw-Hill

CO-PO mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	3	3	-	-	-	-	2	-	-	2
CO3	3	3	3	3	-	-	-	-	2	-	-	2
CO4	3	3	3	3	-	-	-	-	2	-	-	2
CO5	3	3	3	3	-	-	-	-	2	-	-	2

CO-PSO mapping

COs/POs	PSO1	PSO2	PSO3
CO1	-	3	3
CO2	-	3	3
CO3	-	3	3
CO4	-	3	3
CO5	-	3	3

-

Course Name: Data Science
Course Code: EC802B
Contacts: 3:0:0
Total Contact Hours: 36
Credit: 3

PRE-REQUISITES: Introduction to Programming, Probability

Course Outcome:

CO1:	Describe the basic and intermediate concepts of probability, statistics, and distributions.
CO2:	Able to Apply regression, ANOVA, and goodness of fit test to construct model and infer conclusions about population/sample.
CO3:	Able to Analyze hypothesis to accept/reject alternative hypothesis based on statistical evidence available.
CO4:	Able tolearn Programming Tools for Data Science
CO5:	Solve real-world machine learning tasks from data to inference

Course Content:

Module-I : 10L

Introduction to Data Science: Concept of Data Science, Sample, Population, Measures of Central Tendency: Mean, median, mode, Range, Inter Quartile range, Cumulative frequency distribution,Traits of Big data, Web Scraping, Analysis vs Reporting.

Introduction to Programming Tools for Data Science

Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Panda.

Tabular and Graphical Descriptive Techniques,: Bar Charts, Line Charts, Scatter plots

Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction

Module II: Statistics for data science 16L

Measures of Dispersion: Meaning, Quartile deviation, Standard Deviation, Variance, Moments, Skewness, Kurtois, Numerical Problem

Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, Binomial, Poisson, Normal Distribution, The Central Limit Theorem, Standard error, Numerical Problem

Correlation and Regression: Bivariate Data, Correlation, Covariance, Correlation coefficient, Regression, Numerical Problem

Hypothesis and Inference: Hypothesis Testing, Inference about a population, Confidence Intervals,

Theory of Test of significance, z-statistics and z score, t- statistics, Degrees of Freedom, Type I & Type II error, P- values, Chi square test, Bayesian Inference, Numerical Problem

Module-III: 6L

Machine Learning : Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks- Learning And Generalization, Overview of Deep Learning.

Module IV: 4L

Case Studies of Data Science Application (Any four)

Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis. Image visibility improvement through statistical model.

LIST OF SUGGESTED BOOKS

1. N.G. Das “Statistical Methods”,Mc Graw Hill
2. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
3. Jain V.K., “Data Sciences”, Khanna Publishing House, Delhi.
4. Jain V.K., “Big Data and Hadoop”, Khanna Publishing House, Delhi.
5. Jeeva Jose, “Machine Learning”, Khanna Publishing House, Delhi.
6. Chopra Rajiv, “Machine Learning”, Khanna Publishing House, Delhi.
7. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press

http://www.deeplearningbook.org

CO-PSO Mapping:

	PSO1	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**
CO2	**3**	**3**	**3**
CO3	**3**	**3**	**3**
CO4	**3**	**3**	**3**
CO5	**3**	**3**	**3**

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	-	-	1	2	1	1	1
CO2	3	3	3	3	1	-	-	1	2	1	1	3
CO3	3	3	3	2	1	-	-	1	2	1	1	3
CO4	3	3	3	1	1	-	-	1	2	1	1	3
CO5	3	3	3	2	1	-	-	1	2	1	1	2

Course Name: Block Chain
Course Code: EC802C
Contacts: 3:0:0
Total Contact Hours: 36
Credit: 3

PRE-REQUISITES: Cryptography Techniques, Data Structures and Algorithms, Introduction to Programming

OBJECTIVES:
The objective of this course is to provide conceptual understanding of how block chain technology can be used to innovate and improve business processes.
The course covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions using block Chain technology.

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Understand block chain technology.
CO2: Develop block chain based solutions and write smart contract using Hyper ledger Fabric and Ethereum frameworks.
CO3: Build and deploy block chain application for on premise and cloud based architecture.
CO4: Integrate ideas from various domains and implement them using block chain technology in different perspectives.

COURSE CONTENT:
Module I: Introduction (6 L)
Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

Module I: Understanding Block chain with Crypto currency (9 L)
Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Module III: Understanding Block chain for Enterprises (12 L)
Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain-Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems. Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain

Module IV: Block chain application development (9 L)
Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

BOOKS:
1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015
2. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming"
3. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
4. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
5. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing
6. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018

CO-PSO Mapping:

	PSO1	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**
CO2	**3**	**3**	**3**
CO3	**3**	**3**	**3**
CO4	**3**	**3**	**3**

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**3**	**1**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**1**
CO2	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**3**
CO3	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**3**
CO4	**3**	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**3**

Course Name: Biomedical Electronics and Imaging
Course Code: EC803A
Contacts: 3:0:0
Total Contact Hours: 36
Credit:3

Pre-requisite:
Concepts in Analog Electronics (Studied in Basic Electronics Engineering).
Fundamental concepts on mathematics.
Concepts in Digital signal Processing

Course Objectives:
To familiarize the students with concepts related to medical electronics and imaging.
To understand medical measurement systems and system modelling.
To understand time domain and frequency domain analysis of real time biomedical signals like ECG, EEG etc.
To understand the different medical imaging techniques like CT Scan, PET, ultrasound and understand the different types of data acquisition electrodes and amplifiers.

Course Outcomes:

EC704B.1	Explain Bioelectric signals, human physiological system and different types of transducers.
EC704B.2	Understand different types of medical measurement system.
EC704B.3	Able to understand deferent types of biomedical signal acquisition electrodes and different types of signal amplification techniques and able to design the amplifiers.
EC704B.4	Able to examine the data handling, filtering techniques of bio-medical signals and able to analysis of time and frequency domain.
EC704B.5	Able to understand medical imaging techniques and implement different algorithms to feature extract the signals.

Course Content:
Module I: Introduction of Medical Electronics:
Origins of Bioelectric signals, Electrocardiogram (ECG), Electromyogram (EMG), Recording Electrodes- Silver-silver Electrodes, Electrodes for ECG, EEG and EMG, Physiological Transducers- Pressure Transducers, Temperature sensors, Pulse sensors; Sources of bioelectric potential, resting potential, action potential, propagation of action potentials in nerves, Rhythmic excitation of heart. [6L]

Module II: Medical Measurement systems:
Specifications of instruments, static & dynamic characteristics, classification of errors, statistical analysis. Introduction to reliability, accuracy, fidelity, speed of response, linearization of technique, data acquisition system. Detection of physiological parameters using impedance techniques: Impedance and current distribution, bipolar and tetra polar circuits, skin impedance, galvanic skin response measurement, total body impedance, cardiac output, neural activity, respiratory activity, impedance plethysmography - resistance and capacitance type.[8L]

Module III: Bio-amplifier and Bio-potential electrodes
Need for bio-amplifier -single ended bio-amplifier, differential bio-amplifier –right leg driven ECG amplifier. Band passes filtering, isolation amplifiers –transformer and optical isolation -isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference. Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, impedance, polarization effects of electrode Non-polarizable electrodes. Types of electrodes -surface, needle and micro electrodes and their equivalent circuits. Recording problems -measurement with two electrodes. [8L]

Module IV: Medical Signal Processing
Biomedical signal origin & dynamics (ECG), Biomedical signal origin & dynamics(EEG, EMG etc.), Filtering for Removal of artifacts Statistical Preliminaries; Time domain filtering (Synchronized Averaging, Moving Average) Illustrations of problem with case studies Morphological Analysis of ECG Correlation coefficient The Minimum phase correspondent and Signal Length. [8L]

Module V: Medical Imaging Techniques
CT scan, ultrasound, NMR and PET, Experiments are based on acquisition of biomedical signals, Implementation of algorithms covered in the course to characterize these signals. [6L]

Books:
Wavelets and Time frequency methods for Biomedical signal Processing- M. Akay, IEEE Press,
Digital Processing of speech signals- L. Rabinar, Pearson Education
Biomedical Instrumentation and Measurements-Cromwell, Weibell and Pfeiffer, PHI

CO-PO mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	2
CO2	3	3	3	3	-	-	-	-	2	-	-	2
CO3	3	3	3	3	-	-	-	-	2	-	-	2
CO4	3	3	3	3	-	-	-	-	2	-	-	2
CO5	3	3	3	3	-	-	-	-	2	-	-	2

CO-PSO mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Automotive Electronics
Course Code: EC 803B
Contacts: 3:0:0
Total contact hours: 36
Credit: 3

Course Outcomes
After successfully completing the course students will be able to:
Co1: Obtain an overview of automotive components, subsystems, design cycles, communication protocols and safety systems employed in today's automotive industry
CO2: Interface automotive sensors and actuators with microcontrollers
CO3: Develop, simulate and integrate control algorithms for ECU switch hardware

Module 1: Automotive Systems, Design Cycle and Automotive Industry Overview [10L]
Overview of Automotive Industry: Leading players, automotive supply chain, Global challenges, Role of technology in Automotive Electronics and interdisciplinary design, Tools and processes.
Introduction to Modern Automotive Systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles. Spark and Compression Ignition Engines: Ignition systems, Fuel delivery systems, Engine control functions, Fuel control, Electronic systems in engines.
Vehicle Braking Fundamentals: Vehicle dynamics during braking, Hydraulic brake system components, Introduction to antilock braking systems.
Steering Control: Steering system basics, Fundamentals of electronically controlled power steering, electronically controlled hydraulic systems and electric power steering systems, Passenger safety and convenience, Occupant protection systems, Tire pressure monitoring systems.

Module 2: Automotive Sensors and Actuators [10L]
Examples of Sensors: Accelerometers, Wheel speed, Brake pressure, Seat occupancy, Engine speed, Steering wheel angle, Vehicle speed, Throttle position, Turbine speed, Temperature, Mass air flow(MAF) rate, Exhaust gas oxygen concentration, Throttle plate angular position, Crankshaft angular position /RPM, Manifold Absolute Pressure (MAP), Differential exhaust gas pressure and Air bag sensors.
Examples of Actuators: Relays, Solenoids and motors. Chassis control systems and Automatic transmission control systems.

Module 3: Communication protocols [8L]
Communication protocols: Overview of automotive communication protocols, CAN, LIN, Flex Ray, MOST, Ethernet,D2B and DSI, Communication interface with ECUs, Interfacing techniques and Interfacing with infotainment gadgets, Relevance of Protocols such as TCP / IP for automotive applications, Wireless LAN standards such as Bluetooth, IEEE 802.11x communication protocols for automotive applications.

Module 4: Safety Systems in Automobiles and Diagnostic Systems [8L]
Active Safety Systems: ABS, TCS, ESP, Brake assist, etc. Passive Safety Systems: Airbag systems, Advanced Driver Assistance Systems (ADAS): Combining computer vision techniques as pattern recognition, feature extraction, learning, tracking, 3D vision, etc. to develop real-time algorithms able to assist the driving activity. Examples of Assistance Applications: Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles.

Module4: Safety Systems in Automobiles and Diagnostic Systems [8L]
Active Safety Systems: ABS, TCS, ESP, Brake assist, etc. Passive Safety Systems: Airbag systems, Advanced Driver Assistance Systems (ADAS): Combining computer vision techniques as pattern recognition, feature extraction, learning, tracking, 3D vision, etc. to develop real-time algorithms able to assist the driving activity. Examples of Assistance Applications: Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles.

Functional Safety: Need for safety systems, Safety concept, Safety process for product life cycle, Safety by design, Validation Diagnostics: Fundamentals of Diagnostics, Basic wiring system and multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system

Text Books:

1. Williams. B. Ribbens: "UnderstandingAutomotiveElectronics",6thEdition, Elsevier Science, Newnes Publication, 2003.
2. Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.

Reference books:

1. Ronald K Jurgen: "AutomotiveElectronicsHandbook",2nd Edition, McGraw-Hill,1999. James D. Halderman: "Automotive Electricity and Electronics", PHI Publication.
2. Terence Rybak & Mark Stefika: "Automotive Electromagnetic Compatibility (EMC)", Springer, 2004.
3. Allan Bonnick: "Automotive Computer Controlled Systems, Diagnostic Tools and Techniques", Elsevier Science, 2001

CO-PSO Mapping

COs/POs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC803B.1	3	1	2	3	2	1	2	3	2	1	1	1
EC803B.2	3	2	1	2	3	3	2	1	2	1	2	2
EC803B.3	2	3	2	3	2	1	1	2	3	2	1	1

Course Name: Physical Design, Verification & Testing
Course Code: EC 803C
Contact: 3:0:0
Total contact Hours: 36
Credit: 3

Pre-requisites: Digital Design, Concept of Algorithm

Course Objective: This course covers introduction to the concepts and techniques of VLSI (Very Large Scale Integration) design verification and testing. Details of test economy, fault modeling and simulation, defects, Automatic Test Pattern Generation (ATPG), design for testability, and built-in self-test (BIST) also covered.

Course Outcome (CO):

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes
			On completion of the course students will be able to
8th	Physical Design, Verification & Testing (EC 803C)	EC 803C.1	Design, Verification and Test a VLSI circuit pertaining to these three phases.
		EC 803C.2	Understand the important problems/algorithms/tools so that students get a comprehensive idea of the whole digital VLSI design flow
		EC 803C.3	Understand High level Synthesis, Verilog RTL Design, Combinational and Sequential Synthesis Logic Synthesis (for large circuits) through VLSI Design
		EC 803C.4	Analyze Hardware Verification and methodologies, Binary Decision Diagrams (BDDs) and algorithms over BDDs through Verification Techniques.
		EC 803C.5	Analyze Fault models, Fault Simulation, Test generation for combinational circuits, Test generation algorithms for sequential circuits and Built in Self test through VLSI Testing. .

Course Content:
Module I: ASIC & FPGA
Introduction to Application specific Integrated circuits (ASICs) &Classification of ASIC, Classification of ASIC in details (Full & Semi Custom ASIC), Classification of PLD in details & design of logic circuits using PLDs (PAL, PLA, PROM), Circuit realization using FPGA, Programming method of FPGA.

Module II: Physical Design Automation
Partitioning (K-L Algorithm), Floor Planning (Technology File, Circuit Description, Design, Constraints, Design Planning, Pad Placement, Power Planning, Macro Placement, Clock Planning), Placement-Global & Detailed Placement (Min Cut Algorithm & Simulated Annealing). Routing-Special, Global & Detailed Routing (Wire length estimation algorithms).

Module III: Fault Modeling & simulation
Different types of Faults in ASIC Design, Classification of Fault Models, Faults detection and Redundancy of Combinational & Sequential Circuits (Single and multiple Stuck at Fault model, Rauth's Algorithm or D-Algorithm), Fault Simulation: Serial, Parallel, Deductive & Concurrent Fault Simulation.

Module IV: Testing
Test Generation: Boundary Scan Test (BST), Built-In-Self-Test (BIST) technique, Automatic Test Pattern Generation (ATPG), Design for Testability (DFT).

Books:
D. D. Gajski, N. D. Dutt, A.C.-H. Wu and S.Y.-L. Lin, High-Level Synthesis: Introduction to Chip and System Design, Springer, 1st edition, 1992.
S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Prentice Hall, 2nd edition, 2003.
G. De Micheli. Synthesis and optimization of digital circuits, 1st edition, 4. 1994.
M. Huth and M. Ryan, Logic in Computer Science modeling and reasoning about systems, Cambridge University Press, 2nd Edition, 2004.
Bushnell and Agrawal, Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits, Kluwer Academic Publishers, 2000.

CO-PO mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	2	-	-	3
CO2	3	3	3	3	-	-	-	-	2	-	-	3
CO3	3	3	3	3	-	-	-	-	2	-	-	3
CO4	3	3	3	3	-	-	-	-	2	-	-	3
CO5	3	3	3	3	-	-	-	-	2	-	-	3

CO-PSO mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Adaptive Signal Processing
Course Code: EC 891A
Contacts: 0:0:3
Credit: 1.5

Prerequisite: Discrete and continuous signals and systems, and introductory linear algebra.

Course Outcomes:
After completion of the course, the student is able to
CO1: Comprehend design criteria and modelling adaptive systems and theoretical Performance evaluation.
CO2: Design a linear adaptive processor.
CO3: Apply mathematical models for error performance, stability adaptive modelling systems for real time applications
CO4: Comprehend the estimation theory for linear systems and modelling algorithms.
CO5: Design based on Kalman filtering and extended Kalman filtering.

Name of the experiments:

1. Implementation of LMS algorithm using MATLAB
2. Implementation of RLS algorithm using MATLAB
3. Implementation of unknown system identification using MATLAB
4. Implementation of channel equalisation using MATLAB
5. Implementation of Adaptive Line Enhancer using MATLAB
6. Implementation of noise cancellation using MATLAB
7. Implementation of lattice filter using MATLAB
8. Implementation of Kalman filter using MATLAB
9. Implementation of any other application of adaptive filter using MATLAB
10. Implementation of adaptive algorithms in DSP hardware kit
11. Any other innovative experiment

TEXTBOOKS

1. Simon Haykin, “Adaptive Filter Theory”, Pearson Education, Fifth Edition, 2013.
2. Bernard Widrow and Samuel. D. Stearns, “Adaptive Signal Processing”, Pearson Education, 2001

REFERENCE BOOKS

1. Farhang-BoroujenyB.,"Adaptive Filters Theory and Applications", John Wiley & Sons, 1st Ed.,1998.
2. John. R. Triechler, C. Richard Johnson (Jr), Michael. G. Larimore, “Theory and Design of Adaptive Filters”, Prentice Hall India Private Limited, 2004
3. Ali H. Sayed,"Fundamentals of Adaptive Filtering", Wiley, 1st Ed., 2003.
4. Todd K. Moon, Wynn C. Stirling, “Mathematical Methods and Algorithms for Signal Processing” Prentice Hall, First edition, 1999.

CO-PO mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	3	-	-	2
CO2	3	3	3	3	3	-	-	-	2	-	-	2
CO3	3	3	3	3	3	-	-	-	3	-	-	2
CO4	3	3	3	3	3	-	-	-	3	-	-	2
CO5	3	3	3	3	3	-	-	-	3	-	-	2

CO-PSO mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Wireless Sensor Network Lab
Course Code: EC 891B
Contacts: 0:0:3
Credit: 1.5

Prerequisite:
The candidates should have the basic knowledge of communication and network.

Course Outcome:
After successful completion of this course, students should be able to:
CO1: Analyze the parameters associated with wireless sensor networks in simulated environment.

CO2: Learn different types of wireless topologies and routing protocols.

CO3: Demonstrate an application of wireless sensor network through simulation.

List of Experiments:

1. Introduction and installation of wireless sensor network simulator.
2. Introduction to syntax, looping, conditional check, functions, execution of mathematical operations and execution in network simulator.
3. To study nodes creation, traffic flows, queuing disciplines and result analysis in sensor network simulator.

4. To simulate a wireless sensor topology of multiple nodes.
5. To analyze the performance of various routing protocols in a simulated environment.
6. To scan vulnerabilities in wireless sensor networks.
7. To perform an innovative experiment featuring an important application of wireless sensor network during natural disaster.

CO-PSO mapping

COs/POs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC891B.1	3	3	3	3	3	-	-	-	3	-	-	2
EC891B.2	3	3	3	3	3	-	-	-	2	-	-	2
EC891B.3	3	3	3	3	3	-	-	-	3	-	-	2

Course Name: Embedded system Lab
Course Code: EC 891C
Contacts: 0:0:3
Credits: 1.5

Course Outcome:
CO1: Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO2: Become aware of the architecture of the embedded processors
CO3: Become aware of interrupts, peripherals and Different types of Communication protocols.
CO4: Design real time embedded systems using the concepts of RTOS.

Prerequisite: Digital Electronics, Microprocessor & Microcontroller, Programming Concept & Concept of Communication

List of the Experiments:

I: FPGA based experiment
a) Design a 3 to 8 decoder circuit.
b) Design a 8:1 MUX
c) Design an UP/DOWN counters and displays the count on a 7-segment display.
d) Designing an ALU and verify with mathematical operations.
e) Innovative Project.

I: Microcontroller based experiment
a) Serial port programming
b) Interfacing of Stepper motor
c) Interfacing of Temperature sensor and Relay control
d) Interrupts programming examples
e) Innovative Project

III: DSP Processor based experiment
a) Computation of N- Point DFT of a Given Sequence
b) Implementation of FFT of Given Sequence
c) Implementation of LP FIR & IIR Filter for Given Sequence & Implementation of HP FIR Filter for Given Sequence
d) Generation of Sinusoidal Signal Through Filtering
e) Generation of DTMF Signals
f) Implementation of Decimation Process & Interpolation Process
g) Impulse Response of First Order and Second Order Systems
h) Audio Applications
i) Noise removal: Add noise above 3kHz and then remove ; Interference Suppression using 400 Hz Tone

Text Books:

1. Frank Vahid and Tony Givargis, 'Embedded System Design: A Unified Hardware/Software Introduction', John Wiley & Sons
2. K. Shibu, "Introduction to Embedded Systems", TMH
3. Embedded Systems - Raj Kamal

Reference books:

1. Jack Ganssle, "Art of Designing Embedded Systems", Newnes Pub.
2. Embedded system Design: Peter Marwedel, Springer

CO-PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC801C.1	3	3	3	3	3	-	-	-	3	-	-	2
EC801C.2	3	3	3	3	3	-	-	-	2	-	-	2
EC801C.3	3	3	3	3	3	-	-	-	3	-	-	2
EC801C.4	3	3	3	3	3	-	-	-	3	-	-	2

Course Name: Essence of Indian Knowledge Tradition Course
Code: MC 801
Total Contact Hours: 3h /Week Non-
Credit Mandatory Course

Course Objectives:
The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system

Course Outcomes:
At the end of the Course, Student will be able to:
CO 1: Identify the concept of Traditional knowledge and its importance.
CO 2: Explain the connection between Modern Science and Indian Knowledge System.
CO 3: Understand the importance of Yoga for health care.
CO 4: Interpret the effect of traditional knowledge on environment.

Course Content:
UNIT-I: Basic structure of Indian Knowledge System
Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

UNIT-2: Modern Science and Indian Knowledge System
Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT-3: Yoga and Holistic Health care
Yoga for positive health, prevention of stress related health problems and rehabilitation, Integral approach of Yoga Therapy to common ailments.

UNIT-4: Traditional Knowledge and Environment
Traditional knowledge and engineering, Traditional medicine system, Importance of conservation and sustainable development of environment, Management of biodiversity

Books:

- V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
- Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
- Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
- Fritzof Capra, The Wave of life
- VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
- Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata

CO-PO mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	3	3	-	-	-	2
CO2	-	-	-	-	-	-	3	3	-	-	-	2
CO3	-	-	-	-	-	-	3	3	-	-	-	2
CO4	-	-	-	-	-	-	3	3	-	-	-	2
CO5	-	-	-	-	-	-	3	3	-	-	-	2

CO-PSO mapping

COs/POs	PSO1	PSO2	PSO3
CO1	-	-	3
CO2	-	-	2
CO3	-	-	2
CO4	-	-	2
CO5	-	-	2