Revised Curriculum Structure
(to be effective from 2018-19 admission batch)

Department: Applied Electronics & Instrumentation Engineering

Curriculum for B. Tech
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								
10	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**	**24.0**

* 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	PC	EI 301	Analog Electronic Circuits	3	0	0	3	3
3	PC	EI 302	Digital Electronic Circuits	3	0	0	3	3
4	ES	EI 303	Circuit Theory and Networks	3	1	0	4	4
5	PC	EI 304	Electrical & Electronic Measurement & Instrumentation	3	0	0	3	3
Total of Theory							**17**	**17**
B. PRACTICAL								
6	PC	EI 391	Analog Electronic Circuits Lab	0	0	3	3	1.5
7	PC	EI 392	Digital Electronic Circuits Lab	0	0	3	3	1.5
8	ES	EI 393	Circuits Theory and Networks Lab	0	0	3	3	1.5
9	PC	EI394	Electrical & Electronic Measurement & Instrumentation 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	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC 381	MC	Behavioral & Interpersonal skills	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**35**	**24.5**

*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.

4 TH SEMESTER								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	PH 401	Physics – II	3	0	0	3	3
2	PC	EI 401	Sensors and Transducers	3	0	0	3	3
3	PC	EI 402	Microprocessors and Microcontrollers	3	0	0	3	3
4	PC	EI403	Digital Signal Processing	3	0	0	3	3
5	PC	EI 404	Electromagnetic Theory and Transmission Line	3	0	0	3	3
Total of Theory							**15**	**15**
B. PRACTICAL								
6	BS	PH 491	Physics –II Lab	0	0	3	3	1.5
7	PC	EI 491	Sensors and Transducers Lab	0	0	3	3	1.5
8	PC	EI 492	Microprocessor and Microcontrollers Lab	0	0	3	3	1.5
9	PC	EI493	Digital Signal Processing 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								
10	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	HU502	Economics for Engineers	2	0	0	2	2
2	PC	EI 501	Industrial Instrumentation	3	0	0	3	3
3	PC	EI 502	Analog & Digital Communication Theory	3	0	0	3	3
4	PC	EI 503	Control Engineering	3	1	0	4	4
5	PE	EI 504A	Optoelectronics & Fibre Optic Sensors	3	0	0	3	3
		EI 504B	Soft Computing					
		EI 504C	IoT based Instrumentation System					
Total of Theory							**15**	**15**
B. PRACTICAL								
6	PC	EI 591	Industrial Instrumentation Lab	0	0	3	3	1.5
7	PC	EI 592	Analog & Digital Communication Lab	0	0	3	3	1.5
8	PC	EI 593	Control Engineering Lab	0	0	3	3	1.5
9	PROJ	PR 591	Project-V	0	0	2	2	1
10	PROJ*	PR 592	Innovative activities-IV	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 501	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**29**	**21**

* 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	EI 601	Process Control-I	3	0	0	3	3
2	PE	EI 602	A. Bio Medical Instrumentation B. Advance Sensors C. Non Destructive Testing & Ultrasonic Instrumentation	3	0	0	3	3
3	PE	EI 603	A. Analytical Instrumentation B. Non-Conventional Energy Sources C. Artificial Intelligence	3	0	0	3	3
4	OE	EI 604	A. Power Electronics B. Industrial Drives C. Robotics Engineering	3	0	0	3	3
5	OE	EI 605	A. Data Structures & Algorithms B. Database Management System C. Software Engineering	3	0	0	3	3
	Total of Theory						**15**	**15**
B. PRACTICAL								
6	PC	EI 691	Process Control Lab	0	0	3	3	1.5
7	OE	EI 692	A. Power Electronics Lab B. Industrial Drives Lab C. Robotics Engineering Lab	0	0	3	3	1.5
8	OE	EI 693	A. Data Structures & Algorithms Lab B. Database Management System Lab C. Software Engineering Lab	0	0	3	3	1.5
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 Presentation & Group Discussion-I	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**29**	**21**

*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	HU701	Values & Ethics in Profession	2	0	0	2	2
2	PC	EI 701	Telemetry and Remote Control	3	0	0	3	3
3	PE	EI 702	A. Process Control-II B. Power Plant Instrumentation C. Plant Automation	3	0	0	3	3
4	OE	EI 703	A. Computer Networking B. Computer graphics and Multimedia C. Object Oriented Programming	3	0	0	3	3
Total of Theory							**11**	**11**
B. PRACTICAL								
5	PC	EI 791	Telemetry and Remote Control Lab	0	0	3	3	1.5
6	OE	EI 792	A. Computer Networking Lab B. Multimedia Lab C. Object Oriented Programming Lab	0	0	2	2	1
7	PROJ	PR 791	Project-VII	0	0	0	6	3
8	PROJ*	PR 792	Innovative activities-VI	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
9	MC	MC 781	Technical Presentation & Group Discussion-II	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**25**	**17**

*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	HU	HU 804	Principles of Management	2	0	0	2	2
2	PE	EI 801	A. Virtual Instrumentation B. Embedded System Design C. Mechatronics	3	0	0	3	3
3	OE	EI 802	A. Mobile Communication B. VLSI & Microelectronics C. Quantum Computing	3	0	0	3	3
Total of Theory							**8**	**8**
B. PRACTICAL								
4	PE	EI 891	A. Virtual Instrumentation Lab B. Embedded System Design Lab C. Mechatronics 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	0
Total of Theory, Practical & Mandatory Activities/Courses							**20**	**12.5**

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 semester for MOOCs Courses from approved organization (Listed by AICTE / MAKAUT) 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	25	24*
Professional Core Courses	53.5	48*
Professional Elective Courses relevant to chosen specialization/Branch	16.5	18*
Open Elective Courses-Electives from other technical and / or emerging subjects	16	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
Total	160	160

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

Subject Distribution in Different Category:

A. Humanities, Social Sciences & Management Courses (HS)							
Sl No	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	HU 101	English	2	0	0	2	2
2	HU 291	Language Lab	0	0	2	2	1
3	HU502	Economics for Engineers	2	0	0	2	2
4	HU701	Values & Ethics in Profession	2	0	0	2	2
5	HU804	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 101	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	CH 191/ PH191	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 201	Chemistry - (Gr. B) / Physics – I (Gr. A)	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 401	Physics II	3	0	0	3	3
9	PH 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	EI 303	Circuit Theory and Networks	3	1	0	4	4
11	EI393	Circuits Theory and Networks Lab	0	0	3	3	1.5
		Total Credit:					**25**
D. Professional Core Courses (PC)							
1	EI 301	Analog Electronic Circuits	3	0	0	3	3
2	EI 302	Digital Electronic Circuits	3	0	0	3	3
3	EI 304	Electrical & Electronic Measurement & Instrumentation	3	0	0	3	3
4	EI 391	Analog Electronic Circuits Lab	0	0	3	3	1.5
5	EI 392	Digital Electronic Circuits Lab	0	0	3	3	1.5
6	EI394	Electrical & Electronic Measurement &	0	0	3	3	1.5

		Instrumentation Lab					
7	EI 401	Sensors and Transducers	3	0	0	3	3
8	EI 402	Microprocessors and Microcontrollers	3	0	0	3	3
9	EI403	Electromagnetic Theory and Transmission Line	3	0	0	3	3
10	EI 404	Digital Signal Processing	3	0	0	3	3
11	EI 491	Sensors and Transducers Lab	0	0	3	3	1.5
12	EI 492	Microprocessor and Microcontrollers Lab	0	0	3	3	1.5
13	EI494	Digital Signal Processing Lab	0	0	3	3	1.5
14	EI 501	Industrial Instrumentation	3	0	0	3	3
15	EI 502	Analog & Digital Communication Theory	3	0	0	3	3
16	EI 503	Control Engineering	3	1	0	4	4
17	EI 591	Industrial Instrumentation Lab	0	0	3	3	1.5
18	EI 592	Analog & Digital Communication Lab	0	0	3	3	1.5
19	EI 593	Control Engineering Lab	0	0	3	3	1.5
20	EI 601	Process Control-I	3	0	0	3	3
21	EI 691	Process Control Lab	0	0	3	3	1.5
22	EI 701	Telemetry and Remote Control	3	0	0	3	3
23	EI 791	Telemetry and Remote Control Lab	0	0	3	3	1.5
		Total Credit:					**53.5**
E. Professional Elective Courses relevant to chosen specialization/Branch (PE)							
1	EI 504A	Optoelectronics & Fibre Optic Sensors	3	0	0	3	3
	EI 504B	Soft Computing					
	EI 504C	IoT based Instrumentation System					
2	EI 604A	Bio Medical Instrumentation	3	0	0	3	3
	EI604B	Advance Sensors					
	EI604C	Non Destructive Testing & Ultrasonic Instrumentation					
3	EI605A	Analytical Instrumentation	3	0	0	3	3
	EI605B	Non-Conventional Energy Sources					
	EI605C	Artificial Intelligence					
4	EI 703A	Process Control-II	3	0	0	3	3
	EI 703B	Power Plant Instrumentation					
	EI703C	Plant Automation					
5	EI801A	Virtual Instrumentation	3	0	0	3	3
	EI 801B	Embedded System Design					
	EI801C	Mechatronics					
6	EI 891A	Virtual Instrumentation Lab	0	0	3	3	1.5
	EI 891B	Embedded System Design Lab					
	EI891C	Mechatronics Lab					
		Total Credit:					**16.5**

F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE):							
1	EI602A	Power Electronics	3	0	0	3	3
	EI602B	Industrial Drives					
	EI602C	Robotics Engineering					
2	EI603A	Data Structures & Algorithms	3	0	0	3	3
	EI603B	Database Management System					
	EI603C	Software Engineering					
3	EI692A	Power Electronics Lab	0	0	3	3	1.5
	EI692B	Industrial Drives Lab					
	EI692C	Robotics Engineering Lab					
4	EI693A	Data Structures & Algorithms Lab	0	0	3	3	1.5
	EI693B	Database Management System Lab					
	EI693C	Software Engineering Lab					
5	EI702A	Computer Networking	3	0	0	3	3
	EI702B	Computer graphics and Multimedia					
	EI702C	Object Oriented Programming					
6	EI792A	Computer Networking Lab	0	0	3	3	1
	EI792B	Multimedia Lab					
	EI792C	Object Oriented Programming Lab					
	EI802A	Mobile Communication	3	0	0	3	3
	EI802B	VLSI & Microelectronics					
	EI802C	Quantum Computing					
		Total Credit:					**16**
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	6	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	0	0	
2	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	0	3	
3	MC 381	Behavioral & 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 Presentation & Group Discussion-I	0	0	3	3	
7	MC 781	Technical 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.

So, we can distribute the credit with respect to weeks as follows:
4 to 7 weeks: 2 Credit
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 & Instrumentation Engineering

Sl No	MOOC Courses	Applicable Students (Semester wise)
1	Environmental Science & Studies	**I/II**
2	Computer Fundamentals	**I/II**
3	Electrical and Electronic Measurements and Instrumentation	**III/IV**
4	C Programming	**III/IV**
5	Data Structure	**III/IV**
6	Basic Electrical Engineering	**III/IV**
7	Basic Electronics Engineering	**III/IV**
8	Digital Signal Processing	**III/IV**
9	Programming Using Python	**III/IV/V/VI**
10	Soft Computing	**V/VI**
11	Internet of Things : Basic and Advanced	**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	Biomedical Instrumentation	**V/VI**
20	Process Control and Automation: Basic and Advanced	**V/VI**
21	Artificial Intelligence	**V/VI**
22	Robotics Engineering: Basic and Advanced	**V/VI**
23	Signal Processing	**VII/VIII**
24	Electronics Measurement	**V/VI**
25	Integrated Circuits	**V/VI**
26	Programming with MATLAB	**III/IV/V/VI**
27	Renewable Energy Sources & Its Applications	**IV/V/VI/VII**
28	Telemetry and Remote Sensing	**VI/VII**
29	Satellite Communication	**VI/VII**
30	Advanced Communications	**VII/VIII**
31	Information Theory & Coding	**V/VI**
32	Virtual Instrumentation	**III/IV/V**
33	Digital Image Processing	**VII/VIII**
34	Digital Speech & Audio Processing	**VII/VIII**
35	Biomedical Signal Processing	**VI/VII**
36	Embedded System Design	**VII/VIII**
37	Mobile Communication	**VI/VII**
38	Optical fibre Communication	**VII/VIII**
39	Biomedical Instrumentation & Imaging	**VI/VII**
40	Artificial Intelligence & Robotics	**VII/VIII**
41	VLSI and Microelectronics	**VI/VII/VIII**
42	Internet of Things (IOT)	**VI/VII/VIII**
43	Quantum Computing	**VI/VII/VIII**
44	Data Sciences	**VI/VII/VIII**

45	Big Data	**VI/VII/VIII**
46	Cloud Computing	**VI/VII/VIII**
47	Machine Learning	**VI/VII/VIII**
48	Operating System	**VI/VII/VIII**
49	Arduino	**V/VI**
50	Software Engineering	**VII/VIII**
51	DBMS	**VI/VII**
52	Object Oriented Programming with JAVA	**VI/VII**
53	Computer Network	**VI/VII**
54	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 & Instrumentation 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												

Curriculum for Applied Electronics & Instrumentation Engineering
Under Autonomy (GR A: ECE, EE, EIE, BME; GR B: CSE, IT, ME, CE, FT)

Implemented from the Academic Year 2018

Bansari Deb Majumder
TIC, EIE, NIT.

Dibyendu Sen
Asst. Prof. EIE. NIT

Sushmita Das
Asst. Prof., EIE, NIT

Pradip kumar Banerjee
Professor, NIT
(Ex-Dept, Co-professor, Jadavpur University)

Achintya Das.
Professor, KGEC.

Achintya Das.
Ex. Prof (CU)

(Ex. Prof, Applied Physics (CU))

27/11

27/11/19.

27/11/19

27/11/19

27/11/19

27/11/19

Chatterjee
27/11/19

27/11/19
(MRS. BAPITA ROY
HOD, AEIE, GNIT)

27/11/19

27/11/19

Department: ***Electronics and Instrumentation 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**

Course Name: Mathematics-I

Course Code: M 101
Contact: 3:1:0
Total contact Hours: 48
Credit: 4

Prerequisite:

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

Course Outcome:

COs	DESCRIPTIONS
CO1	Recall the distinctive characteristics of matrix algebra and calculus.
CO2	Understand the theoretical working of matrix algebra and calculus.
CO3	Apply the principles of matrix algebra and calculus to address problems in their disciplines.
CO4	Examine the nature of system using the concept of matrix algebra and calculus.

Course Content:

Module I: Matrix Algebra (11)

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

Module II: Differential Calculus and Infinite Series (10)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

Module III: Multivariable Calculus (Differentiation) - I (9)

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian.

Module IV: Multivariable Calculus (Differentiation) - II (7)

Maxima and minima of functions of two variables, Method of Lagrange multipliers; Directional derivatives, Gradient, Divergence, Curl.

Module V: Integral Calculus (11)

Evolutes and involutes; Evaluation of definite integrals and its applications to evaluate surface areas and volumes of revolutions; Improper integrals; Beta and Gamma functions and their properties.

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:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969

CO-PO Mapping:

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

Course Name: Chemistry

Course Code: CH 101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: A basic knowledge in 10+2 science with chemistry

Course Outcome:

CO 1: Able to describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table

CO 2: Able to apply fundamental concepts of thermodynamics in different engineering applications.

CO 3: Able to apply the knowledge of water quality parameters, corrosion control & polymers to different industries.

CO 4: Able to determine the structure of organic molecules using different spectroscopic techniques.

CO 5: Capable to 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

Course Content:

9

Module-I: Inorganic Chemistry

Atomic structure (5 Lectures)
Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation.
Periodic properties (4 Lectures)
Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.

Module-II: Physical Chemistry

8

Use of free energy in chemical equilibria (6 lectures)
Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.
Real Gases (2 lectures)
Reason for deviation of real gases from ideal behaviour, Equations of state of real gases, Vander Waals' equation, pressure & volume correction, validity, critical state of gas.

Module III: Organic Chemistry

8

Stereochemistry (4 lectures)
Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.
Organic reactions (4 lectures)
Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction)

Module IV: Industrial Chemistry

8

Water (2 lectures)
Hardness, alkalinity, numerical

Corrosion. (2 lectures)
Types of corrosion: wet & dry, preventive measures
Polymers (3 lectures)
Classification of polymers, conducting polymers, biodegradable polymers
Synthesis of a commonly used drug molecule. (1 lecture)
Paracetamol, Aspirin

Module V: Spectroscopic techniques in Chemistry

3

Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, 1H Nuclear magnetic resonance spectroscopy, chemical shift

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:

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

Course Name: Basic Electrical Engineering
Course Code: EE101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Pre-requisite:

Basic 12th standard Physics and Mathematics, Concept of components of electric circuit.

Course Outcome:

After completion of the course students able to

CO1: Understand Basic Electrical circuits, Power distribution and Safety measures.

CO2: Analyze an apply DC network theorems.

CO3: Analyze and apply concept of AC circuits of single-phase and three-phase.

CO4: Analyze and apply concepts of AC fundamentals in solving AC network problems.

CO5: Understand basic principles of Transformers and Rotating Machines.

Course Content:

Module I: DC Circuits (9L)

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.

Module II: AC Fundamentals (9L)

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 series and parallel circuits with phasor diagrams, impedance and admittance, impedance triangle and power triangle, Power factor, concept of resonance, Power in AC circuit, simple problems (series and parallel circuit only), Three-phase balanced circuits, Concept of three-phase power measurement.

Module III: Single-Phase Transformer (5L)

Brief idea on constructional parts, classifications, working principle. Problems on EMF equation. Phasor diagram, Equivalent circuit.

Module IV: Electrical Rotating Machines (8L)

a) DC Machines (4L)

Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

b) Three-Phase Induction Motor (4L)

Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problem.

Module V: General Structure of Electrical Power System (1L)

Power generation to distribution through overhead lines and underground cables with single line diagram.

Module VI: Electrical Installations (4L)

Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger.

Text books:

1. D. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
2. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
3. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
4. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH.
5. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education**.**

Reference books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Printice Hall India, 1989.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	2	-	-	-	2	2	1
CO2	2	3	-	-	-	-	-	-	-	-	1	1
CO3	2	3	1	-	-	-	-	-	-	-	1	1
CO4	1	2	3	1	-	-	-	-	-	-	-	1
CO5	3	-	-	-	-	-	-	-	-	-	-	1

Course Name: ENGLISH
Course Code: HU 101
Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Prerequisite: The course presupposes a high school level knowledge of English grammar, punctuation, and elementary to intermediate reading and writing skills.

Course Outcome:

CO1: Able to comprehend the basic knowledge of communication skills in English through exposure to communication theory and practice.
CO2: Apply the basic grammatical skills of the English language through intensive practice.
CO3 Able to develop listening and writing skills.
CO4: Able to write Official Letters , Technical report, memo, notice, minutes, agenda, resume, curriculum vitae.
CO5: Able to apply /illustrate all sets of English Language and Communication skills in creative and effective ways in the professional sphere of their life.

Course Content:

Module 1: Communication in a Globalized World **4L**
1.1 Definition, Process, Types of Communication
1.2 Verbal and Non-Verbal Communication
1.3 Barriers to Communication
1.4 Workplace Communication

Module 2: Functional Grammar **4L**
2.1Articles, Prepositions and Verbs
2.2 Verb-Subject Agreement
2.3 Voice, Modality and Modifiers
2.4 Direct and Indirect Speech
2.5 Common Errors in English

Module 3: Vocabulary and Reading **6L**
3.1 Word Roots, Prefixes and Suffixes
3.2 Antonyms, Synonyms and one word Substitution
3.3 Reading—Purposes and Skills (Skimming, Scanning & Intensive Reading)
3.4 Reading Comprehension (Fictional and Non-fictional prose)

Module 4: Professional Writing **10L**
4.1Writing Functions: Describing, Defining, Classifying
4.2 Structuring—coherence and clarity
4.3 Business Writing—Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application letters), Memos, Notices, Circulars, Agendas and Minutes of Meetings).
4.4 E-mails—types, conventions, jargons and modalities.
4.5 Reports and Proposals
4.6 Précis writing
4.7 Essay writing
4.8 Punctuation and its importance in writing
4.9 Writing for an Audience

Text Books:

1.Ruskin Bond: The Night Train at Deoli
2.Khushwant Singh: The Portrait of a Lady
2.Roald Dahl: Lamb to the Slaughter
3.Somerset Maugham: The Man with the Scar
4.Anne Frank: The Diary of a Young Girl (Letters of 3rd February 1944, 12th February 1944 and 13th February 1944)
5.Jawaharlal Nehru: "How Britain Ruled India" (Glimpses of World History, Chap 112)

Reference Books:

1.Raymond Murphy. *English Grammar in Use*. 3rd Edn. CUP, 2001.
2. A. J Thomson and A. V. Martinet. *A Practical English Grammar* Oxford: OUP, 1980.
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. Ben Heasley and Liz Hamp-Lyons. *Study Writing*. Cambridge: CUP, 2006.

CO-PO Mapping:

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

Course Name: Chemistry Lab
Course Code: CH 191
Contact: 0:0:3
Total Contact Hours: 24
Credits: 1.5

Prerequisite: 10+2 science with chemistry

Course Outcome:

CO1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2: Able to work as an individual also as a team member
CO3: Able to analyse different parameters of water considering environmental issues
CO4: Able to synthesize nano and polymer materials.
CO5: Capable to design innovative experiments applying the fundamentals of chemistry

List of Experiments: 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
CO1	1	3	2	2	2	-	-	-	-	1	2	2
CO2	3	3	3	2	1	-	2	1	-	1	-	3
CO3	3	3	3	3	3	1	1	1	-	1	-	2
CO4	2	3	3	3	3	-	-	-	-	1	1	2
CO5	3	3	3	3	1	1	1	-	1	-	2	3

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:

CO1	Identify and use common electrical components.
CO2	To develop electrical networks by physical connection of various components and analyze the circuit behavior.
CO3	Apply and analyze the basic characteristics of transformers and electrical machines

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:

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

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

Prerequisite: Basic knowledge of geometry

Course Outcome:
CO1: Get introduced with Engineering Graphics and visual aspects of design.
CO2: Know and use common drafting tools with the knowledge of drafting standards.
CO3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
CO4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

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-PO Mapping:

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

CO1:	Use mathematical tools to evaluate multiple integrals and vector integrals
CO2:	Apply effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
CO3:	Recall the properties of Laplace Transform to evaluate multiple integrals and their usage
CO4:	Understand the concept of Laplace transform to solve ordinary differential equations.

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 2^{nd} 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 $t\,f\,(t)$, LT of $\frac{f\,(t)}{t}$, LT of derivatives of f (t), LT of $\int f(t)dt$, 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:

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

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 12th standard.

Course Outcome

At the end of the course students should be able to

CO1: Describe various types mechanical resonance and its electrical equivalence
CO2: Explain basic principles of Laser, Optical fibers and various types of semiconductors
CO3: Apply superposition to explain interference and diffraction as well as apply wave mechanics to attainment of Heisenberg's uncertainty principle
CO4: Analyze importance of light as a carrier of information and examine different crystallographic structures according to their co-ordination number and packing factors
CO5: 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.

CO-PO Mapping:

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

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:

CO1: Study PN junction diode, ideal diode, diode models and its circuit analysis, application of diodes and special diodes.

CO2: Learn how operational amplifiers are modelled and analysed, and to design Op-Amp circuits to perform operations such as integration differentiation on electronic signals.

CO3: Study the concepts of both positive and negative feedback in electronic circuits.

CO4: Develop the capability to analyse and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.

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- PO Mapping:

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

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: Understand and differentiate among different programming languages for problem solving.

CO2: Describe the way of execution and debug programs in C language.

CO3: Define, select, and compare data types, loops, functions to solve mathematical and scientific problem.

CO4: Understand the dynamic behavior of memory by the use of pointers.

CO5: Design and develop modular programs using control structure, selection structure and file.

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 3L

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) 2L

Overview of Procedural vs Structural language, compiler and assembler (basic concepts) 1L

Problem solving-Algorithm & flow chart 2L

Module II: C Fundamentals: (28 L)

Variable and Data Types: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements 2L

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 4L

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 5L

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-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
CO5	3	3	3	3	2	3	-	-	3	3	3	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 of equilibrium. 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 2nd 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 – PO Mapping:

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

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-PO Mapping

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

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.
7. Innovative Experiment

CO-PO Mapping:

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

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:

CO1: Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.

CO2: Analyse the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.

CO3: Determination of input-offset voltage, input bias current and Slew rate, Common- mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.

CO4: Able to know the application of Diode, BJT & OPAMP.

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	2	2	1	2	-	-	-	-	-	-	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2
CO3	3	3	3	2	1	-	-	-	-	-	-	3
CO4	3	3	2	3	2	-	-	-	-	-	-	3

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 arcwelding.
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-PO Mapping

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

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

Pre requisite: Basic knowledge of LSRW skills

Course Outcome:

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 analyze communication behaviours.
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.IIT 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-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	-	-	3	-	**3**	**2**	**2**	**3**	**3**	-	**3**
CO2	2	3	3	3	-	**3**	**3**	**3**	**2**	**3**	-	3
CO3	1	3	3	3	-	**2**	**2**	**2**	**2**	**3**	-	2
CO4	1	2	3	3	-	**2**	**1**	**1**	**2**	**3**	-	2
CO5	3	3	2	3	-	**2**	**3**	**2**	**2**	**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	PC	EI 301	Analog Electronic Circuits	3	0	0	3	3
3	PC	EI 302	Digital Electronic Circuits	3	0	0	3	3
4	ES	EI 303	Circuit Theory and Networks	3	1	0	4	4
5	PC	EI 304	Electrical & Electronic Measurement & Instrumentation	3	0	0	3	3
Total of Theory							**17**	**17**
B. PRACTICAL								
6	PC	EI 391	Analog Electronic Circuits Lab	0	0	3	3	1.5
7	PC	EI 392	Digital Electronic Circuits Lab	0	0	3	3	1.5
8	ES	EI 393	Circuits Theory and Networks Lab	0	0	3	3	1.5
9	PC	EI394	Electrical & Electronic Measurement & Instrumentation Lab	0	0	3	3	1.5
10	PROJ	PR 391	Project-III	0	0	2	2	1.0
11	PROJ*	PR 392	Innovative activities-II	0	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 381	Behavioral & Interpersonal skills	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**35**	**24.5**

*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

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 Objectives:

The objective of this course is to disseminate the prospective engineers with advanced techniques for solving ordinary differential equations and basic techniques for solving partial differential equations. It also aims to equip the students with concepts and tools of calculus of complex variables, Fourier series and Fourier transform, and probability distribution as an intermediate to the advanced level of applications that they would find useful in their disciplines.

Course Outcomes (COs):
On successful completion of the learning sessions of the course, the learner will be able to:

CODES	DESCRIPTIONS
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 Content:

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 related problems.
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 (problems only).

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.

Project Domains:

1. Study of physical processes through PDE and ODE.
2. Application of calculus of complex variable in real world engineering problems.
3. Study of uncertainty in real world phenomena using probability distribution.
4. Application of Fourier series and Fourier transform in engineering problems.

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-PO Mapping:

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

Course Name: Analog Electronic Circuits
Course Code: EI 301
Contact : 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:

1. Provide a strong foundation on Linear Circuits.
2. Familiarize students with applications of various IC's.
3. Having a broad coverage in the field that is relevant for engineers to design Linear circuits using Op-amps.
4. Familiarize the conversion of data from Analog to Digital and Digital to Analog.

Course Outcome:

At the end of this course students will be able to

CO1: Explain the characteristics of diodes and transistors
CO2: Design and analyze various rectifier and amplifier circuits
CO3: Design sinusoidal and non-sinusoidal oscillators
CO4: Analyse the functioning of OP-AMP and design OP-AMP based circuits
CO5: Design ADC and DAC

Prerequisite: Concept of basic electronics devices, basic law of circuit analysis

Module I: **[4]**
Small signal amplifiers: Introduction to Analog Integrated Circuits, BJT Modeling-hybrid model of transistors; Emitter follower circuits, High frequency model of transistors. FET Small signal analysis - Source follower

Module II: **[9]**
Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

Feedback Amplifiers & Oscillators: Feedback concept, Voltage series-shunt, current series-shunt feedback Configurations, Berkhausen criterion, Colpitts, Hartley's, Phase shift, Wien bridge and crystal oscillators

Module III: **[14]**
Operational Amplifier: Introduction to Integrated Circuits, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), Block Diagram of OPAMP, Ideal OPAMP

Applications of Operational Amplifiers: analog adder, subtractor, integrator, differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Analog multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running Multivibrator , zero crossing detector

Multivibrator – Monostable, Bistable, Astable multivibrators ; Monostable and astable operation using 555 timer.

Module IV: **[9]**

Large signal Amplifiers: Introduction to power amplifiers (Class A, B, AB)

Power Supply:

Analysis for DC voltage and ripple voltage with C, L-C and C-L-C filters in Rectifier Circuit - Regulated DC power supplies- Line regulation, output resistance and temperature coefficient, Series and Shunt Voltage Regulation – percentage regulation, Fixed output voltage IC regulator 78xx and 79xx series , Adjustable output voltage regulator, LM 337 series power supply ICs , Concept of **Switched** Mode Power Supply`

Text Books:

1. Millman Halkias – Integrated Electronics, McGraw Hill
2. Schilling & Belove—Electronic Circuit: Discrete & Integrated, 3/e, McGraw Hill
3. Ramakant A. Gayakwad —Op- Amps and linear Integrated Circuits, Pub: PHI
4. Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI
5. "Operational Amplifiers and Linear Integrated Circuits" by Robert F. Coughlin, Frederick F. Driscoll

Reference Books:

1. Rashid-Microelectronic Circuits- Analysis and Design- Thomson(Cenege Learning)
2. Linear Integrated Circuits – D. Roy Choudhury & Shail B. Jain
3. Analog Integrated Circuits – J. B. Gupta

CO-PO Mapping:

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

Course Name: Digital Electronic Circuits
Course Code: EI 302
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Concept of basic electronics and number system

Course Objective:

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2. To introduce number systems and codes
3. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
4. Give students the basic tools for the analysis and design of combinational circuits and sequential circuits
5. To introduce the concept of memories, programmable logic devices and digital ICs.
6. To acquire the knowledge of Digital-to-Analog Conversion, Analog-to-Digital Conversion.

Course Outcome:

On completion of this Subject/Course the student shall be able to:
CO1: Interpret of the fundamental concepts and techniques used in digital electronics.
CO2: apply the concept of various number systems in digital design.
CO3: analyze and design various cost effective combinational and sequential circuits.
CO4: solve complex circuit problem by applying knowledge of digital electronics.

Module1:
Introduction:
Digital system, Comparison between Analog and Digital system, Logic level, Element of Digital Logic, Functions of Digital logic.
Data and number systems:
Number system: Binary, Octal and Hexadecimal representation and their conversions.
Number Representation: Signed binary number representation with 1's and 2's complement methods, Fixed point - Floating point
Binary Codes: BCD- Gray code- Excess 3 code- Alpha Numeric codes – Error detecting and correcting codes- properties
Binary Arithmetic: Addition, subtraction, Multiplication, Division, Addition and subtraction by 1's and 2's complement, BCD addition and subtraction [5]

Boolean algebra:
Theorems and operations, Boolean expressions and truth tables, Representation in SOP and POS forms Boolean functions; Min-term and Max-term expansions Minimization of logic expressions by algebraic method, K-map method and Quine- McClauskey method
Various Logic gates- their truth tables and circuits; Design of circuits with universal gates. Exclusive-OR and Exclusive NOR and equivalence operations [6]

Module II:
Design procedure–Adder: and Subtractor circuit: half and full adder and subtractor, BCD adder and

subtractor, controlled inverter.
Convertors: BCD to excess-3 and vice versa, Binary to BCD, Gray to binary and viceversa.
Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and Checker. [7]

Module III:
Sequential Logic:
Basic memory element-S-R, J-K, D and T Flip Flops-Truth table and Excitation table, Conversion of Flip-flop ,Various types of Registers and their design and application, Synchronous and Asynchronous counters, Irregular counter- counter design [5]

Sequential Circuits Design: State diagrams and tables, transition table, excitation table, Examples using flip-flops. Analysis of simple synchronous sequential circuits, construction of state diagram, State Machine-Mealy and Moore machine [5]

Module IV:
Memory Systems: RAM: Static RAM and Dynamic RAM, ROM, EPROM, EEROM
Programmable logic devices: programmable read only memory, programmable logic arrays and programmable array logic, Design using PLA, PAL, PROM [2]

Logic families:
TTL, ECL, MOS and CMOS, their operation and specifications: Logic levels, propagation delay time, power dissipation fan-out and fan-in, noise margin.
Implementation of Logic gate using TTL, MOS [2]
Different types of A/D and D/A:
Conversion techniques: analog-to- digital (successive approximation, Dual slope, flash) and digital-to- analog converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADCs and DACs (resolution, quantization, significant bits, conversion/settling time)
[4]

Text Books:
1. A.Anand Kumar, Fundamentals of Digital Circuits- PHI
2 Morries Mano- Digital Logic Design- PHI
3. R.P.Jain—Modern Digital Electronics
4. Digital Integrated Circuits -- Taub and Schilling . Mcgraw Hill

Reference Books:
1. Digital Fundamental, Floyd-PHI
2. Digital, Principle and Application, Leach Malvino,Mcgraw Hill

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3	2	2	2	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	2
CO3	3	2	2	2	-	-	-	-	-	-	-	1
CO4	2	3	2	2	-	-	-	-	-	-	-	2

Course Name : Circuit Theory and Networks
Course Code: EI 303
Contact : 3:1:0
Total Contact Hours: 48
Credits: 4

Pre-Requisite: Concept of Basic electrical

Course Objective:

1. To prepare the students to acquire basic knowledge in the analysis of Electrical Networks
2. To solve electrical network using mesh and nodal analysis by applying network theorems
3. To analyze the transient response of series and parallel circuits and to solve problems in time and frequency domains
4. To understand the concept of resonance in series and parallel circuits.
5. To design various types of filters.
6. To relate various two port parameters and transform them.

Course Outcome:

On completion of this Subject/Course the student shall be able to:

CO1: Solve complex circuit problem by applying knowledge of circuit theorems.
CO2: Analyze dynamic performance of the networks using Laplace Transform.
CO3: Find out resonance of different circuit.
CO4: Analyze two port networks using A,B,C,D and Z,Y Parameter Model.
CO5: Design different types of filters.

Module1:
Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Source Transformation, Star-Delta conversion [5]
Network equations: Kirchoff's Voltage Law & Current Law, Formulation of network equations, Loop variable analysis, Supermesh Analysis, Node variable analysis, Supernode Analysis
Network theorem: Superposition, Thevenin's, Norton's,Maximum power transfer, Compensation & Reciprocity theorem. Millman's theorem and its application. Solution of Problems with DC & AC sources. [7]

Module II:
Laplace transforms: Concept of complex frequency, properties of Laplace Transform, Initial Value Theorem and Final Value Theorem, Concept of Convolution theorem and its application, Transformation of step, ramp, impulse, exponential, damped and undamped sine & cosine functions. Laplace Transform of Gate function & its application. Laplace transform of Periodic function. Inverse Laplace Transform, application of Laplace Transform in circuit analysis. [7]

Circuit Transients: Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions using AC & DC source. Solutions of Problems with DC & AC sources [6]

Module III:
Two port network analysis: Open circuit Impedance & Short circuit Admittance parameters, Transmission parameters, Hybrid parameters and their inter relations. Condition of Reciprocity & symmetry. Interconnection

of two port networks. Solution of Problems with DC & AC sources. [6]

Resonant Circuits: Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Solution of problems [5]

Module IV:

Graph of Network: Concept of Tree, Branch, Tree link, junctions, Incident matrix, Tie-set matrix and loop currents, Cut-set matrix and node pair potentials, duality of networks, solution of problems. [5]

Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems. [5]

Filter Circuits: Analysis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems [2]

Text Books:

1. Network Analysis, M.E.Van Valkenburg (Prentice H all)
2. Engineering Circuit Analysis, W.H.Hayt, J.E.Kenmerly, S.M.Durbin,(TMH)
3. Network and Systems, D.Roychowdhury,(New Age International)

Reference Books:

1. Network and Systems, Ashfaq Husain,(Khanna Book Publisher)
2. Modern Netwok Analysis, F.M.Reza & S.Seely, McGraw Hill.
3.Circuits and Networks: Analysis and Synthesis Paperback , A. Sudhakar, Shyammohan S. Palli (TMH)
4. Network Analysis And Synthesis, C L Wadhwa, ,(New Age International)

CO-PO Mapping:

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

Course Name : Electrical & Electronic Measurement &Instrumentation
Course Code: EI304
Contact : 3:0:0
Total Contact Hours : 36
Credits: 3

Course objective:

1. To familiarize the students how different types of electrical and electronics meters work and their construction and applications.
2. To provide an extensive knowledge about standards and units of measurements.
3. To provide knowledge for the calibration and standardization of various instruments.
4. To provide students with opportunities to develop basic skills in the design of measuring equipments.
5. To familiarize the students with the available software for virtual instrumentation.

Course Outcome:

On completion of this Subject/Course the student shall be able to:

CO1: Apply the knowledge to measure a particular parameter using an appropriate measuring instrument
CO2: Calibrate and standardize the instruments applying the knowledge of calibration .
CO3: Design measuring instruments on requirement basis.
CO4: Apply the knowledge of the instrumentation and measurement systems in the real life applications

Module I:
Introduction to Electrical & Electronic Measurement &Instrumentation
Static and dynamic characteristics of measuring instruments: Definitions of accuracy, precision, hysteresis, nonlinearity, sensitivity, speed of response, fidelity, static and dynamic error, Statistical analysis of errors [4]
Reliabity, MTTF, Bath tub curve [1]

Introduction to electrical voltmeters and ammeters: PMMC, MI, Electrodynamometer: Construction, Torque equation, Damping, range extension [6]

Module II:
Measurement of Resistance: Wheatstone bridge & Kelvin's Double bridge (DC Bridge), Loss of charge method, Meggar
Measurement of Capacitance: De Sauty's bridge & Schering bridge (AC Bridge)
Measurement of Inductance: Maxwell's inductance capacitance bridge (AC Bridge), Anderson Bridge
(***each bridge should cover:** Bridge balance equation, Magnitude and phase balance of AC bridges, Phasor Diagram), Localization of cable faults [7]

Basic concept of Potentiometer, Wattmeter and Energy meter [4]

Module III:
PLL including VCO: Block diagram, circuit diagram, operation, modes Charge amplifier [2]
True RMS voltmeter, Digital Voltmeter, Digital frequency meter including V to F, F to V [5]
Q meter [1]

Module IV:
Oscilloscopes and its applications: Oscilloscope Time Base, Triggering, Oscilloscope Controls, Oscilloscope Probes, Digital Storage Oscilloscope [5]
Spectrum Analyzer [1]

Text Books:

1. Golding E.W. & Widdis F.C. : Electrical Measuring Instruments & Measurements ; Wheeler
2. Sawhney A K : A course in Electrical & Electronic Measurements & Instruments, Dhanpat Rai & Co.
3. Helfrick A.D. & Cooper W.D. : Modern Electronic Instrumentation & Measuring Instruments; Wheeler
4. Bell, David : Electronic Instrumentation & Measurement, Reston Publishers
5. D.C. Patranabis, Principles of Electronic Instrumentation, PHI
6. A. K. Ghosh, Introduction to Measurements and Instrumentation

Reference Books:

1. Harris, F. K. – Electrical Measurements, Wiley.
2. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill
3. Reissland M.U.: Electrical Measurement, New Age International

CO-PO Mapping:

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

Course Name: Analog Electronics Lab
Course Code : EI 391
Contact :0:0:3
Credits : 1.5

Course Objective:

1. Understand the scope of modern electronics.
2. Describe models of basic components.
3. Design and construct simple electronic circuits to perform a specific function, e.g.,designing of amplifiers, ADC etc.
4. Understand capabilities and limitations and make decisions regarding their best utilization in a specific situation.

Course Outcome:

At the end of this course students will be able to:

CO1: Verify the working of diodes, transistors and their applications.

CO2:Build a common emitter/base/collector amplifier and measure its voltage gain.

CO3: Explore the operation and advantages of operational amplifiers.

CO4: Design different types of filters and apply the same to oscillators and amplifiers.

CO5: Design a circuit to convert an analog signal to digital one.

List of Experiment:

1. Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter
2. Construction of a R-C coupled amplifier & study of its input impedance, output impedance and frequency response
3. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator
4. Study a linear voltage regulator using regulator IC chip
5. Construction of analog adder and subtractor using opamp
6. Construction of integrator and differentiator using opamp
7. Construction of precision rectifier using opamp
8. Construction of a simple function generator using opamp
9. Construction of a Schmitt trigger circuit using opamp
10. Design and testing of Wien bridge oscillator
11. Study and analysis of Instrumentation Amplifier
12. Innovative Experiment

CO-PO Mapping:

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

Course Name: Digital Electronic Circuits Lab
Course Code: EI 392
Contact: 0:0:3
Credits: 1.5

Course Objective:

1. To reinforce learning through hands-on experience with design, construction, and implementation of digital circuits.
2. To train students with all the equipment which will help in improving the basic knowledge

Course Outcome:

On completion of this course students will be able to:

CO1: operate laboratory equipment.

CO2: design digital circuits

CO3: construct, analyze, and troubleshoot the digital circuits.

CO4: measure and record the experimental data, analyze the results and prepare a formal laboratory report

List of Experiment:

1. Realization of basic gates using Universal logic gates
2. Code conversion circuits- BCD to Excess-3 & vice-versa
3. 4-bit parity generator & comparator circuits
4. Construction of simple Decoder & Multiplexer circuits using logic gates
5. Design of combinational circuit for BCD to decimal conversion to drive 7segment display using multiplexer
6. Construction of simple arithmetic circuits-Adder, Subtractor.
7. Realization of RS-JK & D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops & logic gates.
9. Realization of Universal Register using multiplexer & flip-flops.
10. Realization of Asynchronous and Synchronous Up/Down counter.
11. Design of Sequential Counter with irregular sequences.
12. Realization of Ring counters.
13. Innovative Experiment.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO1 1	PO12
CO1	2	3	2	2	2	-	-	-	-	-	-	1
CO2	1	2	2	-	-	-	-	-	-	-	-	2
CO3	2	2	2	2	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	2

Course Name: Circuits and Networks Lab
Course Code: EI 393
Contact: 0:0:3
Credits : 1.5

Course Objective:

1. To acquaint students with the simulation software such as MATLAB to carry out design experiments as it is a key analysis software of engineering design
2. To generate different signals and transform those to s- domain using MATLAB
3. To verify various network theorem and other network aspects using SIMULINK.
4. To provide basic laboratory experience with analyzing the frequency response of different filters using simulation software.

Course Outcome:

On completion of this Subject/Course the student shall be able to:

CO1:Apply the techniques and skills of modern engineering tools necessary for engineering practice.
CO2:Identify, formulate and solve engineering problems with simulation software.
CO3:Analyze transient response of series /parallel R-L-C circuit using simulation software.
CO4:Determine frequency response of different filters using simulation software

List of Experiments:

1. Introduction to MATLAB
2. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
3. Verification of Network Theorems using simulation software
4. Determination of Laplace transform and inverse Laplace transformation using MATLAB
5. Transient response in R-L and R-C Network: Simulation/hardware
6. Transient response in R-L-C Series circuits Network: Simulation and hardware.
7. Determination of Impedance (Z) and Admittance(Y) parameters of two port network
8. Frequency response of LP and HP filters: Hardware
9. Frequency response of BP and BR filters
10. Evaluation of convolution integral for periodic & non-periodic signal using MATLAB
11. Innovative Experiment

CO-PO Mapping:

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

Course Name:Electrical & Electronic Measurement & Instrumentation Lab
Course Code: EI 394
Contact: 0:0:3
Credits: 1.5

Course objective:
1. To understand how different types of bridge circuits are to be operated
2. To understand about different types of static and dynamic characteristics.
3. To understand the operation of VCO and PLL
4. To understand the operation of Digital Storage Oscilloscope
5. To familiarize the calibration procedure of different electrical meters

Course outcome:
On completion of this Subject/Course the student shall be able to:
CO1: Apply the knowledge for calibration of different electrical meters.
CO2: Relate different static and dynamic characteristics of a measuring instrumentfor a typical application.
CO3: Analyze the measured data statistically.
CO4: Reconstruct a given signal using the knowledge of Digital Storage Oscilloscope.

List of Experiment:
1. Measure the resistivity of material using Kelvin Double Bridge
2. Measurement of Capacitance by De Sauty Bridge
3. Calibrate dynamometer type Wattmeter by potentiometer
4. Calibrate A.C. energy meter.
5. Measurement of Power using Instrument transformer
6. Study of Static Characteristics of a Measuring Instrument
7. Study of Dynamic Characteristics of a Measuring Instrument
8. Realization of a V-to-I & I-to-V converter.
9. Statistical analysis of errors in measurement.
10. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).
11. Analysis of various waveforms and spectrum using Spectrum Analyser.
12. Familiarization with Digital Storage Oscilloscope.
13. Innovative experiment

CO-PO Mapping:

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

Course Name: Behavioral & Interpersonal Skills
Course Code: MC 381
Contact: 0:0:3
Total Contact Hours: 36

Course Objective: To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error rectification through feedback.

Course Outcome:
After completion of this course students will be able to
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 ONE – 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 TWO- 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 THREE – 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 FOUR – 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

ASSESSMENT		
1.	**Viva**	**10**
2.	**Personal Skill Enhancement Log**	**25**
3.	**Movie Making: Corporate Business Meeting**	**25**
4.	**Term End Project**	**40**

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.

4 TH SEMESTER								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	PH 401	Physics – II	3	0	0	3	3
2	PC	EI 401	Sensors and Transducers	3	0	0	3	3
3	PC	EI 402	Microprocessors and Microcontrollers	3	0	0	3	3
4	PC	EI403	Digital Signal Processing	3	0	0	3	3
5	PC	EI 404	Electromagnetic Theory and Transmission Line	3	0	0	3	3
Total of Theory							**15**	**15**
B. PRACTICAL								
6	BS	PH 491	Physics –II Lab	0	0	3	3	1.5
7	PC	EI 491	Sensors and Transducers Lab	0	0	3	3	1.5
8	PC	EI 492	Microprocessor and Microcontrollers Lab	0	0	3	3	1.5
9	PC	EI493	Digital Signal Processing 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								
10	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 401
Contacts: 3:0:0
Total Contact Hours : 36
Credits: 3

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

Course Objective:
The Physics-II course will provide the exposure to the physics of materials that are applied in digital circuitry, storage devices; exposure to the physics of quantum logic gate operation and quantum computation; an insight into the science & technology of next generation; foundations of electromagnetic theory and communication systems; concept of fundamental particles and associated applications in semiconductors

Course Outcome:
After completion of this course student will be able to
CO1: explain electron transport in metal-insulators and semiconductors using energy Band theory.
CO2: apply Schrödinger equation in variety of atomic scale problems including nanomaterials.
CO3: analyze the physics of various kinds of electric and magnetic materials
CO4: justify the importance of Fermi energy level in turning electronic properties of various semiconductors

Module 1: Electric and Magnetic properties of materials (09L)
Module 1.01:Insulating materials:
Dielectric Material: Concept of Polarization, the relation between **D, E** and **P**, Polarizability, Electronic (derivation of polarizability), Ionic, Orientation & Space charge polarization (no derivation), behavior of Dielectric under alternating field (qualitative discussion only), Local electric field at an atom: Lorentz field, Lorentz relation; Dielectric constant and polarizability – Clausius-Mossotti equation (with derivation) ; Dielectric losses. ferroelectric and piezoelectrics (Qualitative study).
4L
Module 1.02: Magnetic materials and storage devices:
Magnetic Field & Magnetization M, relation between **B, H, M**. Bohr magneton, susceptibility, Diamagnetism- & Paramagnetism - Curie law (qualitative discussion), Ferromagnetism– Curie Temperature, Weiss molecular field theory (qualitative) & Curie-Weiss law, concept of θ_p , Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storage devices) and Soft ferromagnets (Permalloys, Ferrites etc.) **5L**

Module 2: Quantum Mechanics-II (8L)
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. 4L

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 $E<V_0$). 4L

Module 3: Statistical Mechanics: (6L)
Concept of energy levels and energy states, phasespace, 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, Density of states, Application in metals, no of particles, average energy calculation at 0^o K. 6L
Module 4: Elements of solid state physics (6L)
Module 4.01: Free electron theory (qualitative) - Electronic conduction in solids : Drude's theory, B Wiedemann Frantz Law, Idea of quantization of energy-Sommerfeld theory. 3L

Module 4.02: Band theory of solids: Bloch Theorem-statement only, Kronig-Penny model (qualitative treatment)- Energy-band (E-k) diagram, allowed and forbidden energy bands 3L

Module 5: 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, grapheme, electronic, environment, medical). 4L

Module 6: Nuclear energy as future energy (3L)

Nuclear Binding Energy, Liquid drop model, Concept of Nuclear Fission, Nuclear Fusion & Energy output , Nuclear Reactor. 3L

Books:

1. Insulating Materials: Principles, Materials, Applications, Margit Pfundstein , Roland Gellert , Martin Spitzner & Alexander Rudolphi: Birkhauser Verlag AG; 1
2. High Voltage and Electrical Insulation Engineering, Ravindra Arora, Wolfgang Mosch: Online ISBN: 9780470947906 DOI: 10.1002/9780470947906 Series Editor(s): Mohamed E. El-Hawary
3. Physics-II, Sujay Kumar Bhattacharya and Soumen Pal, McGraw Hill Education Private Limited
4. Advanced Engineering Physics, S. P. Kuila, New Central Book Agency (P) Ltd.
5. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
6. Quantum Mechanics- Bagde Singh (S. Chand Publishers)
7. Principles of Engineering Physics Vol 1 and Vol 2; by Md. N. Khan and S. Panigrahi, Pub: Cambridge Univ. press
8. Advanced Quantum Mechanics-J. J. Sakurai (TMH)
9. Quantum Computation and Quantum Information(10th Anniversary Edition)- Nielsen & Chuang (Cambridge University Press)
9.Fundamental of Statistical Mechanics: B Laud
10.Introduction to statistical mechanics : .Pathria
11.Fundamental of Statistical and Thermal Physics: .F. Reif Advanced Engineering Physics-S. P. Kuila New Central Book Agency (P)Ltd.
12. Electricity and Magnetism (In Si Units): Berkeley Physics Course - Vol.2, Edward M Purcell
13. Introduction to Electrodynamics-Griffiths David J.
14. The Feynman Lectures on Physics. 2 (2nd ed.)., Feynman, Richard P Addison-Wesley.
ISBN 978-0-8053-9065-0
4. Solid State Physics, A. J. Dekker, McMillan
15.Nanostructure and Nanomaterials, B.K. Parthasarathy
16.Introduction to Nanotechnology, B.K. Parthasarathy
17.Essentials of Nanotechnology, Rishabh Anand
18.Nanomaterials Handbook (Advanced Materials and Technologies)-YuryGogotsi (Editor) 1. Nuclear Physics,
Irvin Keplan
19. Nuclear Physics, J. Pearson, University of Manchester, 2008
20. Nuclear and Particle Physics, Jenny Thomas - University College London , 2000.
21. Solid State Physics, S.O. Pillai.

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	2	2	3	-	-	-	-	-	-	-	1

Course Name: Sensors and Transducers
Course Code: EI 401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:

1. To deal with various types of Sensors & Transducers and their working principle.
2. To deal with Resistive, Capacitive and Inductive transducers.
3. To deal with some of the miscellaneous transducers.
4. To know the overview of different advance sensors.

Course Outcome:

Students should be able to
CO1: Illustrate the fundamental principles of various types of sensors.
CO2: Illustrate the different types of transducers available.
CO3: Employ appropriate sensors to perform engineering tasks and scientific researches.
CO4: Design of different Sensors.
CO5: Reorganize the basics of modern sensors

Module I:

Introduction & Characteristics of Transducers

Introduction to sensors and transducers, Measurement system, Principles of sensing & transduction, Classification of sensors, Static characteristics, Dynamic characteristics: Zero, first order and second order measurement system, Response to impulse, step, ramp and sinusoidal inputs, sensitivity calculation, error estimation.

Resistive Sensing Element

Potentiometer: Loading effect, Strain gauge: theory, types, temperature compensation, applications: force, velocity and torque measurements.

Inductive Sensing Element

Self-inductive transducer, Mutual inductive transducers, Variable Reluctance type, Linear Variable Differential Transformer (LVDT): construction, Characteristic Curve, application: LVDT Accelerometer, LVDT displacement sensors

Module II:

Capacitive Sensing Element

Capacitive transducer: Variable Area Type, Variable distance type , Variable Permittivity type, calculation of sensitivities, applications.

Piezoelectric & Piezoresistive Sensing Element

Piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, force and stress sensing, piezoelectric accelerometer, piezoresistive sensor.

Tachometers: Stroboscopes, Encoders, seismic accelerometer, Measurement of vibration, Proximity switches, Load cells: pneumatic, piezoelectric, elastic and magneto-elastic types - their mounting.**08L**

Module III:

Optical Sensors

Light Dependent Resistor, Optocoupler, Photodiode, Phototransistor, Photomultiplier tube, solar cell.

Magnetic Sensors

Sensors based on Villari effect for assessment of force, torque, rpm meters,Hall effect and Hall drive, performance characteristics

Radioactive sensors

Gieger counter, proportional counter, Scintillation detection, Ionization chamber . 0**8L**

Module IV:

Miscellaneous Sensors

IC temperature Sensor, Electrochemical Gas sensors, Fibre optic sensors- Thick film technology-MEMS sensors- Nano sensors- Sensors for intelligent systems- Introduction to Smart sensors and Sensor network.**08L**

Text Books:

1. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 1999.
2. John Brignell,"Intelligent Sensor Systems", CRC Press; 2nd Revised edition edition,1996

Reference Books:

1. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.
2. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
3. Murthy.D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
4. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, DhanpatRai& Company Private Limited, 2007.

CO-PO Mapping:

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

Course Name: Microprocessors and Microcontrollers
Course Code: EI 402
Contact : 3:0:0
Total Contact Hours:36
Credits: 3

Prerequisite: Concept of Digital electronics

Course Objective:

1. To understand the architectures of 8085 & 8086 microprocessors and 8051 microcontroller.
2. To familiarize with the assembly level programming technique.
3. To understand interfacing of 8 bit microprocessor /microcontroller with memory and peripheral chips involving in system design.
4. To be able to design a microprocessor /microcontroller based system.

Course Outcome:

On completion of this course, students will be capable of

CO1: Apply the knowledge of the internal architecture 8085/8086 microprocessors and 8051 for a specific application.
CO2: Analyzing various instructions related to particular programs for specific applications.
CO3: Applying the knowledge of interfacing circuits to some real time applications
CO4: Designing various microprocessor and microcontroller based systems for a specific application.

Module I:
Introduction to microprocessors:
Introduction to microprocessors, Evolution of microprocessors, The 8085 Internal architecture, Pin Diagram Instruction set and Assembly Language Programming. Addressing Modes. **7L**

Module II
Microprocessor Related Operations:
The 8085 microprocessor: Timing diagrams, Stack and subroutine related operation, Counter and Time delay generation, Interrupt systems, DMA operation, Introduction to Serial Communication

7L

Module III
Peripherals interfacing techniques with 8085:
Interfacing memory, Interfacing I/O devices. Programmable peripheral devices (PPI) – Intel 8255, Programmable interval timer – Intel 8254, A/D and D/A converters, Programmable Interrupt Controller 8259A, Intel 8251 USART

8L

Module IV
Intel 8086/8088 Microprocessor:
Architecture, Register organization, Clock Generator, Resetting the microprocessor, Wait State Inserting, Bus Buffering, Pin details, Assembly Language Programming and Addressing Modes.

4L

Module V

Introduction to single chip microcontrollers:

Intel MCS-51 family features, 8051/8031 architecture, pin configuration, I/O ports and Memory organization. Instruction set and basic assembly language programming. Timer/Counter and Serial Communication, Interrupts

Assembly language programming using 8051:

Moving data, external data moves, code memory read only data moves, PUSH, POP, data exchanges

Logical instructions, Byte level, bit level instructions, ROTATE, SWAP instructions, Arithmetic instructions, Flags, incrementing, decrementing, addition, subtraction, multiplication, division, decimal arithmetic

Jump and Call instructions, Jump and Call ranges, subroutines and return instructions

MCS-51 applications: Square wave and pulse wave generation. **10L**

Text Books:

1. Douglas V. Hall – Microprocessors & Interfacing, Tata McGraw-Hill
2. Ramesh S. Gaonkar , Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989.
3. Ray &Bhurchandi – Advanced Microprocessors & Peripherals, Tata McGraw-Hill
4. Kenneth J. Ayala – The 8051 Microcontroller, Architecture, Programming and Applications, West Publishing Company

Reference Books:

1. B.Ram , Fundamental of Microprocessor and Microcontrollers, DhanpatRai Publications.
2. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley interscience publications, 1980.
3. Walter A. Tribel – The 8088 and 8086 Microprocessors, Pearson Education
4. Barry B. Brey – The Intel Microprocessors, PHI/Pearson Ed. Asia
5. Muhammed Ali Mazidi and Janice GillispieMazidi – The 8051 Microcontroller and Embedded Systems, Pearson Education Inc.
6. Ajay V Deshmukh – Microcontrollers Theory and Applications, Tata McGraw-Hill
7. MykePredko, Programming and Customizing the PIC Microcontroller (Tab Electronics).

CO-PO Mapping:

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

Course Name: Digital Signal Processing
Course Code: EI 403
Contact: 3:0:0
Total Contact Hours: 36
Credits : 3

Prerequisite: Analog Electronics circuit, Signals & Systems, Analog Filters

Course Objective:

1. To develop the knowledge on signals used in digital signal processing.
2. To impart the knowledge of the principles of discrete-time signal analysis to perform various signal operations
3. Apply the principles of Fourier transform analysis to describe the frequency characteristics of discrete-time signals and systems
4. To study various sampling techniques and different types of filters
5. To learn the use of computer programming tools to create, analyze process and visualize signals and to plot and interpret magnitude and phase of LTI system frequency responses
6. To understand the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.

Course Outcome:

The students will be able to:

CO1: Apply the knowledge about continuous and discrete time signals
CO2: Understand the Fourier Transform, and examine the process of Quantization and the effects of finite register length
CO3: Understand and implement DFTs on long data sets such as speech signals and images.
CO4: Develop different types of FIR & IIR filter structures and their implementations
CO5: Use of FFTs for efficient implementation of linear convolution
CO6: Excel in fields such as speech processing, audio signal processing, digital image processing, video and audio compression.

Module I:

LTI systems: [8L]
Concept of signals & systems, digital signal processing and its relevance to digital communication.
Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems.

Module II:

Discrete Time Fourier Transform(DTFT): [2L]
Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain.
Discrete Fourier Transform: [8L]
Concept and relations for DFT/IDFT; Relation between DTFT & DFT; Twiddle factors and their properties; DFT/DFT as linear transformation and matrices ; Computation of DFT/IDFT by matrix method; Properties of DFT – periodicity, linearity, time reversal, circular time & frequency shift, symmetry, circular symmetry,

duality, multiplication of two DFTs, circulation convolution, circular correlation ; Computation of circular convolution by graphical; Linear filtering using DFT, aliasing error, filtering of long data sequences- Overlap-Save and Overlap-Add methods.

Fast Fourier Transforms: [4L]

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.

Module III:

Filter design: [6L]

Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform. Concept of Chebyshev filters and comparison with Butterworth filter. Design of linear phase FIR filters -no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization. Some examples on practical filters.

Multirate Digital Signal Processing: [2L]

Introduction to multirate digital signal processing, sampling rate conversion, multistage interpolator & decimator, digital filter banks.

Module IV:

Digital Signal Processor: [6L]

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs.

Text Books :

1. Digital Signal Processing–Principles,Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. Digital Signal processing – A.V. Oppenheim,R.W.Schafer, Prentice Hall
5. Discrete-time Signal processing – A.V. Oppenheim,R.W.Schafer, John R. Buck, Prentice Hall

Reference Books :

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing; A Hands on Approach, C. Schuler &M.Chugani, TMH Publishing Co.
4. Digital Signal Processing,A. NagoorKani, TMH Education
5. Digital Signal Processing S. Poornachandra& B. Sasikala, MH Education
6. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
7. Texas Instruments DSP Processor user manuals and application notes.
8. Digital Signal Processing: A MATLAB-Based Approach, V.K.Ingle and J.G.Proakis, Cengage Learning
9. Modern Digital Signal Processing,V. Udayashankara, PHI Learning

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	1	1	1	1	1	1	1
CO2	3	3	1	2	1	1	1	1	1	1	1	1
CO3	3	3	1	3	3	3	1	1	1	1	1	1
CO4	3	3	3	3	1	2	1	1	1	1	1	1
CO5	3	3	3	3	3	1	1	1	1	1	1	1
CO6	3	3	3	3	3	3	3	3	3	3	3	3

Courser Name: Electromagnetic Theory and Transmission Line
Course Code: EI-404
Contact : 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Concept of physics ,vector analysis

Course Objective:

1. To acquire the knowledge of Electromagnetic field theory that makes the student to get a theoretical foundation to be able in the future to design emission , propagation and reception of electromagnetic wave systems

2. To identify , formulate and solve the problems related to fields and electromagnetic waves propagation in a multidimensional frame

3. Understand the basic concepts of electric and magnetic fields

4. To provide the students with a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies

5. Understand the concept of conductors, dielectrics, inductance and Capacitance, Gain knowledge on the nature of magnetic materials. Understand the concept of static and time varying fields.

Course Outcome:

Student will be able to:
CO1: understand and interpret the physical meanings of gradient, divergence and curl, vector calculus and orthogonal coordinates.
CO2: apply the concept of steady fields and different associated laws in different cases and mediums and realize the physical significances of Maxwell's equations for static field.
CO3: solve different problems of the time varying fields and correlate the Poynting vector and Poynting theorem.
CO4: understand the thorough treatment of the theory of electro dynamics, mainly from a classical field theoretical point of view, and includes such things as electrostatics and magneto statics, boundary conditions.
CO5: analyze the wave equations, and be able apply the concepts in transmission line, wave guide.
CO6: explain universal concepts in three-dimension real world, i.e., electro-magnetic wave propagation in free-space, dielectrics, conductors.

Module I
Introduction to the Electromagnetic Theory,
Vector calculus – orthogonal Coordinate Systems, Curvilinear co-ordinate system (basics).Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl – their physical interpretations; Divergence Theorem, Stoke's Theorem, Laplacian operator.**6L**

Module II

Coulomb's law, electric field intensity, charge distribution.; Gauss' law, flux density and electric field intensity.. Current Densities, Conductors, Poisson's & Laplace's equations, Uniqueness theorem, Biot-Savart law, Ampere's law, Relation between J & H, Vector magnetic Potential. Maxwell's equations for static field. Study of different Applications on static fields using MATLAB Programming . **6L**

Module III

Faraday's law & Lenz's law, Displacement Current, J C – J D Relation, Maxwell's equations for time varying field, Time harmonic fields, Maxwell's equations for time harmonic field, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Free space, good conductor, skin effect and skin depth. Poynting Theorem, Power flow, Poynting vector. Wave polarizations. **10L**

Module IV

Transmission Lines: Concept of Lump parameters and Distributed parameters, Line Parameters, Transmission line equations and solutions, Physical significance of the solutions. Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation, group velocity , phase velocity; Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith chart, Load Matching Techniques. **9L**

Module V

Transmission line at microwave frequency; brief of rectangular waveguide, circular waveguide, resonators, concept of cavity, Basics of Antenna.**5L**

Text Books:

1. Mathew N.O.Sadiku , Principles of Electromagnetics, 4th Edition
2. W.H. Hayt & J.A. Buck, Engineering Electromagnetics, 7th Edition, Tata- McGraw-Hill
3. Edminister , Theory and Problems of Electromagnetics , 2nd Edition, Tata-McGraw- Hill

References:

1. S.P.Seth, Elements of Electromagnetic Fields
2. Syed Hasan Saeed And FaizanarifKhan , Electromagnetic Field Theory
3. G.S.N. Raju , Electromagnetics Field Theory & Transmission Lines, Pearson

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	1	1	1	1	1	1	1	2
CO2	3	3	1	3	1	1	1	1	1	1	1	2
CO3	3	3	1	3	1	1	1	1	1	1	1	2
CO4	3	3	1	3	1	1	1	1	1	2	1	3
CO5	3	3	2	3	2	1	1	1	1	2	1	1
CO6	3	3	2	3	2	2	1	1	1	1	1	1

Paper Name: Physics II Lab
Paper Code: PH 491
Total Contact Hours: 0:0:3
Credit: 1.5

Pre requisites: Knowledge of Physics up B. Tech. 1st year Physics-I course
Course Objective:
The Physics-II course will provide

B. exposure to the physics of materials that are applied in electrical engineering

C. an insight into the science & technology of next generation and related technicalities through quantum mechanics

D. advanced materials for electrical engineering

E. concept of fundamental particles and associated applications in semiconductors

At the end of the course students' will be able to
CO1 : demonstrate experiments allied to their theoretical concepts
CO2 : conduct experiments using semiconductors , dielectric and ferroelectrics
CO3 : classify various types of magnetic materials
CO4 : participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO5 : analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

Experiments on Module 1: Electric and Magnetic properties of materials (8L)
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)/Measurement of losses in a dielectric using LCR circuits.

Experiments on Module 2: Quantum Mechanics-II (6L)
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.

Experiments on Module 4: Solid state physics (9L)
9. Determination of band gap of a semiconductor.
10. Determination of Hall co-efficient of a semiconductor and measurement of Magneto resistance of a given semiconductor

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.

Probable experiments beyond the syllabus:
1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
2. Determination of thermal conductivity of a good conductor by Searle's mothod.
3. Study of I-V characteristics of a LED.
4. Study of I-V characteristics of a LDR
5. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.
6. Innovative Experiment

CO-PO Mapping:

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

Course Name:Sensors and Transducers Lab
Course Code: EI 491
Contact: 0:0:3
Credits: 1.5

Course Objective:

1. To identify suitable instruments for thespecificphysical parameter measurement.
2. To operate Resistive, Capacitive and Inductive transducers.
3. Torecommend the transducers for specific physical parameter measurement.
4. To characterizespecific transducers.

Course Outcome:
The students will be able to:

CO1: Illustrate the working of transducers and various transducers used for the measurement of various physical variables.
CO2: Analyze the characteristics of the transducers.
CO3: Design sensor based on the real time application.
CO4: Estimate the design specifications of different transducers.

List Of Experiment:

1. Displacement measurement by using a capacitive transducer.
2. Pressure and displacement measurement by using LVDT.
3. Study of a load cell with tensile and compressive load.
4. Torque measurement Strain gauge transducer.
5. Speed measurement using magnetic proximity sensor.
6. Speed measurement using a Stroboscope.
7. Study of the characteristics of a LDR.
8. Pressure measurement using Piezo-electric transducer
9. Study of the Characteristics of Hall-effect transducer
10. Innovative experiment

CO-PO Mapping:

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

Course Name: Microprocessors and Microcontrollers Lab
Course Code :EI 492
Contact :0:0: 3
Credits : 1.5

Course Objective:

1. To enable the students analyze microprocessors and microcontrollers.
2. To grow programming concept using microprocessor.
3. To make students able to write programs, interface with peripherals and implement them in projects.
4. To be able to choice suitable microprocessors and microcontrollers for any design and implementations.
5. To be able to interfacing microprocessors and microcontrollers with peripherals device.

Course Outcome:

After completion of this course, the students will be able to
CO1: write microprocessor and microcontroller based programs to solve any given problem statement.
CO2: design microprocessor based systems for real time applications.
CO3: reconstruct microprocessor and microcontroller based interfacing as per the requirements.

List Of Experiment:

1. Familiarization with 8085 and 8051 trainer kit components.
2. Program development using basic instruction set (data transfer, Load/ Sore, Arithmetic, Logical) using 8085 trainer kit such as

   a) Addition and subtraction
   b) Copying and shifting a block of memory
   c) Packing and unpacking of BCD numbers
   d) Addition of BCD numbers
   e) Binary to ASCII conversions
   f) String matching
   g) Multiplication of two numbers
   h) Sorting of array of numbers
3. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit, write subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc.
4. Study of 8051 Micro controller kit and writing programs as mentioned in section 2.
5. Innovative experiment

CO-PO Mapping:

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

Course Name: Digital Signal Processing Lab
Course Code: EI 494
Contact: 0:0:3
Credits: 1.5

Course Objective:

1. To implement simulation and development of basic signal processing algorithms.

2. To study the standardized environments such as MATLAB and general-purpose DSP development kits.

3. To analyze and Observe Magnitude and phase characteristics of different signals.
4. The experiments implement fundamental concepts of digital signal processing like sampling and aliasing, internal arithmetic operations, digital filter design and implementation, signal generation.

5. Students will try to learn about the knowledge on different algorithms associated with filtering of long data sequences.

Course Outcome:

After completion of the laboratory course students will be able to:

CO1: Understand various signals generation.

CO2: Compute the system output using convolution method with MATLAB Software package.

CO3: Analyze and Observe Magnitude and phase characteristics of different signals.

CO4: Calculate DFT, FFT, IDFT using MATLAB.

CO5: Analyze Magnitude and phase characteristics (Frequency response Characteristics) of digital LP,HP& FIR Butterworth filters.

CO6: Develop and Implement DSP algorithms in software using a Computer language such as C with TMS320C6713 floating point Processor.

Experiments:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations using MATLAB.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
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. Implementation of FFT of given sequence.
9. Implementation of LP & HP FIR filters for a given sequence.

10. Hardware Laboratory :

Writing & execution of small programs related to arithmetic operations and Convolution using Assembly Language of TMS320C 5416/6713 Processor

11. Innovative Experiment

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	1	2	-	3	-	-	-	-	-	-	-	1
CO3	1	2	-	-	-	-	-	-	3	-	-	1
CO4	1	2	-	-	-	-	-	-	-	3	-	1
CO5	1	2	-	3	-	-	-	-	-	-	-	1
CO6	2	2	-	2	-	-	-	-	1	-	-	1

C. MANDATORY ACTIVITIES / COURSES

Course Name: Environmental Science
Course Code: MC401
Contact: 3:0:0
Total Contact Hours: 22
Credits: 3l

Pre-requisite: Basic knowledge of Chemistry & Mathematics

Course Objective:

1. Be able to understand the natural environment and its relationships with human activities.
2. Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
3. Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
4. Be able to solve scientific problem-solving related to air, water, and noise& land pollution.

Course Outcome:

After completion of this subject students will be able to:

CO1 : Study the mathematics and calculations of population growth, material balance and sustainable development.
CO2 : Study the components and diversity of eco system.
CO3 : Study the fundamental knowledge of air pollution, calculations of earth's surface temperature, atmospheric window and lapse rate.
CO4: Acquire fundamental knowledge of water pollution and its consequences knowledge and calculations regarding BOD, COD.
CO5: Understand the basic concepts regarding noise and musical sound, decibel unit and its relation with sound intensity, reasons and consequences of noise pollution.
CO6: Understand the concepts of land pollution and its remedies.

1.General

1.1 Natural Resources: Forest Resource, water resource, mineral resource, energy resources (renewable, non-renewable, potentially renewable)
1.2 Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield
1.3 Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)
1.4 Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Foodweb, Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems **1.5 Environmental Management**: Environmental impact assessment, Environmental laws and protection act of India, Different international environmental agreement.

2. Air pollution and control

2.1Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary

pollutant

2.2 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),

2.3Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

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

2.5 control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury)

3. Water Pollution

3.1 Classification of water (Ground & surface water)

3.2 Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatileorganiccompounds.

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

Lake: Eutrophication [Definition, sourceandeffect].

3.4Ground water: Aquifers, hydraulic gradient, ground water flow(Definitiononly),ground water pollution (Arsenic & Fluoride; sources, effects, control)

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

3.7 Layout of waste water treatment plant (scheme only).

4. Land Pollution

4.1 Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste

4.2 Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).

5. Noise Pollution

5.1 Definition of noise, effect of noise pollution on human health,

5.2 Average Noise level of some common noise sources

5.3 Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18 hr Index).

5.4 Noise pollution control.

Text Book:

1. A Textbook of Environmental Studies, ShashiChawla. 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.

Department: ***Applied Electronics and Instrumentation Engineering***

Curriculum Structure & Syllabus

(Effective from 2018-19 admission batch)

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

5th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	HS	HU502	Economics for Engineers	2	0	0	2	2
2	PC	EI 501	Industrial Instrumentation	3	0	0	3	3
3	PC	EI 502	Analog & Digital Communication Theory	3	0	0	3	3
4	PC	EI 503	Control Engineering	3	1	0	4	4
5	PE	EI 504A	Optoelectronics &Fibre Optic Sensors	3	0	0	3	3
		EI 504B	Soft Computing					
		EI 504C	IoT based Instrumentation System					
Total of Theory							**15**	**15**
B. PRACTICAL								
6	PC	EI 591	Industrial Instrumentation Lab	0	0	3	3	1.5
7	PC	EI 592	Analog & Digital Communication Lab	0	0	3	3	1.5
8	PC	EI 593	Control Engineering Lab	0	0	3	3	1.5
9	PROJ	PR 591	Project-V	0	0	2	2	1
10	PROJ*	PR 592	Innovative activities-IV	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 501	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**29**	**21**

Course Name: Economics For Engineers
Course Code: HU 502
Contact:2:0:0
Credits: 2
Total Contact Hours: 24

Prerequisites: NIL

Course Objective:

- To develop decision making skills using basic economic Principles
- To educate the students in evaluating various Business Projects

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 of 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

Text Books:

1. Economics,by Lipsey and Chrystal, Oxford university Press
2. Modern Accountancy,vol.-I-, by Hanif &Mukherjee,TataMgrowHill

References:

1. Modern Economic Theory ,by K.K. Dewett, S.Chand
2. Principles of Economics,by H.L. Ahuja, S. Chand
3. Engineering Economics,by R.PaneerSeelvan, PHI
4. Economics for Engineers, by Dr. Shantanu Chakraborty &Dr. Nilanjana singharoy, Law Point Publication

CO-PO mapping:

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

Course Name: Industrial Instrumentation
Course Code: EI501
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of Sensor & Transducer, Measurement

Course Objective:

1. To understand the importance of different industrial instruments.
2. To understand the working principle of different measuring instruments.
3. To measure different physical parameters like pressure, temperature, flow rate, level etc
4. To install the different instruments.

Course Outcome:

CO1: Able to explain working principle of different measuring instruments

CO2: Able to Describe the specification of different instruments and advantages and disadvantages.

CO3: Able to Measure different physical parameters like pressure, temperature, flow rate, level etc

CO4: Able to install the instrument

Module I : Measurement of Pressure and Vacuum : [6L]

Manometers – U tube, Inclined Tube and Well type Manometers, Characteristics of Elastic Pressure Sensor, Bourdon Tube Pressure Gauge, Diaphragm, Bellows, Capsule Gauge, Differential Pressure Gauge, Pressure Switch, DP transmitters, McLeod Gauge, thermal conductivity gauge, ionization gauge.

Module II : Flow rate Measurement: [11L]

Types of Flow, Reynolds's number, Bernoulli's Equation, Calibration of flow meters,
Head type flow measurement – analysis and calculation - orifice, venturi, pitot tube, flow nozzle,
Variable Area Flowmeters – Glass and metal tube rotameters,
Mass flow meters : Coriolis, Thermal, Impeller type,
Electromagnetic type, Ultrasonic type, Positive displacement type

Module III : Level Measurement: [5L]

Gauge glass, Bi-Colour, Magnetic and Reflex Level Gauge, Float and displacers type instruments, Hydrostatic type level measurement, Capacitive type level instrument, Ultrasonic and Microwave type level instruments

Module IV : Temperature Measurement: [9L]

Temperature scale, Thermometers: Liquid, vapour and gas filled: construction details and comparison, Bimetal elements, Thermostats,
RTD: review of materials, construction, types; measuring circuits, ranges, errors and minimization of errors,
Thermocouples: types, thermoelectric power, circuits, ranges, errors, cold junction compensation, compensating cables, Linearization techniques of thermocouples, Thermopile, thermowell. Thermistors,
Radiation Thermometer sensors: spectral and other characteristics, Pyrometers.

Module V: [5L]

Installation of pressure measuring instruments and Temperature elements

Pneumatic Instrumentation : Flapper nozzle system - pneumatic force balance and motion balance system , Pneumatic Transmitter.

Hazardous Area Instrumentation: Basic Concept

Text Books:

1. D. Patranabis, 'Principles of industrial Instrumentation', TMH, New Delhi, 2nd Ed
2. S.K.Singh:'Industrial instrumentation And Control' TMH, New Delhi, Third edition,
3. Arun Kumar Ghosh: 'Introduction to Measurement & Instrumentation', PHI, New Delhi, 4th edition.
4. K.Krishnaswamy, S.Vijayachitra: 'Industrial Instrumentation',New age International Publishers, 2nd edition.
5. B. G. Liptak: 'Instrument Engineers Handbook', vol-I and vol-II, Chilton Book Co. Philadelphia
6. Ernest O. Doeblin, 'Measurement Systems – Application and Design', Tata-McGraw Hill
7. 7.S.K.Sen, 'Measurement Techniques in Industrial Instrumentation',New Age International.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	3	2	3	-	-	-	3	-	-	-	1	2
CO2	-	-	1	-	-	-	-	-	-	-	-	-
CO3	2	-	2	-	1	-	**2**	-	-	-	-	-
CO4	-	-	2	-	-	**2**	**2**	-	-	-	-	-

Course Name: Analog & Digital Communication Theory
Course Code: EI 502
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Signals and Systems, Analog and digital electronic circuits

Course Objectives:

1. To understand the building blocks of communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a communication system.
4. To analyze error performance of a communication system in presence of noise and other interferences.
5. To understand concept of spread spectrum communication system.

Course Outcome

CO1: Able to analyze the performance of a baseband and pass band communication system in terms of error rate and spectral efficiency.
CO2: Able to perform the time and frequency domain analysis of the signals in a communication system.
CO3: Able to select the blocks in a design of communication system.
CO4: Able to analyze Performance of spread spectrum communication system.

Module I: Elements of communication system: [10L]

The basic elements of a communication system, Concept of transmitter and receiver, origin of noise and its effects in communication system, Concept and effects of SNR and its importance in system design.
Linear (AM) modulation, Generation and demodulation of AM wave. Concept of DSBSC, SSBSC and brief discussion of VSBSC. Concept of QAM.
Basic principle of nonlinear (FM, PM) modulation and their relations. Generation and demodulation of FM waves.

Module II: Sampling and Pulse Modulation techniques: [8L]

Sampling theorem, sampling rate, impulse sampling, natural & flat topped sampling, reconstruction of signal from samples, Concept of Aliasing and anti-aliasing filter.
Quantization noise, Uniform quantization, Non-uniform quantization, A-law and μ-law.
A/D and D/A conversion techniques, Concept of Bit rate, Baud rate, M-ary encoding.
Analog pulse modulation-PAM, PWM, PPM.
Fundamentals of PCM, Block diagram of PCM, basic concept of Delta modulation, Adaptive delta modulation.
Introduction to DPCM.
Different types of multiplexing: TDM, FDM.

Module III: Digital Transmission: : [8L]

Basic concept of Digital communication, comparative study of digital communication and analog communication.
Encoding, coding efficiency. Line coding & its desirable properties, Different types of line coding: NRZ & RZ, AMI, Manchester coding and their spectra.
Base band pulse transmission, optimum filter, Matched filter and correlation filter, Inter Symbol Interference (ISI), Eye pattern, Signal power in binary digital signal.

Module IV: Digital carrier modulation & demodulation technique: [6L]

Introduction to the digital modulation techniques- ASK. FSK, PSK, BPSK, QPSK, M-ary PSK and their comparisons. Basic concept of spread spectrum modulation and CDMA.

Module V: Introduction to coding theory: [4L]

Introduction, Measurement of Information and its unit, Entropy, Mutual information, Information rate, Basic principle of error control & error correction coding.

Text Books:

1. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford University press
2. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, S. K. Kataria& Sons
3. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
4. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.

Reference Books:

1. Digital and Analog communication Systems, Leon W Couch II, Pearson, Education Asia.
2. An Introduction to Analog and Digital communication, Simon Haykin, Wiley India.
3. Principles of Communication Systems, Taub and Schilling, Tata McGraw-Hill Education

CO-PO Mapping:

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

Course Name: Control Engineering
Course Code: EI 503
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

The students to whom this course will offer must have the Knowledge of electrical measurement systems, basic laws of mathematics and formulation of integral and differential equations.

Course Objective:

1. To construct the model of a physical dynamical system by a linear time invariant ordinary differential equation
2. To analyze the under-damped, over-damped and critically damped cases of a second order system in time domain.
3. To illustrate the effects of poles and zeros location in the s-plane on the transient and steady state behavior of a system.
4. To determine the system stability in frequency domain.
5. To explain the effects of Lead, Lag and Lag-Lead compensator on second order System

Course Outcome:

CO1: Apply Laplace transform and state space techniques to model dynamic systems.
CO2: Demonstrate an understanding of the fundamentals of control systems.
CO3: Determine the time domain responses of first and second-order systems.
CO4: Analyze the system behavior in frequency domain & the system stability using compensator.

Course Content:

Module I: Mathematical Model of Physical System & Analysis in Time Domain (12L)

Introduction to Elementary control concepts:-Brief introduction, Applications area. Open loop and close loop system and their comparison. Mathematical Model of Physical Systems:- Introduction, Differential equation representation of physical systems, Transfer function concepts, Block diagram algebra, Signal flow graphs :- Mason's gain formula. Time Response Analysis: - Introduction, Review of standard test signals-Step , Ramp , Impulse , sinusoid .Time response of first order system, Design specifications of first order systems, Time response of second order systems, Design specifications of second order systems.

Module II: Stability Analysis of System in Time Domain (10L)

Stability Analysis in Time Domain: The concept of stability, Assessment of stability from pole positions, Necessary conditions for stability, Routh Stability Criterion, Relative stability analysis, Illustrative examples. Root Locus Technique: Introduction, The root locus concept, Root locus construction rules, Root contours, Advantages & limitations, Relative stability analysis using root locus.

Module III: Stability Analysis of System in Frequency Domain (11L)

Frequency Response Analysis: Introduction, Performance Indices ,Frequency response of second order systems, Polar plots, Bode plots, All pass systems, Minimum-phase and Non-minimum-phase systems, Assessment of relative stability – Gain Margin and Phase Margin, examples. Stability Analysis in Frequency Domain: Introduction, A brief review of Principle of Argument, Nyquist stability criterion, Illustrative examples. Introduction to Design: The design problem, Concepts of cascade and feedback compensation, Realization of basic compensators- Lead, Lag, Lag-Lead

compensator. State variables: Concepts of state, state variables and state model, State models of linear continuous-time systems, Concept on Controllability and Observability.

TextBooks:

1. Modern Control. Engineering. Fifth Edition. Katsuhiko Ogata
2. CONTROL SYSTEMS: ENGINEERING, 5th Edition [I. J. Nagrath, M. Gopal]
3. Automatic Control Systems [FaridGolnaraghi, Benjamin C. Kuo]
4. NagoorKani. Edition, 2. Publisher, RBA Publications
5. Automatic Control Engineering, 5th Edition by Raven, Francis H atBiblio
6. Control Engineering: Theory and Practice [M. N. Bandyopadhyay]

ReferenceBooks:

1. Book. Modern Control Engineering. Marcel Dekker, Inc. New York, NY, USA ©2001
2. Classical Feedback Control by B. Lurie and P. Enright
3. Control Systems Engineering: Analysis and Design" by Norman S Nise
4. 2. Control Systems, Ambikapathy, Khanna Book Publishing Co. (P) Ltd., Delhi

CO-PO Mapping:

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

Course Name: Optoelectronics And Fibre Optic Sensors
Course Code: EI 504A
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of optics and semiconductor physics

Course Objective:

1. To make the learners understand the different aspects of optoelectronic sources
2. To make the learners understand the different aspects of optoelectronic detectors
3. To make the learners understand the different aspects of optical fiber
4. To make the learners understand the application and advantages of different fiber optic sensors

Course Outcome:

After the completion of the course, earner will be able to:

CO1: compare double heterojunction LED, surface emitter LED, edge emitter LED, super luminescent LED, and semiconductor based LASER (p-n junction laser, double heterojunction laser, stripe geometry) as optoelectronic sources based on working principles and applications

CO2:compare optoelectronic detectors (p-n photodiode, p-i-n photodiode, avalanche photo diode, Schottky photodiode, hetero junction diode, phototransistor, LDR, photovoltaic cells, photo emissive cells) based on detector parameters, which are responsivity, efficiency, and working principle

CO3: select a suitable optical fiber for an engineering application, based on number of modes required, distance to be covered and V-parameter

CO4: justify the selection of intensity modulated fiber optic sensors, phase modulated fiber optic sensors, and spectrally modulatedfiber optic sensors for engineering applications, which are measurement of temperature, pressure, displacement, and liquid level. Justify optical fiber as communication channel,

Course content:

Module I: Optoelectronic sources and laser (8L)

Optoelectronics: Characteristics of optical emission, electro-luminescence, optical emission from p-n junction, direct bandgap and indirect band gap materials.

LED: spontaneous emission, power and efficiency calculation, materials of LED, structure of LED and its characteristics, double heterojunction LED, surface emitter LED, edge emitter LED, superluminescent LED.

Laser: Einstein relations, population inversion, 3- and 4-energy level systems, optical pumping, modes of laser, lasing materials-gaseous, liquid, and solid.

Semiconductor based lasers – p-n junction laser, double heterojunction laser, stripe geometry.

Holography.

Module II: Optoelectronic detectors (8L)

Optical detection principle, quantum efficiency, responsivity.

Photo diode: p-n photodiode, p-i-n photodiode, avalanche photo diode, Schottky photodiode, hetero junction diode, phototransistor

LDR, photovoltaic cells, photo emissive cells - types, materials, construction, response.

Opto-couplers – components, characteristics, noise figures, applications

Module III: Optical fiber and fiber optics (8L)

Fiber optics: Optical fiber – materials, construction, step index and graded index fibres, ray propagation. Modes in optical fibres, intermodal dispersion. Single mode and multimode fiber, attenuation and dispersion in single mode and multimode optical fibers

Active fiber

Optical fiber coupling- splices and connectors

Module IV: Fiber optic sensors (8L)

Fibre-optic sensors: advantages, intrinsic and extrinsic sensors

Classification- intensity modulated sensors, phase modulated sensors, spectrally modulated sensors.

Fibre optic sensors for Industrial applications: temperature, displacement, pressure and liquid-level sensors.

Fiber optic interferometer- Mach –Zahnder interferometer, Sagnac interferometer

Module V: Fiber optic communication (8L)

Introduction, block diagram of basic fiber optic communication system, advantages and disadvantages, introduction to repeater, comparison of WDM and OFDM

Books:

1. P. Bhattacharjee, *Semiconductor Optoelectronic Devices*, PHI
2. John Wilson and John Hawkes, *Optoelectronics- An Introduction*, PHI
3. John M. Senior, *Optical Fibre Communications*, PHI
4. R.P. Khare, *Fiber Optics and Optoelectronics*, Oxford

CO-PO Mapping:

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

Course Name: Soft Computing
Course Code: EI 504B
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of set theory, nervous system, and biological evolution

Course Objective:

1. To make the learners understand the advantages of soft computing techniques
2.To make the learners understand the different aspects of fuzzy logic and fuzzy reasoning
3. To make the learners understand the different aspects of artificial neural networks
4.To make the learners understand the different aspects of genetic algorithm

Course Outcome:

After the completion of the course, earner will be able to:

CO1: justify the use of fuzzy logic for decision making in presence of uncertainty
CO2: design a fuzzy logic control system for a continuous-time plant with single i/p-single o/p
CO3: compare the supervised and unsupervised learning techniques in artificial neural networks
CO4: explain the operation of genetic algorithm based optimization technique

Course content:

Module I: Soft Computing and Fuzzy logic (10L)
Soft-computing-definition, advantage over conventional computing, areas of application
Fuzzy Sets, membership function and membership value, linguistic variable
Fuzzy operators, T- Norms and S- Norms
Fuzzy relations, implications, cylindrical extensions, projection
Fuzzification and defuzzification

Module II: Fuzzy reasoning and fuzzy logic control (12L)
Fuzzy extension principle, compositional rule of inference, approximate reasoning (fuzzy reasoning)
Different Fuzzy models-Mamdani's model, Sugeno's model (T-S-K model)
Fuzzy logic control system, fuzzy PID controller

Module III: Genetic algorithm (5L)
Genetic Algorithm (GA)- basic concept, components-chromosome and gene, GA operators, methods of selection, elitism
Fuzzy-GA system

Module IV:Artificial neural networks (9L)
Artificial neural network (ANN)- basic concept, areas of application, McCulloch and Pitts model, perceptron, realization of logic gates, training of ANN, Supervised and unsupervised learning- techniques and comparison
Neuro-fuzzy system

Books:

1. D.Dirankov, H. Hellendoorn, and M.Reinfrank, *An Introduction to Fuzzy logic control*,Narosa
2. S.Rajasekaran and G.A.V. Pai, *Neural Networks, Fuzzy logic and Genetic Algorithm: Synthesys and Applications*, Pearson Education
3. J.S.R.Jang, C.T. Sun and, E.Mizutani, *Neuro-fuzzy and soft Computing*, Pearson Education
4. T.J.Ross, *Fuzzy Logic with Engineering Applications*, Wiley (India)
5. Simon Haykin, *Neural Networks- A Comprehensive Foundation*, Prentice Hall

6. B.Yegnanarayana, *Artificial Neural Networks*, PHI

CO-PO Mapping:

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

Course Name: IoT Based Instrumentation System
Course Code: EI504C
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

1. Microprocessor, Microcontroller & Computer Networking

Course Objective:

2. To introduce IOT Devices.
3. To acquire the basic knowledge to design & develop IOT Devices.
4. To Understand State of the Art – IoT Architecture.
5. To Understand Hardware platforms and operating systems commonly used in IoT systems.

Course Outcome:

After the completion of the course, the students will be
CO1: Able to understand the building blocks of IoT Technology.
CO2: Able to understand the application areas of IoT ·
CO3: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO4: Able to use processors & peripherals to design & build IoT hardware.

Module I: Introduction to IoT: [8L]

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models, Machine-to-Machine Communications

Module II: Network & Communication aspects [8L]

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery

Module III:Developing IoTs [12L]

Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino. Introduction to Python programming, Introduction to Raspberry Picture, developing sensor based application through embedded system platform, Implementation of IoT with Raspberry Pi

Module IV: Data handling & Domain specific applications of IoT [8L]

Data Handling and Analytics, Cloud Computing, Sensor cloud, Fog computing. Applications: Smart Cities and Smart Homes, Smart Grid, Industrial Io

Text Books :

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti (Universities Press).

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2
CO1	2	2	2	2	2	1	1	1	1	1	1	1
CO2	2	3	3	1	2	2	2	1	1	2	1	2
CO3	3	3	1	3	3	2	1	1	1	2	1	2
CO4	3	3	2	3	3	2	1	1	1	1	1	1

Course Name:Industrial Instrumentation Lab
Course Code :EI 591
Contact :0:0:3
Credits : 1.5

Course Objectives:

1. To understand the importance of calibration of different industrial instruments.
2. To measure different physical parameters like pressure, temperature, flow rate, level etc
3. To understand the working principle of different measuring instruments
4. To choose the suitable instrument for desired measuring parameter.

Course Outcomes:

CO1: Able to calibrate different instruments.
CO2: Able to measure different industrial parameter like pressure, temperature, flow,level etc.
CO3: Able to understand the working principle of different instruments
CO4: Able to choose the suitable instrument for desired measuring parameter.

Experiments:

1. Calibration of Pressure Gauge using Dead Weight Tester
2. Study of Thermocouple characteristics and Measurement of Temperature.
3. Study of Thermistor characteristics and Measurement of Temperature.
4. Study of RTD characteristics and Measurement of Temperature.
5. Measurement of temperature using AD590
6. Measurements of flow rate and velocity of fluid flow by head type flow meter.
7. Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter
8. Measurement of level using capacitive type level instrument.
9. Measurement of moisture using moisture analyzer
10. Measurement of viscosity
11. Innovative Experiment

CO-PO Mapping:

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

Course Name: Analog & Digital Communication Lab
Course Code: EI 592
Contact : 0:0:3
Credits : 1.5

Course Objective:

The course objectives are to enable the students to

1. Understand the fundamental concepts of communication systems.
2. Understand and compare different analog modulation schemes.
3. Understand and compare different digital modulation schemes.
4. Understand the design tradeoffs and performance of communications systems.
5. Learn about practical communication systems

Course Outcome:

CO1: To learn signal and linear time invariant system properties.

CO2: Study, design, and build modulation systems examining trade-offs indifferent communication systems.

CO3: To be able to perform experiments in converting analog informationinto digital data via sampling, quantization, and coding.

CO4: To be able to choose necessary modulation technique for specificsignal transmission.

Experiments: -

1. Observation of modulation index in Amplitude modulation and construction of envelope for different values of modulation index.
2. Observation and generation of Double Side Band Suppressed Carrier (DSB-SC) signal.
3. Observation and generation of Single Side Band Suppressed Carrier (SSB-SC) signal.
4. Observation of Frequency Modulation & Demodulation and calculation of modulation index.
5. Generation of Time Division Multiplexing (TDM) &Demultiplexing interlacing several sampled signal using PAM.
6. To interpret Pulse Amplitude Modulation (PAM) and demodulation for various modulating voltages.
7. Generation of Pulse Width Modulation (PWM) and demodulation for various modulating voltages.
8. To analyze a FSK modulation system and interpret the modulated and demodulated waveforms.
9. Innovative Experiment

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

Course Name: Control Engineering Laboratory
Course Code: EI 593
Contact: 0:0:3
Credits: 1.5

Prerequisite:

Student should have the knowledge of MATLAB with SIMULINK

Course Objective:

1. Will have a strong knowledge on MATLAB software..
2. They get the basic knowledge on practical control system.
3. To get the Design applications of control system.
4. They get the knowledge of stability analysis of different control systems.

Course Outcome:

The students will be able to:

CO1. Apply formulate transfer function for given control system problems.
CO2. Demonstrate an understanding of the fundamentals of control systems.
CO3. Determine time response of given control system model.
CO4. Analyze the system behavior through Root Locus, Bode plots & Nyquist plot fora given control system model.

List of Experiments:

1. Familiarization with MATLAB & SIMULINK control system toolbox.

2. Study of impulse, step, ramp & sinusoidal response for first and second order system with unity feedback and calculation of parameters for different system designs.

4. Modelling of a first order system and its response analysis.

5. Modelling of a second order system and its response analysis.

6. Simulation of impulse response for types 0, 1 and 2 with unity feedback using MATLAB.

7. Determination of root-locus, using MATLAB toolbox for a given second order transfer function and analysis of result.

8. Bode plot, using MATLAB toolbox for a given second order transfer function and analysis of result.

9. Nyquist plot using MATLAB toolbox for a given second order transfer function and analysis of result.

10. Study of position control system (AC/DC).

11. Innovative Experiment

TextBooks:

1: B. C. Kuo “Automatic Control Systems” 8th edition– by 2003– John wiley and son’s.,
2: I. J. Nagrath and M. Gopal, “Control Systems Engineering” New Age International (P) Limited, Publishers, 2nd edition.

Reference Books:

1:Katsuhiko Ogata "Modern Control Engineering" Prentice Hall of India Pvt. Ltd., 3rd Edition, 1998.
2: N.K.Sinha, "Control Systems" New Age International (P) Limited Publishers, 3rd Edition, 1998.
3: NISE "Control Systems Engg." 5th Edition – John wiley
4:Narciso F. Macia George J.
Thaler, "Modeling & Control of Dynamic Systems" Thomson Publishers

CO-PO Mapping:

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

Course Name: Constitution of India
Course Code: MC501
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

Department: ***Applied Electronics and Instrumentation Engineering Curriculum***

Structure & Syllabus

(Effective from 2018-19 admission batch)

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

6th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	PC	EI 601	Process Control-I	3	0	0	3	3
2	PE	EI 602	A. Bio Medical Instrumentation B. Advance Sensors C. Non Destructive Testing& UltrasonicInstrumentation	3	0	0	3	3
3	PE	EI 603	A. Analytical Instrumentation B. Non-Conventional Energy Sources C. Artificial Intelligence	3	0	0	3	3
4	OE	EI 604	A. Power Electronics B. Industrial Drives C. Robotics Engineering	3	0	0	3	3
5	OE	EI 605	A. Data Structures & Algorithms B. Database Management System C. Software Engineering	3	0	0	3	3
	Total of Theory						**15**	**15**
B. PRACTICAL								
6	PC	EI 691	Process Control Lab	0	0	3	3	1.5
7	OE	EI 692	A. Power Electronics Lab B. Industrial Drives Lab C. Robotics Engineering Lab	0	0	3	3	1.5
8	OE	EI 693	A. Data Structures & Algorithms Lab B. Database Management System Lab C. Software Engineering Lab	0	0	3	3	1.5
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 Presentation & Group Discussion-I	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							**29**	**21**

*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: Process Control-1
Course Code: EI601
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of Control Theory

Course Objective:

This course helps the student

1. To have a knowledge on basic process control loop & characteristics
2. To understand the different controller modes
3. To know about methods of tuning of controllers
4. To have a knowledge of final control element & different actuators
5. To apply the knowledge of Cascade, Ratio, Feed forward control to control a complex process
6. To provide knowledge levels needed for PLC programming and functioning.

Course Outcome:

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

CO1: Design a controller by applying the knowledge of different control action
CO2: Calculate controller parameters by applying different tuning methods
CO3: Describe different advanced control strategy
CO4 : State the operation and use of final control element
CO5 : Develop ladder logic programs and understand basics of DCS

Module I: [10]

General Review of Process, Process Control and Automation. Servo and Regulatory Control, Basic process Control loop block diagram. Characteristic parameters of a process – Process Quantity, Process Potential, Process Resistance, Process Capacitance, Process Lag, Self Regulation Characteristics and functions of different modes of control actions : Schemes and analysis of On-Off, Multistep, Floating, Time Proportional, Proportional, Integral, Derivative, PI,PD & PID control Electronic PID controller design, Pneumatic Controllers - brief analysis

Module II:[5]

Process Reaction Curves, Controllability - using (i) deviation reduction factors (ii) gain bandwidth product, State Controllability ,Tuning of Controllers: both Closed and Open loop methods (Ziegler – Nichols, Cohen – Coon, PRC method and 3-C method of parameter adjustment)

Module III:[12]

Different control strategies - schemes, brief analysis and uses
(i) Ratio control
(ii)Cascade control
(iii)Feedforward control
(iv)Multivariable control
Final Control Element: Actuators (Pneumatic Actuators, Electrical Actuators) and Control Valves (Globe, Ball, Butterfly, Gate, Pinch), Different Parts, Fail Position, Valve characteristics, Cv, Single & Double Seated Valves, Valve sizing, Valve selection, Cavitation, Flashing, Noise
Control Valve Accessories – Air Filter Regulator, I/P Converter

Brief study of Safety Valves and Solenoid valves

Module IV:[9]

Introduction to Programmable Logic Controllers (PLCs) – Basic Architecture and Functions; Input-Output Modules and Interfacing; CPU and Memory; Relays, Timers, Counters and their uses; PLC Programming and Applications.
Introduction to DCS: overview, block diagram

Books:

1) D. Patranabis, Principles of Process Control, TMH, New Delhi, 2nd Ed.
2) D. P. Eckman, Automatic Process control, John Wiley, New York
3) Surekha Bhanot, Process Control Principal & Application, Oxford
4) B. W. Bequette, Process Control – Modeling, Design and Simulation, PHI
5) D. R. Coughanowr, Process Systems Analysis and Control, McGraw Hill
6) G. Stephanopoulos, Chemical process Control, PHI
7) C. D. Johnson, Process Control Instrumentation Technology, PHI
8) B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia

CO-PO Mapping:

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

Course Name: Biomedical Instrumentation
Course Code: EI 602A
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Sensors & Transducers, Signal Processing

Course Objectives:

1. To understand the various systems of the human physiology and signals of biological origin obtained from various systems,
2. To analyse various biosensors, transducers and bio-potential electrodes used to acquire various bio-potentials.
3. To understand various methods of measurement of blood pressure, blood flow, heart sounds and pacemaker
4. To familiarize with various amplifiers for measuring biopotentials.
5. To acquire knowledge about Electrical safety of medical devices and their protective measures.

Course Outcome

After completion of this course, the students will be able to
CO1: Able to understand the detailed physiology of various human anatomical systems.
CO2: Able to identify proper transducer for acquisition of a particular bioelectric potential.
CO3: Able to analyse various biological conditions from the measured bioelectric potentials.
CO4: Able to design biotelemetry systems for acquiring bioelectric potentials from long distance.

Module I: Physiology of various anatomical systems:[6L]

Introduction to the physiology of cardiac, nervous, muscular and respiratory systems

Module II: Bioelectric potential and measuring transducers: [8L]

Bioelectric potentials: Definitions, types, range, basic characteristics. resting and action potential
Different types of transducers and electrodes: construction, selection for acquiring various bio-potentials

Module III: Measurements on cardiovascular and respiratory system [12L]

Blood pressure - characteristics of blood flow - Heart sounds - ECG - Measurement of blood pressure, blood flow, heart sounds and Cardiac pace-maker: types and its detail instrumentation.

Module IV: Electrical activities in brain and muscles: [2L]

Electromyography and Electroencephalograph: characteristics, measurements and signal analysis.

Module V: Medical Imaging Techniques [4L]

Ultrasound imaging and IR Imaging: image acquisition technique and analysis, MRI

Module VI: Biotelemetry [2L]

Transmission and Reception aspects of Biological signals over long distances.

Module VII: Measurement Errors and safety issues [2L]

Errors in bio-potential measurement, types and methods to minimize errors
Electrical- Safety codes and standards, basic approaches to protection against shock, power distribution protection, equipment protection

Text Books:

1. Cromwell L – Biomedical Instrumentation and Measurement, Pearson
2. Khandpur R.S., Hand book of Biomedical Instrumentation, Tata McGraw Hill
3. Webster J S – Medical Instrumentation – Application and Design
4. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.
5. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning

CO-PO Mapping:

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

Course Name: Advanced Sensors

Course Code: EI 602B
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

Student should have Knowledge of Sensor & Transducer; Fabrication techniques.

Course Objective:

1. To understand basics of sensors, actuators and their operating principle.
2. To educate the students on different types of microfabrication techniques for designing and developing sensors (Several applications from Electronics to Biomedical will be covered).
3. To explain working of various types of electrochemical sensors and actuators.
4. To provide information about interfacing of sensors and signal conditioning circuits to establish any control system or monitoring system.
5. To provide an understanding on characteristic parameters to evaluate sensor performance.

Course Outcome:

Students will be able to

CO1 Explain different techniques of sensors designing parameters.
CO2 Determine the specification of different types of sensors.
CO3 Understand and compare the different micro sensor development technique.
CO4 Design & Apply the micro sensors using different technique.

CourseContent:

Module I: Sensor Signal conditioning & Reliability [12L]

Design techniques of signal conditioning for different sensors
Sensor reliability, reliability models and testing, ageing tests, failure mechanisms and their evaluation, stability studies

Module II: Micro Sensor & MEMS: Introduction & Application [12L]

Historical Development of Microelectronics, Evolution of Micro sensors, Evolution of MEMS, Emergence of Micro machines, Sensor Systems, Sensors types and classification, Mechanical Sensors, Acoustic Sensors, Magnetic Sensors, Thermal Sensors, Optical sensors Chemical Sensors, Radiation Sensors and Biosensors. Micro sensors, Sensors based on surface-acoustic wave devices. Review of Fabrication Techniques (Lithography, PVD, CVD, RIE), Applications

Module III: Smart Sensors [12L]

Importance and Adoption of Smart Sensors, Architecture of Smart Sensors: Important components, their features, Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapour, Anodization, Sol- gel, Interface Electronic Circuit for

Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor and Future scope of research in smart sensor

Text Books:

1. Triethy HL - Transducers in Electronic and Meachanical Design, Mercel Dekker 1986
2. D. Patranabis – Sensor and Transducers (2e) Prentice Hall, New Delhi, 2003
3. Silicon Sensors – Middlehoek S and Audel S. A. – Academic Press, London 1989
4. Chemical Sensors – Edmonds T. E. (Ed); Blackie – London, 1988
5. Problems and possibilities of oxidic and organic semiconductor gas sensors, G. Heiland and D. Kohl, Sensors andActuators, Volume 8, Issue 3, November 1985, Pages 227-233.
6. Thick-film sensors: an overview, Maria Prudenziati and Bruno Morten, Sensors and Actuators, Volume 10, Issues 1–2,10 September 1986, Pages 65-82.
7. The use of polymer materials as sensitive elements in physical and chemical sensors, F.J. Gutierrez Monreal, Claudio M. Mari,Sensors and Actuators, Volume 12, Issue 2, August–September 1987, Pages 129-144.

Reference Books:

1. Principles of Measurement systems John P. Bentley, Third edition 2000, Pearson Education Asia pvt. Ltd.
2. Understanding Smart Sensors, Randy Frank, Second edition, Artech House sensors library.
3. Sensors Handbook, Sabrie Soloman, McGraw-Hill, 1999
4. Sensors, Nanoscience, Biomedical engineering and instruments, Richard C. Dorf, CRC Press, Taylor and Francis group USA

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	3	**1**	-	-	3	-	-	-	1	1
CO2	**1**	**3**	1	-	-	-	-	-	-	-	-	1
CO3	3	-	3	-	1	-	-	-	-	-	**1**	-
CO4	3	3	1	**3**	-	-	-	-	-	-	**1**	2

Course Name: Non Destructive Testing and Ultrasonic Instrumentation

Course Code: EI602C
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Course Objective:

The objective is to impart an in-depth knowledge on the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.
This course Non Destructive Testing and Ultrasonic Instrumentation (EI602C)helps the student

- To introduce the basic principles, techniques, equipment, applications and limitations of NDT methods
- To enable selection of appropriate NDT methods
- To identify advantages and limitations of nondestructive testing methods

Course Outcome:

On the completion of this course, students will be able to

CO1.Understand the concept of non destructive testing
CO2.Describe the various types of NDT tests carried out on components
CO3.Analyze the different types of test carried out on components and surfaces.
CO4.Understand the properties of materials suitable for NDT.

Module I: [8L]

Introduction and importance of NDT. General Principles and Basic Elements of NDT ,
Overview of the Non Destructive Testing Methods
Surface feature inspection and testing: General, Visual, Chemical, and Mechanical
Optical - laser probe, holography

Module II: [6L]

Magnetic - magnetization, flux, and Electro potential, Electrical resistivity,
Electromagnetic - eddy current techniques, Penetrant, Radiation backscatter

Module III: [8L]

Sub - surface (Internal feature inspection and Testing: Thermal - temperature sensing, Electrical resistivity
X rays - refraction / diffraction and fluorescence, Gamma rays - radiography. IQI (image quality indicator), Xerography,
Image intensification methods, Electron microscopic techniques. ISO specifications and other certifications.

Module IV: [8L]

Ultrasonic waves, Basic principle of propagation ,Principle of Ultrasonic Test, Their Advantages and limitations
Ultrasonic Test methods: Echo, Transit time, Resonance, Direct contact and immersion types
longitudinal and shear wave methods, acousticemission methods
Ultrasonic surface wave probing

Module V: [6L]

Ultrasonic methods of measuring thickness, depth, flow, level etc. Various parameters affecting ultrasonic testing and measurements, their remedy

TEXT BOOKS-

1. Mclutive p (Ed) – NDT Handbook, American Society for NDT, 1989.
2. Hull B and John V – Non Destructive Testing, FI BS/McMillan.
3. Krantkramer - Ultrasonic Testing of materials, Springer 2005
4. Handbook of Nondestructive Testing, McGraw Hill, 1998
5. J. M. Farley and R. W. Nichols – Non Destructive Testing, Proceedings of the 4th European Conference, London; UK, September 1987, Pergmon Press.
6. Balder Raj, T. Jayakumar and M. Thavasimuthu – Practical Non Destructive Testing, 2nd Edition, Narosa.

CO-PO Mapping:

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

Course Name: Analytical Instrumentation

Course Code: EI603A
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of measurement methods of various process parameters

Course Objective:

1. To elaborate the physical properties of samples like pH, viscosity, humidity and moisture
2. To analyse various methods to identify the compositions of various media
3. To explain the function and importance of analyzer sample systems.
4. To describe the operating principles of numerous types of analytical instruments and analyzers.

Course Outcome:

After completion of the course, the students will be

CO1: able to determine the physical properties of samples like pH, viscosity, humidity and moisture.

CO2: able to quantitatively measure the composition of various gas and liquid samples.

CO3: able to identify the elements present in the given sample using analytical techniques.

CO4: able to apply and use chromatography in real time industrial environments.

Module I:Introduction to Analytical Instrumentation [8]

Measurement of Humidity: dry & wet psychrometer, hair hygrometer, Electrolysis type hygrometer
Moisture: electrical conductivity type, capacitive method type, IR method
Viscosity: Saybolt's viscometer, rotameter type viscometer, Searle's rotating cylinder type
Density: pressure head type, buoyancy effect type, radioactive type, photoelectric type, displacer type
Gas Analysis: a) Thermal conductivity method
b) Heat of Reaction method.
Oxygen Analysis: a) Magneto Dynamic instrument (Pauling cell)
b) Thermomagnetic type or Hot wire type instrument.
c) Zirconia oxygen analyzer.

Module II: Liquid analysis [9]

a) Electrodes-Ion selective, Molecular selective types- their variations.
b) pH analysis: pH electrodes, circuit for pH measurement and applications.
c) Conductivity cells – standards, circuits.
d) Polarography- apparatus, circuits and techniques-pulse polarography, applications
e) Colorimetry

Module III: Spectroscopic Methods [12]

Introduction, Laws relating to absorption of radiation, Molecular Absorption Spectroscopy in UV & VIS ranges: sources, wavelength selectors, sample container, detectors
Spectrophotometers (Single beam & Dual beam arrangement)
Atomic Absorption & Emission spectroscopy : Atomizers, sources, single & dual beam arrangement.

Atomic X Ray spectrometry : Absorption & diffraction phenomena, sources, detectors, techniques. IR Spectroscopy : sources, monochromators, detectors. IR Spectrometer, FT-IR spectrometers. Introduction to NMR

Module IV: Chromatography [7]

Introduction, basic definitions, some relationships. Gas chromatography : basic parts, columns ,detectors, techniques. LC : types, HPLC : basic parts, sample injection system, column, detectors, Applications..

Books:

Principles of Industrial Instrumentation- D.C. Patranabis, Publisher: Tata McGraw Hill
Analytical Instrumentation- B.G. Liptak
Principles of Instrumental Analysis- Skoog, Holler, Nieman, Publisher: Thomson Brooks/Cole
Introduction to Instrumental Analysis- Robert D. Braun, Publisher: Pharma Book Syndicate
Handbook of Analytical Instruments- R.S. Khandpur, Publisher: Tata McGraw Hill

CO-PO mapping:

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

Course Name: Non-Conventional Energy Sources
Course Code: EI603B
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:
Student requires the knowledge of basic chemistry & physics; Knowledge of basic thermodynamics.

Course Objective:

1. To know different nonconventional energy resources.
2. To explain the different techniques of energy extraction from non-conventional energy resources.
3. To understand and compare the different energy conversion technique.
4. To choose and design the energy conversion plants after survey the suitability fruitfulness of the plant.

Course Outcome:
Student will be able to
CO1 Explain the different non-renewable sources.
CO2 Apply solar energy in different Field using photo voltaic cells.
CO3 Analyses the performance and testing of different energy resources.
CO4 Select the design parameters of the nonconventional energy plants.

Course Content:

Module I: Introduction to Energy Sources [2L]

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

Module II: Solar Energy & Applications photovoltaic cell [10L]

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. Flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; Photovoltaic - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems**.** Types and performance characteristics. Characteristics equivalent circuit photo voltaic effect photo voltaic for battery charging applications. Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, Solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. Solar cell power plant and limitations solar collectors.

Module III: Biomass Energy Systems: [4L]
Availability of Biomass and its conversion theory, production processes, Gasification, Anaerobic Digestion, Pyrolysis, Biogas, performance analysis and testing.

Module IV: Wind Energy: [8L]
Wind distribution, principles of wind energy conversion basic components of wind energy conversion advantages and disadvantages, principles of operation of wind turbines, types of wind turbines and characteristics, Generators

for wind Turbines, Control strategies. Performance and limitations of energy conversion systems.

Module V: Geothermal Ocean, wave & Tidal Energy [8L]

Resources of geothermal energy, thermodynamics of geothermal energy conversion- electrical conversion, non-electrical conversion, environmental considerations. Principle of working of various types of fuel cells and their working, performance and limitations. Ocean Thermal Energy conversion: Availability, theory and working principle, performance and limitations. Wave and Tidal wave: Principle of working, performance and limitations, waste recycling plants.

Text Books:

1. G.D.Rai"Non-Conventional Energy sources", Khanna publishers, New Delhi, 1999.
2. G.N.Tiwari and M.K.Ghosal, "Renewable energy resources, Basic principles and Applications", Narosa Publishing house, New Delhi.
3. S.N.Badra, D.Kastha and S.Banerjee"Wind electricalSustems", Oxford University press, New Delhi.
4. M.V.R.KoteswaraRao"Energy resourcesConventional&Non-conventional" BS publications Hyderabad, 2004.
5.Gilbert M.Masters "Renewable and Efficient electric power systems" Wileyinterscience Publications, 2004

Reference Books:

1. "Ecosystem Management and Non-Conventional Energy Sources" by Craig Zodikoff,
2. "Non-Conventional Energy System" by S.K. Agarwal,
3. Non-conventional Energy Systems" by K M Mital,
4. "Non-Conventional Energy Source and Utilization" by R K Rajput,
5. "Energy Technologies and Economics" by Patrick A Narbel and Jan R Lien,

CO-PO Mapping:

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

Course Name: Artificial Intelligence
Course Code: EI 603C
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

Basics of Design and Analysis of Algorithm.
A solid background in mathematics, includingprobability.

Course Objectives:

1. **To learn the overview of artificial intelligence principles and approaches.**
2. To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
3. This course also covers fundamental areas of Local Search Algorithms, Adversarial Searching and NeuralNetworks.

Course Outcome

On completion of the course students will be able to
CO1: **Understand** the concepts of Artificial intelligence
CO2: **Analyze** the dimensions along which agents and environments vary, along with key functions that must be implemented in a general agent
CO3: **Develop** intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
CO4: **Represent** knowledge of the world using logic and **infer** new facts from that Knowledge andworking knowledge in PROLOG in order to write simple PROLOG programs and **explore** more sophisticated PROLOG code on their own.

Module 1: Basics of AI [8L]

Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.
Intelligent Agents [2]
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.
Learning [4]
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Module 2: Different types of searching algorithms [12L]

Problem Solving [2]
Problems, Problem Space & search: Defining the problem as state space search, production system, constraint satisfaction problems, issues in the design of search programs.
Search techniques [3]
Solving problems by searching: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.
Heuristic search strategies [4]
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization

problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Module 3: Knowledge & Reasoning [12L]

Knowledge & Reasoning [3]

Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [4]

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [2]

Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [3]

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster- Shafer theory, Fuzzy sets, and fuzzy logics.

Module 4: Different fields of AI [4L]

Natural Language Processing [2]

Introduction, Syntactic processing, semantic analysis, discourse, and pragmatic processing.

Expert Systems [2]

Representing and using domain knowledge, expert system shells, and knowledge acquisition. Basic knowledge of programming language like Prolog

Text books:

- Artificial Intelligence, Ritch & Knight,TMH
- Artificial Intelligence, A Modern Approach, Stuart Russel, Peter Norvig,Pearson

Recommended books:

- Introduction to Artificial Intelligence & Expert Systems, Patterson,PHI
- Computational Intelligence, Poole, OUP
- Logic & Prolog Programming, Saroj Kaushik, New AgeInternational
- Expert Systems, Giarranto,VIKAS

CO-PO Mapping:

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

Course Name: Power Electronics
Course Code: EI604A
Contact:3:0:0
Credits: 3
Total Contact Hours: 36
Prerequisite: Knowledge of analog electronics & circuit theory.

Course Objective:

1. To understand the constructional features and characteristic of power semiconductor devices

2. To understand the working principle and switching operation of different semiconductor devices.

3. To prepare the students to analyze and design different power converter circuits.

4. To implement the different power supply modules.

Course Outcome:

CO1: Acquire knowledge about fundamental concepts and techniques used in power electronics.

CO2: Ability to express characteristics of SCR, BJT, MOSFET and IGBT.

CO3: Ability to analyze & design of various single phase and three phase power converter, inverters circuits and understand their applications.

CO4: To develop skills to build, and troubleshoot power electronics circuits like SMPS, Intelligent power module, etc's.

Module I: Power Semiconductor Devices & switching devices:[8L]

Rectifier diodes, fast recovery diode and Schottky barrier diode, BJT, Thyristor (SCR), TRIAC, GTO, MOSFET, IGBT and MCT.

Module II: Thyristor triggering & commutation techniques:[7L]

UJT and RC triggering circuit, resonant commutation, self commutation, auxiliary commutation, Complementary commutation.

Module III: Converters: [11L]

Rectifiers: Single phase and three phase controlled bridge rectifiers, DC to DC converters (Choppers): principle of step up and step down converters, DC to AC converters (inverters) : Single phase and three phase inverters, Cycloconverters : Single phase to single phase and three phase to single phase circuits, blocked group operation, circulating current mode.

Module IV: Applications: [8L]

Modern trends in industrial drives and control; AC motor drives in transportation system and traction; induction heating, electronic ballast, UPS, Intelligent power modules.

Books:

1. P.C. Sen, Power Electronics, TMH, New Delhi

2. M. H. Rashid, Power Electronics, PHI/Pearson Education

3. C. W. Lander, Power Electronics, Mc Graw Hill

5. Mohan N, Underland T M & Robbins W P – Power Electronics, John Wiley & Sons

6. P. S. Bimbhra – Power Electronics, Khanna Publishers

7.Soumitra Kumar Mandal- Power Electronics , Mc Graw Hill Education

CO-PO mapping:

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

Course Name: Industrial Drives
Course Code: EI604B
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of Electrical Machinesand Power Electronics.

Course Objectives:

1. To understand the importance of different industrial drives.
2. To understand the working principle of different types of industrial drives.
3. To classifyapplications in different industries.
4. To understand the different control techniques of industrial drives.

Course Outcome

CO1: Demonstrate the basic requirements of dc drive and ac drive.
CO2: Illustrate the principles of speed-control of dc motors and ac motors.
CO3: Classify the industrial applications of dc drive and ac drive.

Module I: AC Drives [14L]

Basic Elements of a Variable Frequency Drive (VFD), External Components in a typical Power and Control Circuit of a drive for a simple pump application, Drive Control modes: Variable Frequency Control, Sensorless Vector Control, Vector Control with sensor, Flux Vector Control, Direct Torque Control , Basic Specifications and Selection Procedure for AC Drives – with specific reference to Variable Torque and Constant Torque applications, Use of AC Drives for energy efficient production as applied to a) Pumps, Fans, Compressors, b) Hoisting, Breaking, Lowering, c) Conveyor Technology.

Module II: DC Drives [12L]

Modern DC Drives and its applications in a) Winders & Un-winders, b) Wire Drawing Machine, c) Bar Rolling Mill, d) Rotary Kiln, Basic Specifications and Selection Procedure for DC Drives.

Module III: Servo Motor and Servo Drives [10L]

Block Diagram of a typical Servo Controlled System with a) velocity and torque feedback, b) velocity and position feedback, DC and AC Servomotors, Selection of Servomotor for an application, Fundamentals of Axis Control and its implementation.

Text Books:

1. Fundamentals of Industrial Drives, B.N. Sarkar, PHI
2. Fundamentals of Electric Drives, Gopal K Dubey, Narosa
3. Electrical Drives And Control, U.A. Bakshi, M.V.Bakshi, Technical Publications

Reference Books:

1. Industrial Drives, Mukhtar Ahmad, MacMillan
2. Electric Drives, V Subramanyam, McGraw-Hill

3. Electric Drives, Boldea & Nasar, CRC
4. Vector Control of AC Drives, Boldea & Nasar, CRC

CO-PO Mapping:

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

Course Name: ROBOTICS ENGINEERING
Course Code: EI604C
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Course Objectives:

1. Impart knowledge about basic mathematics related to industrial robots for their control.
2. Design and application of robotics & automation in modern Industries.

Course Outcome

CO1: Perform kinematic and dynamic analyses with simulation. Designcontrol laws for a simple robot.
CO2: Integrate mechanical and electrical hardware for a real prototype of robotic device.
CO3:Select a robotic system for given industrial application.
CO4: Use of robots in domestic applications.

Module I: Introduction to Robotics: [6L]

Types and components of a robot, Classification of robots, Robotic kinematics systems; Concept of mechanisms and manipulators, Definition of Degrees of Freedom

Module II: Introduction to Robot Kinematics and Dynamics : [8L]

Concept of Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation, Forward and inverse kinematics, Jacobian, Singularity, and Statics,Denavit–Hartenberg parameters, Concept of Dynamic Modeling such as Forward and inverse dynamics, Equations of motion by using Euler-Lagrange formulation and Newton Euler formulation.

Module III: Robotic Sensors and Actuators: [5L]

Robotic Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. Introduction to Cameras, calibration techniques, Geometry of the Image formation, Different transforms such as Euclidean or Projective transformations, Different types of vision applications in robotics.

Actuators: Electric, Pneumatic and Hydraulic actuators, Parameters for selection of actuators, Transmission Gears, Timing Belts and Bearings.

Module IV: Robot Control: [7L]

Basics of control: open loop and closed loop, Definition of transfer functions, Control mechanisms, P, PD, PID, Linear and Non-linear controls.

Module V: Embedded Systems for Robotics and control hardware interfacing mechanisms: [6L]

Embedded Systems, Microprocessors and Microcontroller Architecture and interfacing with robotic sensors, actuators and other components, Programming techniques for Industrial robot.

Module VI: Artificial Intelligence in Robotics [4L]

Applications in unmanned systems, examples: defense, medical, industries, etc. Robotics and Automation for Industrial benefits, Robot safety and social robotics

Text Books:

1. Introduction to Robotics: J. Craig, Pearson
2. Robot Dynamics and Control, Spong&Vidyasagar, McGraw Hill
3. Robotics Engineering: R. Klafter, PHI
4. Robotics: Subir K Saha, McGrawHill
5. Industrial Robotics: M. P. Groover, AshishDutta, McGraw Hill

Reference Books:

1. Richard Paul, Robot Manipulators: Mathematics, Programming and Control, MIT Press, 1981
2. Robert Shilling, Fundamentals of Robotics, Prentice-Hall , 2003
3. Laxmidhar Behera and Indrani Kar, “Intelligent Systems and Control”, Oxford University Press, Nov 2009.
4. M. Felix Orlando, Laxmidhar Behera, Tomayo Tamei, Tomohiro Shibata, Ashish Dutta and Anupam Saxena," On Redundancy Resolution of the Human Thumb, Index and Middle Fingers in Cooperative Object Translation," Robotica, vol. 35, pp. 1992-2017, 2016.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	1	3	2	1	2	1	2	3
CO2	1	2	2	3	2	1	3	2	4	2	1	2
CO3	1	2	2	1	2	2	3	3	2	3	2	2
CO4	1	3	2	1	3	2	1	3	3	3	2	3

Course Name: Data Structures & Algorithms
Course Code: EI605A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Familiarity with the fundamentals of C or other programming language
2. A solid background in mathematics, including probability, set theory.

Course Objectives:

- To learn the basics of abstract data types.
- To learn the principles of linear and nonlinear data structures.
- To build an application using sorting and searching.

Course Outcomes:

On completion of the course students will be able to

CO1. Differentiate how the choices of data structure & algorithm methods impact the performance of program.
CO2. Solve problems based upon different data structure & also write programs.
CO3. Identify appropriate data structure & algorithmic methods in solving problem.
CO4. Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
CO5. Compare and contrast the benefits of dynamic and static data structures implementations.

Course Contents:

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(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. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Reference books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	2	2	3	3	3	2	3
CO2	3	2	2	2	2	2	3	2	2	3	3	2
CO3	3	3	3	2	3	3	3	2	2	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Course Name: Database Management System
Course Code: EI605B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. Tolearnthedata models,conceptualizeanddepicta databasesystem
2. To design system usingE-Rdiagram.
3. TolearnSQL&relationaldatabasedesign.
4. Tounderstandtheinternalstoragestructuresusingdifferentfileandindexingtechniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure**.**

Course Outcomes (COs)

On completion of the course students will be able to
CO1: Apply the knowledge ofEntityRelationship (E-R)diagramforanapplication.
CO2: Createa normalized relationaldatabasemodel
CO3: Analyze real worldqueriesto generatereportsfromit.
CO4: DeterminewhetherthetransactionsatisfiestheACIDproperties.
CO5: Createandmaintainthedatabaseofanorganization.

Course Contents:

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 [9L]
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 [6L]
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 [6L]
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:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin CummingsPublishing. Company.

Reference Books:

1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
4. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill
5. Ramakrishnan: Database Management System , McGraw-Hill
6. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.

CO-PO Mapping:

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

Course Name: Software Engineering
Course Code: EI605C
Contact Hours: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. An understanding of basic computer software
2. Object Oriented programming skills.

Course Objectives:

1. To develop basic Knowledge in Software Engineering including software Engineering layered architecture, software process models for software development.
2. To design software requirements and specifications of documents.
3. To understand project planning, scheduling, cost estimation, risk management.
4. To describe data models, object models, context models, behavioral models and coding style and testing issues.
5. To know about the quality checking mechanism for software process and product.

Course Outcomes:

CO1: To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2: To analyze,elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CO3: To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.

CO4: To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
CO5: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

Course Contents:

Module I [10L]
SoftwareEngineering–Characteristics,Components,Application,Definitions,Software Process models- Waterfall Model, Prototype model, Spiral., Software Project Planning-Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, Basics of estimation : COCOMO (Basic, intermediate, Complete) model

Module II [8L]
System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, DataDictionary, Data Modeling, Software Requirements Specification
Software Design Aspects: Objectives, Principles, Concepts, HLD and LLD, Top-Down and Bottom-Updesign; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object-Oriented approach.

Module III[10L]
Coding & Documentation–Structured Programming, Modular Programming, Module Relationship-Coupling,Cohesion, Object Oriented Programming, Information Hiding, Reuse, System Documentation.
Testing–Levels of Testing, Integration Testing, System Testing**.**
Test Cases-White Box and Black Box testing Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management.

Module IV [8L]

Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, Software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

Text Books:

1. Software Engineering: A practitioner's approach–Pressman(TMH)

Reference Books:

1. Software Engineering-Pankaj Jalote (Wiley-India)
2. Software Engineering-Rajib Mall(PHI)
3. Software Engineering–Agarwal and Agarwal(PHI)

CO-PO Mapping:

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

Course Name: Process Control Laboratory
Course Code : EI691
Contact :0:0:3
Credits : 1.5

Course Outcome:

After completion of the laboratory course students will be able to:

CO1: Recognize & explain basic process control loop elements via hands on experiment.
CO2: Control different process variable (flow, pressure, level & temperature) using different controller mode.
CO3: Use various PLC functions and develop PLC programs to control a real time system.
CO4:Control & monitor different process variable through DCS.

Experiments :

1. Study of Flow, Level, Pressure, Temperature processes and construction of the P&I diagrams in accordance with ISA guidelines / standards

2. Study of a Temperature Control Loop having Furnace, suitable final control element, Temperature transmitter, conventional PID controller/Control System, and data logger/recorder

3.Study of a Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller/Control System

4. Study of a Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System

5.Study of a Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System
6.Study of a typical Air Duct Flow Monitoring and Control
7. PLC Programming
8. Study of a PC based Automation Software / Simulation Software

9. Configuring the DCS for Temp./Flow/Pressure processes.

10. Innovative Experiment

CO-PO mapping:

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

Course Name:Power Electronics Laboratory
Course Code : EI 692A
Contact :0:0:3
Credits : 1.5

Course Objective:

1. To expose students to operation and characteristics of power semiconductor devices and passive components, their practical application in power electronics.
2. To provide a practical exposure to operating principles, design and synthesis of different power electronic converters.
3. To introduce students to industrial control of power electronic circuits as well as safe electrical connection and measurement practices.

Course Outcome:

At the end of the course, a student will be able to:
CO1 : Identify relevant information to supplement to the Power Electronics course & set up testing strategies and select proper instruments to evaluate performance characteristics of Power devices and power electronics circuits and analyze their operation under different loading conditions.
CO2: Realize the limitations of computer simulations for verification of circuit behavior, apply these techniques to different power electronic circuits and evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.
CO3: Prepare professional quality textual and graphical presentations of laboratory data and computational results, incorporating accepted data analysis and synthesis methods, mathematical software,and word-processing tools.
CO4: Primarily via team-base laboratory activities, students will demonstrate the ability to interact effectively on a social and interpersonal level with fellow students, and will demonstrate the ability to divide up and share task responsibilities to complete assignments.

Experiments:

1. Study of Characteristics of an SCR and a TRIAC.
2. Study of Diode-Resistance, Diode-Resistance-Capacitance, Resistance-Capacitance and UJT Triggering Circuits for SCR.
3. Study of the operation of a single phase fully controlled bridge converter supplying R-L load and freewheeling diode, including generation of triggering pulses for the devices for both continuous and discontinuous modes of conduction.
4. Study of a self commutation circuit for commutating an SCR operating on a DC supply.
5. Simulation of DC to DC step down chopper.
6. Simulation of PWM bridge inverter using MOSFET/IGBT with R/R-L load.
7. Simulation of Single phase AC regulator.
8. Study of a control circuit for a stepper motor and its operation./ Study of a single quadrant chopper controlled PM dc motor.
9.Innovative Experiment

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	1	1	1	-	-	-	-	-	-	2	1
CO2	1	2	1	1	-	1	1	-	-	-	-	1
CO3	1	2	1	1	2	-	-	-	-	-	-	1
CO4	1	-	-	-	2	1	1	-	-	-	1	-

Course Name:INDUSTRIAL DRIVES LABORATORY
Course Code :EI692B
Contact :0:0:3
Credits : 1.5

Course Objective:

1. Provide knowledge to operate electrical machines for a specific drive.
2. Study the speed control techniques of electrical machines for particular drive requirement.

Course Outcome:

At the end of this course, students will be able to:

CO1. Test DC and AC motor drive.
CO2. Perform tests on transformers.
CO3. Perform the test on Induction motors

List of Experiments:

1. Study of the characteristics of a DC motor
2. Study of methods of speed control of DC motor
3. Measurement of speed of DC series motor as a function of load torque.
4. Polarity test on a single phase transformer & study of different connections of three phase transformer.
5. Study of performance of three phase squirrel- cage Induction motor – determination of iron-loss, friction & windage loss.
6. Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer & Star-Delta].
7. Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control& frequency control].
8. Speed control of 3 phase slip ring Induction motor by rotor resistance control.
9. Load test on single phase Induction motor to obtain the performance characteristics.
10. Load test on wound rotor Induction motor to obtain the performance characteristics.
11. Innovative Experiment.

Text Books:

1. Fundamentals of Industrial Drives, B.N. Sarkar, PHI
2. Fundamentals of Electric Drives, Gopal K Dubey, Narosa
3. Electrical Drives And Control, U.A. Bakshi, M.V.Bakshi, Technical Publications

Reference Books:

1. Industrial Drives, Mukhtar Ahmad, MacMillan
2. Electric Drives, V Subramanyam, McGraw-Hill
3. Electric Drives, Boldea & Nasar, CRC

4. Vector Control of AC Drives, Boldea & Nasar, CRC

CO-PO Mapping:

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

Course Name:Robotics Engineering Lab
Course Code : EI692C
Contact :0:0:3
Credits : 1.5

Course Objective:

1. Will have a strong knowledge on MATLAB software..
2. They get the basic knowledge on practical control system.
3. To get the Design applications of control system.
4. They get the knowledge of stability analysis of different control systems.

Course Outcome:

The students will be able to:

CO1. Apply formulate transfer function for given control system problems.
CO2. Demonstrate an understanding of the fundamentals of control systems.
CO3. Determine time response of given control system model.
CO4. Analyze the system behavior through Root Locus, Bode plots & Nyquist plot fora given control system model.

List of Experiments:

1. Study components of an industrial robot (PUMA, KUKA, FANUC, MTAB, UR , Etc) and its DH parameters.
2. Forward kinematics and validation using a software (RoboAnalyser/MATLAB).
3. Inverse kinematics of an industrial robot and validation using any open source software.
4. Industrial Robot programming using VAL II or its equivalent.
5. Microcontroller lab – programming (8051 and upper level microcontroller).
6. Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system. (mainly MATLAB)
7. Control experiment using available hardware or software. (mainlyMATLAB).
8. The use of open source computer vision programming tools such as MATLAB, Python, open CV.
9. Research related experiment in AI, multi agent system, unmanned systems control using ROS, etc.
10. Innovative Experiment

TextBooks:

1. Introduction to Robotics: J. Craig, Pearson
2. Robot Dynamics and Control, Spong&Vidyasagar, McGraw Hill
3. Robotics Engineering: R. Klafter, PHI
4. Robotics: Subir K Saha, McGrawHill
5. Industrial Robotics: M. P. Groover, AshishDutta, McGraw Hill

Reference Books:

1. Richard Paul, Robot Manipulators: Mathematics, Programming and Control, MIT Press, 1981
2. Robert Shilling, Fundamentals of Robotics, Prentice-Hall , 2003
3. Laxmidhar Behera and Indrani Kar, “Intelligent Systems and Control”, Oxford University Press, Nov 2009.
4. M. Felix Orlando, Laxmidhar Behera, Tomayo Tamei, Tomohiro Shibata, Ashish Dutta and Anupam Saxena,"

On Redundancy Resolution of the Human Thumb, Index and Middle Fingers in Cooperative Object Translation," Robotica, vol. 35, pp. 1992-2017, 2016.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	3	2	1	2	1	2	3
CO2	1	2	2	3	2	1	2	3	4	2	2	2
CO3	1	2	4	1	2	3	3	3	2	3	2	2
CO4	2	3	2	1	3	2	1	3	3	3	4	3

Name of the Paper: Data Structures & Algorithms Lab
Paper Code: EI693A
Contact Hours: 0:0:3
Credit s: 1.5

Perquisites:

1. Programming for Problem Solving Lab

Course Objectives:

- To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.
- To write and execute write programs in C to implement various sorting and searching methods.

Course Outcomes:

CO1. Choose appropriate data structure as applied to specified problem definition.
CO2. Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.
CO3. Have practical knowledge on the applications of data structures.
CO4. Able to store, manipulate and arrange data in an efficient manner.
CO5. Able to implement queue and stack using arrays and linked list. Implementation of queue, binary tree and binary search tree.

Course Contents:

1. Write a C program to implement Single Link List
2. Write a C program to implement Double Link List
3. Write a C program to implement Single Circular Link List
4. Write a C program to implement Double Circular Link List
5. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
6. Write a C program to convert a given infix expression into its postfix Equivalent.
7. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.
8. Write a C program to implement Binary Search Tree (BST).
9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Insertion sort
   b. Merge sort
10. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    a. Quick sort
    b. Selection sort
11. 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.

12. Write C programs for implementing the following graph traversal algorithms:
    a. Depth first search
    b. Breadth first search
13. Innovative Experiment

Text Books:

1. Data Structures using C, R. Thareja, 2nd Edition, Oxford University Press.
2. Data Structures Using C E. Balagurusamy, Mcgraw Hill

Reference Books:

1. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson
2. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
3. Data structures using C, A.K.Sharma, 2nd Edition, Pearson
4. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

CO-PO Mapping:

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

Course Name: DATABASE MANAGEMENT SYSTEM LAB
Course Code: EI693B
Contact: 0:0:3
Credits: 1.5

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. Tolearnthedata models,conceptualizeanddepicta databasesystem
2. TolearnthefundamentalconceptsofSQLqueries.
3. Tounderstandtheconceptofdesigninga databasewiththenecessaryattributes.
4. ToknowthemethodologyofAccessing,Modifying andUpdatingdata&informationfromtherelational databases
5. To learn database design as well as to design user interface and how to connect with database.

Course Outcomes:

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.

Course Contents:

- Structured Query Language

Module1: [6L]

Creating Database
Creating a Database
Creating a Table Specifying Relational Data Types
Specifying Constraints Creating Indexes

Module2: [3L]

Table and Record Handling
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements

Module3: [6L]

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

Module 4: [3L]
Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE
Module 5:[6L]
PL/SQL
Module 6:[6L]
Database design using E-R model and Normalization
Module 7:[6L]
Design and implementation of some on line system [Library Management System]

Text Books:

1) SQL, PL/SQL by Ivan Bayross, BPB Publications
2) Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

CO-PO Mapping

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

Name of the Paper: Software Engineering Lab
Paper Code: EI693C
Contact Hours: 0:0:3
Credits: 1.5

Prerequisites:

For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Objectives:

- To learn software development skill through various stages of software life cycle. .
- To ensure the quality of software through software development with various protocol based environment.

Course Outcomes:

CO1: To handle software development models through rational method.
CO2: To prepare SRS document, design document, test cases and software configuration management and risk management related document.
CO3: To develop function oriented and object oriented software design using tools like rational rose.
CO4: To perform unit testing and integration testing
CO5: To apply various white box and black box testing techniques

Assignments to be given from the following
1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables.
3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)
4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.
5. Design Test Script/Test Plan(both Black box and White Box approach)
6. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO
7.Innovative Experiment

Text Book:

1. Software Engineering: A practitioner's approach–Pressman(TMH)

Reference Book:

1. Software Engineering-Pankaj Jalote (Wiley-India)

CO-PO Mapping:

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