GITAM

(DEEMED TO BE UNIVERSITY)

(Estd. u/s 3 of the UGC Act, 1956)

VISAKHAPATNAM • HYDERABAD • BENGALURU

Accredited by NAAC with 'A+' Grade

REGULATIONS AND SYLLABUS
of
Bachelor of Technology

in

Electrical and Electronics Engineering (EEE)
with specialized subjects in Robotics & Automation

(w.e.f 2020-21 admitted batch)

B. Tech. in Electrical and Electronics Engineering
with specialization in Robotics & Automation
REGULATIONS
(w.e.f. 2020-21 admitted batches)

1. ADMISSION

1.1 Admission into B. Tech. in Biotechnology program of GITAM (Deemed to be University) is governed by GITAM admission regulations.

2. ELIGIBILITYCRITERIA

2.1 A first class in 10+2 or equivalent examination approved by GITAM (Deemed to be University) with subjects Physics, Chemistry and Mathematics.

2.2 Admission into B.Tech. will be based on an All India Entrance Test (GITAM Admission Test - GAT) conducted by GITAM/Specified rank holders of JEE mains/EAMCET(AP & TS) and the rules of reservation of statutory bodies, wherever applicable, will be followed.

3. CHOICE BASED CREDITSYSTEM

3.1 Choice Based Credit System (CBCS) was introduced with effect from the academic year of 2015-16 admitted batch and revised in 2019-20 academic year, based on guidelines of the statutory bodies in order to promote:

- Activity based learning
- Student centered learning
- Cafeteria approach
- Students to choose courses of their choice
- Learning at their own pace
- Interdisciplinary learning

3.2 Course Objectives, Learning Outcomes and Course Outcomes are specified, focusing on what a student should be able to do at the end of the course and program.

4. STRUCTURE OF THEPROGRAM

4.1 The Program consists of humanities and social sciences, basic sciences, basic engineering, program core, program electives, open electives, interdisciplinary electives, industry internship, laboratory, mandatory courses and project work.

Core Courses	Branch specific	Compulsory
Elective courses	Program Electives	*Supportive to the discipline courses with expanded scope in a chosen track of specialization or cross track courses*
	Interdisciplinary Electives	*Interdisciplinary exposure & nurture the student interests in other department courses.*
	Open Electives	*Common to all disciplines that helps general interest of a student*

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester.

- One credit for each Lecture/Tutorial hour per week.
- One credit for two hours of Practical per week.

4.4 The curriculum of the eight semesters B.Tech. program is designed to have a total of 160 credits for the award of B.Tech. degree.

5. MEDIUM OFINSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6. REGISTRATION

Every student has to register himself/herself for the courses in each semester individually at the time as specified in academic calendar.

7. ATTENDANCEREQUIREMENTS

7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end - semester examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the semester along with his/her juniors.

7.2 However, the Vice-Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance of the students whose attendance is between 65% and 74% on genuine medical grounds and on payment of prescribed fee.

8. EVALUATION

8.1 The assessment of the candidate's performance in a theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end Examination (60 marks).

8.2 A candidate has to secure an aggregate of 40% in the course in the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks out of 60 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical courses are assessed under Continuous Evaluation for a maximum of 100 marks, and a candidate has to obtain a minimum of 40% to secure pass grade.

8.4 The courses having theory and practical combined, 70% of the weightage will be given for theory component and 30% weightage for practical component. The candidate has to acquire 40% in the semester end theory examination. However, candidate must have secured overall 40% (Theory + Practical) to secure pass grade.

8.5 Project Work/ Industrial internship courses are assessed under continuous evaluation for a maximum of 100 marks, and a candidate has to obtain a minimum of 40% to secure pass grade.

8.6 Mandatory Courses are assessed for PASS or FAIL only. No grade will be assigned to these courses. If a candidate secures more than 40 out of 100 marks, he / she will be declared PASS, else FAIL

8.7 Mandatory courses NCC/NSS/NSO/YOGA are assessed for satisfactory or not satisfactory only. No grade will be assigned. A candidate has to undergo two hours training per week in any one of the above in both 1st and 2ndsemesters.

Details of Assessment Procedure are furnished in Table 1.

Table 1: Assessment Procedure

S.No	Component of Assessment	Types of Assessment	Marks Allotted	Scheme of Evaluation
1	Theory courses	Continuous Evaluation	40	(i) Thirty (30) marks for mid semester examinations. Three mid examinations shall be conducted for 15 marks each; performance in best two shall be taken into consideration. ii) Ten (10) marks for Quizzes, Assignments and Presentations.
		Semester End Examinations	60	Sixty (60) marks for semester-end Examinations.
		Total	100	
2	Practical courses	Continuous Evaluation	100	(i) Fifty (50) marks for regularity and performance, record and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the semester. ii) Ten (10) marks for case studies. iii) Forty (40) marks for two tests of 20 marks each (one at the mid-term and the other towards the end of the semester) conducted by the concerned lab teacher.
3	Theory and Practical combined courses	(a) Theory component: continuous evaluation and semester end examination.	100	70% of the weightage will be given for theory component. Evaluation for theory component will be same as S. No 1 as above.
		(b)Practical component: continuous evaluation	100	30% weightage for practical components. Evaluation for practical component will be same as S. No 2 as above
		Total	200	

4	Project work (VII & VIII Semesters)	Continuous Evaluation	100	i) Forty (40) marks for periodic evaluation on originality, innovation, sincerity and progress of the work assessed by the project supervisor. ii) Thirty (30) marks for mid-term evaluation for defending the project before a panel of examiners. iii) Thirty (30) marks for final Report presentation and Viva-voce by a panel of examiners.
5	Industrial Internship (VII Semester)	Continuous Evaluation	100	i) Thirty (30) marks for Project performance, assessed by the Supervisor of the host Industry/ Organization. Submission of Project Completion Certificate from host organization is mandatory. ii) Forty(40) marks for Report and Seminar presentation on the training, assessed by the Teacher Coordinator. iii) Thirty(30)marks for presentation on the training, before a panel of examiners.
6	Mandatory Courses	Continuous Evaluation	100	(i) Sixty (60) marks for mid semester Examinations. Three mid examinations shall be conducted for 30 marks each; performance in best two shall be taken into consideration (ii) Forty (40) marks for Quizzes, Assignments and Presentations

9. RETOTALING &REVALUATION

9.1 Retotaling of the theory answer script of the semester-end examination is permitted on request by the candidate by paying the prescribed fee within one week after the announcement of the results.

9.2 Revaluation of the theory answer scripts of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the result.

9.3 A candidate who has secured _F‘ grade in a theory course shall have to reappear at the subsequent examination held in that course. A candidate who has secured _F‘ grade can improve continuous evaluation marks up to a maximum of 50% by attending special instruction classes held during summer.

9.4 A candidate who has secured _F‘ grade in a practical course shall have to attend Special Instruction classes held during summer.

9.5 A candidate who has secured _F‘ grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examination held in that course. A candidate who has secured _F‘ grade can improve continuous evaluation marks up to a maximum of 50% by attending special instruction classes held during summer.

9.6 A candidate who has secured F‘ Grade in project work/Industrial Training shall be

permitted to submit the report only after satisfactory completion of the work and viva- voce examination.

10. PROVISION FOR ANSWER BOOK VERIFICATION AND CHALLENGE EVALUATION

10.1 If a candidate is not satisfied with his/her grade after revaluation, the candidate can apply for, answer book verification on payment of prescribed fee for each course within one week after announcement of revaluation results.

10.2 After verification, if a candidate is not satisfied with revaluation marks/grade awarded, he/she can apply for challenge valuation within one week after announcement of answer book verification result/ two weeks after the announcement of revaluation results, which will be valued by the two examiners i.e., one Internal and one External examiner in the presence of the candidate on payment of prescribed fee. The challenge valuation fee will be returned, if the candidate is succeeded in the appeal with a change for a bettergrade.

11. SUPPLEMENTARYEXAMINATIONS AND SPECIALEXAMINATIONS.

11.1 The odd semester supplementary examinations will be conducted on daily basis after conducting regular even semester examinations during April/May.

11.2 The even semester supplementary examinations will be conducted on daily basis after conducting regular odd semester examinations during October/November.

11.3 A candidate who has completed his/her period of study and still has –F grade in final semester courses is eligible to appear for Special Examination normally held during summer vacation.

12. PROMOTION TO THE NEXT YEAR OFSTUDY

12.1 A student shall be promoted to the next academic year only if he/she completes the academic requirements of 50% of the credits till the previous academic year.

12.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new regulations after detention as per the equivalency established by the BoS to continue his/her further studies.

13. MASSIVE OPEN ONLINECOURSES

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (**MOOCs**) during the period of study. Students without any backlog courses upto fourth semester are permitted to register for MOOCs from fifth semester onwards up to a maximum of 15 credits from program elective/ interdisciplinary elective/ open elective courses. However the Departmental Committee (DC) of the respective campuses has to approve the courses under MOOCs. The grade equivalency will be decided by the respective Board of Studies (BoS).

14. BETTERMENT OFGRADES

14.1 A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations only in eight theory courses of any semester of his/her choice, conducted in summer vacation along with the Special Examinations.

14.2 Betterment of Grades is permitted ‗only once', immediately after completion of the program of study.

15. HONORS

A student who secured 8 CGPA or above up to IV semester is eligible to register for B. Tech (Honors) degree. The student has to complete additional 20 credits (six theory courses + seminar) as approved by the respective Departmental Committee (DC) to secure B. Tech (Honors). The courses will be approved by DC of respective campuses.

16 GRADINGSYSTEM

16.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

Table 2: Grades and Grade Points

S.No.	Grade	Grade Points	Absolute Marks
1	O (Outstanding)	10	90 and above
2	A+(Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+(Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab.(Absent)	0	-

16.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, subject to securing an average GPA of 5.0 (average of all GPAs in all semesters) at the end of the program to declare pass in the program.

17. GRADE POINTAVERAGE

17.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$GPA = \frac{\Sigma[\ C^{*}\ G\ ]}{\Sigma\ C}$$

where, C = number of credits for the course.

G =grade points obtained by the student in the course.

17.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student‘s performance in all the courses taken, in all the semesters up to that particular semester.

17.3 CGPA required for classification of class after the successful completion of the program is shown in Table3.

Table 3: CGPA required for award of Class

Class	CGPA Required
First Class with Distinction	≥8.0*
First Class	≥ 6.5
Second Class	≥ 5.5
Pass Class	≥ 5.0

* In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the courses of every semester in first attempt.

18. ELIGIBILITY FOR AWARD OF THE B. Tech. DEGREE

18.1 Duration of the program: A student is ordinarily expected to complete the B.Tech. program in eight semesters of four years. However, a student may complete the program in not more than eight years including study period.

18.2 However, the above regulation may be relaxed by the Vice-Chancellor in individual cases for cogent and sufficient reasons.

18.3 A student shall be eligible for award of the B.Tech. Degree if he / she fulfills all the following conditions:

i) Registered and successfully completed all the courses and projects.

ii) Successfully acquired the minimum required credits as specified in the curriculum in the branch of his/her study within the stipulated time.

iii) Has no dues to the Institute, hostels, Libraries, NCC/NSS etc, and no disciplinary action is pending against him/her.

19. DISCRETIONARYPOWER

Notwithstanding anything contained in the above sections, the Vice-Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

Department of Electrical, Electronics and Communication Engineering

B.Tech EEE with specialized subjects in Robotics & Automation (Effective from the academic year 2020-21 admitted batch)

Semester I

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA101	Engineering Mathematics I Calculus and Algebra)	BS	3	0	0		**3**	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2		**3**	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics/ Engineering Chemistry	BS	3	0	3		**4.5**	
4.	19EID131/ 19EEE131	Problem Solving and Programming/ Basic Electrical and Electronics Engineering	ES	3	1	3		**5.5**	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES	0/1	0	3		**1.5/ 2.5**	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NCC/NSS/NSO/ YOGA	MC	0	0	2		**0**	Common to all
Total								**17.5/18.5**	

Semester II

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA102	Engineering Mathematics II (ODE, PDE and Multivariable Calculus)	BS	3	0	0		3	Common with ECE, ME,CE and AE
2.	19ECY131 /19EPH131	Engineering Chemistry / Engineering Physics	BS	3	0	3		4.5	
3.	19EEE131/ 19EID131	Basic Electrical and Electronics Engineering / Problem Solving and Programming	ES	3	1	3		5.5	Common to all
4.	19EID132/ 19EID134	Design Thinking / AI tools	ES	2	0	2		3	Common to all
5.	19EME131 /19EME121	Engineering Graphics / **Workshop**	ES	1/0	0	3		2.5/ 1.5	Common to all
6.	19EEE122	Electrical Workshop	PC	0	0	3		1.5	
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NCC/NSS/NSO/YOGA	MC	0	0	2		0	Common to all
8.	19EHS122	Comprehensive Skill Development I	HS	0	0	0	6	1	Common to all
9	VDC111	Venture Discovery	PW	0	0	4		2	Common to all
Total								**23/22**	

Semester III

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA203	Engineering Mathematics III (Complex Variables and Transform Techniques)	BS	3	0	0		3	Common with ECE
2.	19EID134/ 19EID132	AI Tools / Design thinking	ES	2	0	2		3	Common to all
3.	19EEE231	Electrical Circuit Analysis	PC	3	0	3		4.5	
4.	19EEE233	Electromagnetic Fields	PC	2	0	2		3	
5.	19EEC233	Electronic Devices and Amplifier Circuits	PC	3	0	3		4.5	Common with ECE
6.	19EEC235	Signals and Systems	PC	2	0	2		3	Common with ECE
7.	19EMC281/ 19EMC282	Constitution of India / Environ-mental Sciences	MC	3	0	0		0	Mandatory Course
8.	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	
Total								**22**	

Semeter IV

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA202	Engineering Mathematics IV (Numerical methods, Probability and Statistics)	BS	3	0	0		3	Branch specific
2.	19EID232 /19EID234	Internet of Things / Life Sciences for Engineers	ES/BS	2	0	2		3	Common to all
3.	19EEE232	Electrical Machines I	PC	3	0	3		4.5	
4.	19EEE234	Power Systems I	PC	2	0	2		3	
5.	19EEC232	Digital Logic Design	PC	3	0	3		4.5	Common withECE
6.	19EEC234	Analog Circuits	PC	3	0	3		4.5	Common withECE
7.	19EMC282 / 19EMC281	Environmental Science / Constitution of India	MC	3	0	0		0	Mandatory Course
8.	19EEE292	Comprehensive Skill Development III	PW	0	0	0	6	1	
Total								**23.5**	

Semester V

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EEE333	Electrical Machines – II	PC	3	0	3		4.5	
2.	19EEE331	Linear Control Systems	PC	3	0	3		4.5	
3.	19EID234 / 19EID232	Life Sciences for Engineers/ Internet of Things	BS/ES	2	0	2		3	
4.	19EEE335	**Principles of Robotics**	PC	2	0	2		3	Specialization specific
5.	19ZOE3XX	Open Elective I	OE	3	0	0		3	
6.	19EYY3XX	Interdisciplinary Elective I	ID	2/3	0	2/0		3	
7.	19EEE391	Comprehensive Skill Development - 4	PW	0	0	0	6	1	
Total								**22**	

Semester VI

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EEC332	Microprocessors and Microcontrollers	PC	3	0	3		4.5	Common with ECE
2.	19EEE334	**Programmable logic controllers**	PC	3	0	2		4	Specialization Specific
3.	19EEE3XX	Program Elective I	PE	2/3	0	2/0		3	
4.	19EEE3XX	Program Elective II	PE	2/3	0	2/0		3	
5.	19ZOE3XX	Open Elective II	OE	3	0	0		3	
6.	19EHS302	Engineering Economics and Management	HS	3	0	0		3	
7.	19EMC382	Engineering Ethics	MC	3	0	0		0	Mandatory-Course
8.	19EEE392	Comprehensive Skill Development - 5	PW	0	0	0	6	1	
Total								**21.5**	

Semester VII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EEE431	Power Systems II	PC	3	0	3		4.5	
2.	19EEE433	**Artificial Intelligence in Robotics**	PC	2	0	2		3	Specialization Specific
3.	19EEE3XX	Program Elective III	PE	2/3	0	2/0		3	
4.	19EEE4XX	Program Elective IV	PE	2/3	0	2/0		3	
5.	19EHS403	Organizational Behavior	HS	3	0	0		3	
6.	19EEE491	Project Phase I	PW	0	0	2		1	
7.	19EEC493	Internship	PW					1	
8.	19EEE495	Comprehensive Skill Development - 6	PW	0	0	0	6	1	
Total								**19.5**	

*****Industrial Training / Research Projects in National Laboratories /Academic Institutions

Semester VIII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EYY4XX	Interdisciplinary Elective II	ID	2/3	0	2/0		3	
2.	19EEE4XX	Program Elective V	PE	2/3	0	2/0		3	
3.	19EEE492	Project Phase II	PW	0	0	12		6	
4..	GSS115	Gandhi for 21st Century	PW					1	Online Course
Total								**13**	

Total Number of Credits

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	**17.5/ 18.5**	**23/22**	**22**	**23.5**	**22**	**21.5**	**19.5**	**13**	**162**

Category wise credits distribution

Category	Category Code	Courses	Credits GITAM	Credits suggested by AICTE
Humanities & Social Sciences	HS	Communicative English	11	12
		HS1 and HS2 (elective) Comprehensive Skill Development II & III		
Basic Sciences	BS	Engineering Physics	**24**	**25**
		Engineering Chemistry		
		Mathematics (4 Courses)		
		Life Sciences for Engineers		
Engineering Sciences	ES	Problem Solving and Programming	**24**	**24**
		Basic Electrical and Electronics Engineering		
		AI Tools		
		Engineering Graphics		
		Workshop		
		Design Thinking and Product Innovation		
		Internet of Things		
Open Electives	OE	OE1, OE2	**6**	**18**
Interdis-diplinary	ID	ID1 – ID2	**6**	
Program Electives	PE	PE1 – PE5	**15**	**18**
Program Core	PC	PC1 – PC16	**61**	**48**
Project	PW	Venture Discovery	**15**	**15**
		Internship		
		Comprehensive Skill Development IV –VII		
		Project Phase I		
		Project Phase II		
		Gandhi for 21st Century		
Mandatory	MC	Environmental Science, Constitution of India, Engineering Ethics	-	-
Total			**162**	**160**

Mandatory Course

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMC181A	National Cadet Corps	MC	0	0	2	0	Mandatory Course
2.	19EMC181B	National Service Scheme	MC	0	0	2	0	Mandatory Course
3.	19EMC181C	National Sports Organization	MC	0	0	2	0	Mandatory Course
4.	19EMC181D	Yoga	MC	0	0	2	0	Mandatory Course

Engineering Mathematics-II

S. No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA102	Engineering Mathematics II (ODE, PDE and Multivariable Calculus)	BS	3	0	0	3	Offered for ECE, EEE, ME,CE and AE
2.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	3	Offered for CSE and IT
3.	19EMA106	Mathematics for Biotechnology II	BS	3	0	0	3	Offered for BT

Engineering Mathematics-III

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA201	Engineering Mathematics III (Applications of PDE, Complex Variables and Transform Techniques)	BS	3	0	0	3	Offered for ME,CE andAE

2.	19EMA203	Engineering Mathematics III (Complex Variables and Transform Techniques)	BS	3	0	0	3	Offered for ECE and EEE
3.	19EMA205	Engineering Mathematics III (Discrete Mathematical Structures)	BS	3	0	0	3	Offered for CSE and IT
4.	19EMA207	Mathematics for Biotechnology III	BS	3	0	0	3	Offered for BT

Engineering Mathematics-IV

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA202	Engineering Mathematics IV (Numerical Methods, Probability and Statistics)	BS	3	0	0	3	Offered for CE, ME and EEE
2.	19EMA204	Engineering Mathematics IV (Probability Theory and Random Processes)	BS	3	0	0	3	Offered for ECE
3.	19EMA206	Engineering Mathematics IV (Number Theory and Applications)	BS	3	0	0	3	Offered for CSE and IT
4.	19EMA208	Mathematics for Biotechnology IV	BS	3	0	0	3	Offered for BT

Engineering Physics

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EPH131	Engineering Physics	BS	3	0	3	4.5	Offered for EEE, CSE, ECE and IT
2.	19EPH133	Applied Physics	BS	3	0	3	4.5	Offered for AE,CE and ME
3.	19EPH135	Physics for Biotechnology	BS	3	0	3	4.5	Offered for BT

Engineering Chemistry

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19ECY131	Engineering chemistry	BS	3	0	3	4.5	Offered for EEE, CSE, ECE and IT
2.	19ECY133	Chemistry of Materials	BS	3	0	3	4.5	Offered for AE, CE and ME
3.	19ECY135	Chemistry for Biotechnology	BS	3	0	3	4.5	Offered for BT

OPEN ELECTIVES

Open Elective I

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	19EOE301	Japanese for Beginners	OE	3	0	0	3
2.	19EOE303	French for Beginners	OE	3	0	0	3
3.	19EOE305	Biotechnology and Society	OE	3	0	0	3
4.	19EOE307	Contemporary Relevance of Indian Epics	OE	3	0	0	3
5.	19EOE309	Indian National Movement	OE	3	0	0	3
6.	19EOE313	Personality Development	OE	3	0	0	3
7.	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
8.	IOE010	Introduction to International Business	OE	3	0	0	3
9.	19EOE319	Introduction to Music	OE	3	0	0	3
10.	19EOE321	Environment and Ecology	OE	3	0	0	3
11.	19EOE323	Indian History	OE	3	0	0	3
12.	19EOE327	Professional Communication	OE	3	0	0	3
13.	GEL244	English for Higher Education	OE	3	0	0	3

Open Elective II

S. No.	Course Code	Course Title	Category	L	T	P	C
1.	19EOE302	German for Beginners	OE	3	0	0	3
2.	19EOE304	Chinese for Beginners	OE	3	0	0	3
3.	19EOE306	Analytical Essay Writing	OE	3	0	0	3
4.	19EOE308	Indian Economy	OE	3	0	0	3
5.	19EOE310	Public Administration	OE	3	0	0	3
6.	19EOE312	Environmental Management	OE	3	0	0	3
7.	19EOE327	Professional Communication	OE	3	0	0	3
8.	19MOE301	Basics of Finance	OE	3	0	0	3
9.	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
10.	19EOE313	Personality Development	OE	3	0	0	3
11.	19MOE303	Basics of Marketing	OE	3	0	0	3
12.	GEL345	Work Place Communication – Basic	OE	3	0	0	3
13.	GEL347	Work Place Communication - Advanced	OE	3	0	0	3

INTERDISCIPLINARY ELECTIVES

Interdisciplinary Elective I

S.No	Stream	Course Code	Course Name	Category	L	T	P	C	Remarks Offered by
1	Professional courses	19EEI371	Sensors and signal conditioning	ID	2	0	2	3	EIE
2		19EEI343	Electrical Measurements	ID	2	0	2	3	EIE
3	Computer Oriented Courses	19ECS476	Introduction to Big Data	ID	2	0	2	3	CSE
4		19ECS373	Object Oriented Programming with C++	ID	2	0	2	3	CSE
5		19ECS375	Introduction to Programming with Java	ID	2	0	2	3	IT
6		19ECS478	Introduction to Data Science	ID	2	0	2	3	IT
7		19ECS474	Introduction to Cloud Computing	ID	2	0	2	3	IT
8	Management Courses	19EME371	Quantitative techniques for Management	ID	3	0	0	3	ME
9		19EME356	Enterprise Resource Planning	ID	3	0	0	3	ME

Interdisciplinary Elective II

S.No	Stream	Course Code	Course Name	Category	L	T	P	C	Remarks Offered by
1	Professional courses	19EEC473	Fundamentals of Digital Signal Processing	ID	2	0	2	3	ECE
2		19EEI477	Industrial Automation	ID	2	0	2	3	EIE
3		19EEI475	Medical Instrumentation	ID	2	0	2	3	EIE
4	Computer Oriented Courses	19ECS371	Introduction to Data Base Management Systems	ID	2	0	2	3	CSE
5		19ECS344	Introduction to Machine Learning	ID	2	0	2	3	CSE
6		19ECS475	Introduction to Web Technologies	ID	2	0	2	3	IT
7		19ECS471	Introduction to Operating Systems	ID	2	0	2	3	CSE
8	Management Courses	19EME456	Optimization Techniques	ID	3	0	0	3	ME
9		19EHS475	Entrepreneurship Development	ID	3	0	0	3	Management
10		19EME349	Total Quality Management	ID	3	0	0	3	ME
11		19EME357	Supply Chain Management	ID	3	0	0	3	ME

PROGRAM ELECTIVES

Electives Stream	Programme Elective I	Programme Elective II	Programme Elective III	Programme ElectiveIV	Programme ElectiveV
Power Systems	Electrical Distribution systems	Wind & Solar Energy Systems	Power System Protection	High Voltage Engineering	HVDC Transmission systems
Control Systems	Non -linear control systems	Digital Control systems	Advanced Control systems	Modern control systems	Process control and automation
Power Electronics & Drives	Introduction to Power Electronics	Semi-conductor Drives	Industrial Electrical Systems	Hybrid Electric Vehicles	Power Quality & FACTS
Robotics and Automation	Elements of Mechatronics	Industrial robotics and material handling systems	Adaptive control	Wireless and Sensor networks	Computer vision systems

Program Electives-I

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE341	Electrical Distribution systems	PE	2	0	2	3	
2	Control Systems	19EEE356	Non -linear control systems	PE	2	0	2	3	New
3	Power Electronics & Drives	19EEE332	Power Electronics	PE	2	0	2	3	PC12 in 2019-20
4	Robotics and Automation	19EEE348	Elements of Mechatronics	PE	2	0	2	3	

Note: The faculty has to design the activity for each Program Elective.

Program Electives-II

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE451	Wind & Solar Energy Systems	PE	2	0	2	3	
2	Control Systems	19EEE455	Digital Control systems	PE	2	0	2	3	
3	Power Electronics & Drives	19EEE354	Electrical Drives	PE	3	0	0	3	
4	Robotics and Automation	19EEE358	Industrial robotics and material handling systems	PE	2	0	2	3	

Note: The faculty has to design the activity for each Program Elective.

Program Electives-III

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE342	Power System Protection	PE	3	0	0	3	
2	Control Systems	19EEE457	Advanced control systems	PE	2	0	2	3	New
3	Power Electronics & Drives	19EEE344	Industrial Electrical Systems	PE	3	0	0	3	
4	Robotics and Automation	19EEE459	Adaptive control	PE	2	0	2	3	

Note: The faculty has to design the activity for each Program Elective.

Program Electives-IV

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE441	High Voltage Engineering	PE	3	0	0	3	
2	Control Systems	19EEE346	Modern control systems	PE	2	0	2	3	
3	Power Electronics & Drives	19EEE444	Hybrid Electric Vehicles	PE	3	0	0	3	
4	Robotics and Automation	19EEC351	Wireless Sensor networks and IoT	PE	2	0	2	3	

Note: The faculty has to design the activity for each Program Elective.

Program Electives-V

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE443	HVDC Transmission systems	PE	3	0	0	3	
2	Control Systems	19EEE445	Process control and automation	PE	2	0	2	3	
3	Power Electronics &Drives	19EEE453	Power Quality & FACTS	PE	3	0	0	3	
4	Robotics and Automation	19EEE448	Computer vision systems	PE	2	0	2	3	

S. No	Course Code	Course Title	Category	L	T	P	A	C	Semester	Content
1	19EHS122	Comprehensive Skill Development I	HS	0	0	0	6	1	II	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%)
2	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	III	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%)
3	19EEE292	Comprehensive Skill Development III	PW	0	0	0	6	1	IV	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%
4	19EEE391	Comprehensive Skill Development IV	PW	0	0	0	6	1	V	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%)
5	19EEE392	Comprehensive Skill Development V	PW	0	0	0	6	1	VI	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) **Domain Skills** (50%)
6	19EEE495	Comprehensive Skill Development VI	PW	0	0	0	6	1	VII	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) **Domain Skills** (50%)

19EMA101: **ENGINEERING MATHEMATICS- I (CALCULUS AND ALGEBRA)**
(Common to all branches of Engineering except Biotechnology)

L	T	P	C
3	0	0	3

This course is designed for the students of all B.Tech programmes except for Biotechnology as a prerequisite for the core programme. The course imparts concepts of calculus and matrix algebra that are essential in applications in solving engineering problems.

Course Objectives:

- Tofamiliarizethestudentswiththetheoryofmatricesandquadraticforms.
- To explain the series expansions using mean value theorems.
- To teach basic concepts of partial derivatives.
- To explain the evaluation of double integrals and its applications.
- To demonstrate the evaluation and applications of triple integrals.

UNITI: Matrices **10L**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous linear equations, eigen values, eigenvectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Learning Outcomes:

After completion of this unit, the student will be able to

- solve system of homogeneous and non-homogeneous linear equations(L3)
- find the eigenvalues and eigenvectors of a matrix(L3)
- identify special properties of a matrix(L3)

UNIT II: Mean Value Theorems **6L**

Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof).

Learning Outcomes:

After completion of this unit, the student will be able to

- demonstratethegivenfunctionasseriesofTaylor'sandMaclaurin'swithremainders(L2)
- illustrate series expansions of functions using mean value theorems(L2)

UNIT III: Multivariable Calculus **8L**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

After completion of this unit, the student will be able to

- interpret partial derivatives as a function of several variables(L2)
- apply Jacobian concept to deal with the problems in change of variables(L3)
- evaluate maxima and minima of functions(L3)

UNIT IV: Multiple Integrals-I **8L**

Double integrals, change of order of integration, double integration in polar coordinates, area enclosed by plane curves.

Learning Outcomes:

After completion of this unit, the student will be able to

- apply double integrals in cartesian and polar coordinates(L3)
- calculate the areas bounded by a region using double integration techniques(L3)

UNIT V:MultipleIntegrals-II **8L**

Evaluationoftripleintegrals,changeofvariables(cartesian,cylindricalandsphericalpolarco-ordinates), volume as triple integral.

Learning Outcomes:

After completion of this unit, the student will be able to

- apply multiple integrals in cartesian, cylindrical and spherical
- geometries(L3)
- evaluate volumes using triple integrals(L3)

Text Book(s):

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons,2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers,2017.

References:

1. R.K.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics,3/e,AlphaScience International Ltd.,2002.
2. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas, Calculus, 13/e, Pearson Publishers,2014.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson Publishers,2011.

Course Outcomes:

After completion of this unit, the student will be able to

- utilize the techniques of matrix algebra for practical applications(L3)
- apply mean value theorems to engineering problems(L3)
- utilize functions of several variables in optimization(L3)
- employ the tools of calculus for calculating the areas(L3)
- calculate volumes using multiple integrals(L3)

GEL131: COMMUNICATIVE ENGLISH
(Common to all)

L	T	P	C
2	0	2	3

The course is a unified approach to enhance language skills of learners with an aim to hone their social skills and to increase their employability. The course is designed to acquaint the learners with the necessary LSRW (Listening/ Speaking / Reading/ Writing) skills needed either for recruitment or further studies abroad for which they attempt international exams like TOEFL, IELTS and GRE. It enables the learners improve their communication skills which are crucial in an academic environment as well as professional and personal lives.

Course Objectives:

- To enable learners to develop listening skills for better comprehension of academic presentations, lectures and speeches.
- To hone the speaking skills of learners by engaging the min various activities such as just a minute(JAM), group discussions, oral presentations, and roleplays.
- To exposelearnerstokeyReadingtechniquessuchasSkimmingandScanningforcomprehensionof different texts.
- To acquaint the learners with effective strategies of paragraph and essay writing, and formal correspondence such as email, letters and resume.
- To provide learners with the critical impetus necessary to forgeapathin an academic environment, in the professional life and in an increasingly complex, interdependent world.

UNIT I **8L**

Listening: Listening for gist and specific information, speaking: Introducing self and others; Developing fluency through JAM, Reading: Skimming for gist and Scanning for specific information, Writing: Paragraph writing-writing coherent and cohesive paragraph (narrative and descriptive); use of appropriate Punctuation. Grammar & Vocabulary: Articles & Prepositions; Word Families (Verbs, Nouns, Adjectives, Adverbs; Prefixes and Suffixes)

Learning Outcomes:

After completion of this unit, the student will be able to

- apply the requisite listening skills and comprehend at local and global level.(L5)
- introduce themselves with accurate structure in diverse social and professional contexts.(L2)
- apply relevant reading strategies for comprehension of any given text (L3)
- write a paragraph using cohesive devices maintaining coherence(L3)
- understand the use of Articles and Prepositions, and apply appropriately for meaningful communication(L3)
- understand the relevance of various categories in word family and apply them meaningfully in context(L3)

UNIT II **10L**

Listening: Listening for Note taking and Summarizing, Speaking: Role plays and Oral Presentations, Reading: Intensive Reading-Reading for implicit meaning, Writing: Note making and summarizing, Grammar & Vocabulary: Verb Forms-Tenses; synonyms to avoid repetition in speech and writing.

Learning Outcomes:

After completion of this unit, the student will be able to

- employ note taking and summarizing strategies to comprehend the listening text(L2)
- use strategies for successful and relevant oral presentation(L4)
- demonstrate effective communication skills by applying turn-taking and role distribution techniques for meaningful and contextual Speaking(L4)
- apply various reading strategies imbibing inferential and extrapolative comprehension of any given text.(L3)
- applyvariousnote-makingtechniqueswhilecomprehendingthereadingtexttopresentacomplete and concise set of structured notes(L5)
- apply the notes to draft a summary(L3)
- use correct tense forms and appropriate structures in speech and written communication(L3)
- context specific use of Prefixes and Suffixes for meaningful communication(L3)

UNIT III **8L**

Listening: Listening for presentation strategies: introducing the topic, organization of ideas, conclusion. Speaking: Aided presentations, Reading: Inferring using textual clues, Writing: Formal Letter and Email writing, Grammar & Vocabulary: Active and Passive Voice; linkers and discourse markers.

Learning Outcomes:

After completion of this unit, the student will be able to

- noticeandunderstandeffectivelisteningstrategiestoidentifydiscoursemarkersinpresentations. (L2)
- make formal oral presentations using effective strategies such as audio – visual aids(L3)
- infer meaning and inter – relatedness of ideas(L4)
- understand relevant structures and draft formal letters in suitable format(L4)
- construct relevant sentences in active and passive voice for meaningful communication(L3)
- comprehend and apply available vocabulary items relevant to the context(L3)

UNIT IV **10L**

Listening: Listening for labeling-maps, graphs, tables, illustrations, Speaking: Aided group presentation using charts, graphs etc. Reading: Reading for identification of facts and opinions, Writing: Information transfer (writing a brief report based on information from graph/chart/table), Grammar & Vocabulary: Subject-verb agreement; language for comparison and contrast; Antonyms.

Learning Outcomes:

After completion of this unit, the student will be able to

- match visual and auditory inputs and use the information comprehensively and adequately demonstrate important relationships or patterns between data points(L2)
- choose and coordinate resources appropriate to context and speak intelligibly(L4)
- develop advanced reading skills for analytical and extrapolative comprehension(L5)
- make decisions on arrangement of ideas and transfer them from visual to verbal form using context appropriate structure.(L4)
- demonstrate ability to use task specific grammatically correct structures(L3)
- Comprehend and use expressions for negation/contradiction(L3)

UNIT V **8L**

Listening: Listening to discussions for opinions, Speaking: Group Discussion, Reading: Reading for inferences, Writing: Guided essay writing (argumentative) , Grammar & Vocabulary: Editing short texts: correcting common errors in grammar and usage; Action verbs for fluency and effective writing.

Learning Outcomes:

After completion of this unit, the student will be able to

- apply analytical and problem-solving strategies to identify and interpret facts and opinions from a dialogue.(L3)
- able to administer group dynamics to contribute valid ideas to a discussion with clarity and precision(L3)
- demonstrate techniques to analyze contextual clues(L4)
- compare and correlate ideas and facts to produce an organized essay with adequate supporting evidences(L5)
- organize the available structural/grammatical knowledge and apply them in a real time context (L3)
- comprehend meaning for new words/phrases used and apply them in a new context.(L3)

Reference Book(s):

1. Arosteguy, K.O. and Bright, A. and Rinard, B.J. and Poe, M", A Student's Guide to Academic and Professional Writing in Education", UK, Teachers CollegePress,2019.
2. Raymond Murphy, "English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English, Cambridge UniversityPress,2019.
3. Peter Watkins," Teaching and Developing Reading Skills", UK, CUP, 2018.
4. Deeptha Achar et al., "Basic of Academic Writing" (1and 2) parts New Delhi: Orient Black Swan, (2012&2013).

5. Kumar S and Lata P, "Communication Skills", New Delhi Oxford University Press,2015.

Course Outcomes

By the end of the course, the Student will be able to

- think critically, analytically, creatively and communicate confidently in English in social and professional contexts with improved skills of fluency and accuracy.(L3)
- write grammatically correct sentences employing appropriate vocabulary suitable to different contexts.(L3)
- comprehend and analyze different academic texts.(L4)
- make notes effectively and handle academic writing tasks such as Paragraph writing and Essay writing.(L3)
- effectively handle formal correspondence like e-mail drafting and letter writing.(L3)

19EPH131: ENGINEERING PHYSICS
(Common with ECE & CSE)

L	T	P	C
3	0	3	4.5

This course is designed with fundamentals of electromagnetism and properties of materials for advanced courses in their respective engineering branches. It introduces electromagnetic theory with relevant mathematical tools, optical fibers and their propagation characteristics, properties of dielectric and magnetic materials. It also introduces principles of semiconductors and some widely used semiconductor devices for various applications.

Course Objectives

- To introduce mathematical principles to estimate forces, fields and waves.
- To familiarize students with electromagnetics in modern communication systems.
- To impart knowledge concerning the electrical behavior of dielectric materials.
- To demonstrate the properties of magnets.
- To introduce semiconductor physics and devices.

UNIT I: Basics of Electromagnetics 9L

Electrostatic field: Coulomb's law and Gauss' law, derivation of Coulombs law from Gauss' law, applications of Gauss' law (line charge, thin sheet of charge and solid charged sphere), Gauss' law of electrostatics in dielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson's and Laplace equations.

Magnetostatic field: Biot–Savarts'law,divergenceandcurlofmagneticfields,Faraday'sandAmpere's lawsinintegralanddifferentialform,displacementcurrent,continuityequation,Maxwell'sequations.

Learning outcomes:
After completion of this unit, the student will be able to

- apply Coulomb's and Gauss' laws to electric field configurations from charge distributions(L3)
- apply the Biot-Savart's law to derive magnetostatic field distributions(L3)
- use vector calculus to describe electromagnetic phenomena(L2)
- relate the law of conservation of charge to continuity equation(L3)
- illustrate the Maxwell's equations, Maxwell's displacement current and correction of Ampere's law(L2)

UNIT II: Fiber Optics 7L

Introduction, advantages of optical fibers, principle and structure, acceptance angle, numerical aperture, modes of propagation, classification of fibers, fiber optic communication, importance of V-number, fiber optic sensors (Temperature, displacement and force),applications.

Learning outcomes:
After completion of this unit, the student will be able to

- apply the principle of propagation of light in optical fibers(L3)
- explain the working and classification of optical fibers(L2)
- analyze propagation of light through optical fibers based on the concept of modes(L4)

- summarize applications of optical fibers in medical, communication and other fields(L2)

UNIT III: Dielectric and Magnetic Materials **10L**

Dielectric materials: Introduction, electric polarization, dielectric polarizability, susceptibility and dielectric constant, types of polarizations (qualitative treatment only), frequency dependence of polarization, Lorentz (internal) field (quantitative), Clausius- Mossotti equation.

Magnetic materials: Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theory of ferromagnetism (qualitative), domain theory, hysteresis, soft and hard magnetic materials.

Learning Outcomes:

After completing this unit, the students will be able to

- explain the concept of dielectric constant and polarization in dielectric materials(L2)
- interpret dielectric loss, Lorentz field and Claussius- Mosotti relation(L2)
- classify the magnetic materials(L2)
- explain the phenomenon of hysteresis for a ferromagnetic material and summarize the properties of hard and soft magnetic materials(L2)

UNIT IV: Semiconductor physics **8L**

Introduction, origin of energy band, intrinsic and extrinsic semiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors, carrier concentration in n-type and p-type semi conductors.

Learning outcomes:

After completion of this unit, the student will be able to

- outline the properties of semiconductors(L2)
- interpret expressions for carrier concentration in intrinsic and extrinsic semiconductors(L2)
- assess the variation of carrier concentration in semi conductors with temperature(L5)

UNIT V: Semiconductor devices **8L**

Drift and diffusion currents in semiconductors, Hall effect and its applications, magnetoresistance, p-n junction layer formation and V-I characteristics, direct and indirect band gap semiconductors, construction and working of photodiode, LED, solar cell.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the drift and diffusion currents and formation of junction layer(L2)
- state Einstein's relations(L1)
- explain Hall effect and its applications(L3)
- illustrateandinterprettheV-Icharacteristicsofap-njunctiondiode(L2)
- describe applications of p-n junction diodes in photodiodes, LEDs and solar cells(L3).

Text Book(s)

1. David J.Griffiths,"IntroductiontoElectrodynamics",4/e, Pearson Education,2014.
2. Charles Kittel, "Introduction to Solid State Physics", WileyPublications,2011.

Reference book(s)

1. M.N. Avadhanulu, P.G. Kshirsagar, "A Text book of Engineering Physics", 11/e, S. Chand Publications,2019.
2. Gerd Keiser, "Optical Fiber Communications", 4/e, Tata Mc Graw Hill,2008.
3. S.O. Pillai, "SolidStatePhysics",8/e,NewAgeInternational,2018.
4. S.M. Sze, "Semiconductor Devices-Physics and Technology", Wiley,2008.

Engineering Physics Laboratory

List of Experiments

1. To determine the magnetic field along the axis of a circular coil carrying current.
2. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
3. To determine magnetic susceptibility by Gouy's method
4. To determine the Hall coefficient using Hall effect experiment
5. To determine the resistivity of semiconductor by Four probe method
6. To determine the energy gap of a semiconductor.
7. To study the characteristics of PN Junction diode.
8. To study magnetic hysteresis loop (B-Hcurve).
9. To determine the dielectric constant of a substance by resonance method.
10. To determine hysteresis loss by CRO.
11. To study the characteristics of Photodiode
12. To study the characteristics of Solar Cell

References

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017

Course Outcomes

After completion of this unit the student will be able to

- utilize four probe set up and measure resistance(L3)
- determine the susceptibility of a paramagnetic substance(L5)
- understandthecharacteristicsofphotodiode,p-njunctiondiodeandsolarcell(L2).
- demonstrate the importance of dielectric material in storage of electric field energy in the capacitors(L2)

- assess the intensity of the magnetic field of circular coil carrying current with varying distance (L5)
- evaluate the acceptance angle of an optical fiber and numerical aperture and loss(L5).
- determinehysteresislossesbyB-Hcurveandmeasuremagneticparametersusinghysteresisloop (L5).
- identify the type of semiconductor i.e., n-type or p-type using Hall effect(L3)
- determine the band gap of a given semiconductor(L5)

19ECY131: ENGINEERING CHEMISTRY
(Common with ECE & CSE)

L	T	P	C
3	0	3	4.5

This course enables the students to gain knowledge on various aspects of renewable energy resources, electrochemical energy systems, construction of batteries, technological importance machining and etching, polymers, nano-materials, molecular machines and switches. The knowledge gained in this course can be applied to the latest problems in the above areas.

Course Objectives

- To acquaint with electrochemical energy systems and their applications.
- To impart knowledge on the basic concepts of battery technology.
- To familiarize the students with various sources of renewable energy and their harnessing.
- To demonstrate the construction of photo voltaic cells.
- To introduce different types of nano-materials.
- To expose the students to latest instrumental techniques such as scanning electronic microscope (SEM) & transmission electron microscope(TEM).

UNITI **9L**

Electrochemical Energy Systems

Introduction Origin of electrode potential, Electrode Potentials, Measurement of Electrode Potentials, Nernst Equation for a single electrode, EMF of a cell, Types of Electrodes or Half Cells Hydrogen and Calomel electrode, Electrochemical Cell, Galvanic Cell vs. Electrolytic Cell, Electrochemical conventions, Types of Ion Selective Electrodes- glass membrane electrode, polymer membrane electrodes, solid state electrodes, gas sensing electrodes (classification only), Concentration Cells.

Learning outcomes:

After the completion of the Unit I, the student will be able to

- list the different types of electrodes.(L1)
- illustrate the construction of concentration cells.(L2)
- explain the significance of electrode potentials.(L2)
- compare different types of cells and batteries.(L2)
- classify the ion selective electrodes.(L2)

UNITII **8L**

Battery Technology

Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classicalbatteries-dry/Leclanchecell,Modernbatteries-zincair,lithiumcells-$LiMnO_2$cell-challenges of battery technology. Fuel cells Introduction - classification of fuel cells – hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell.

Learning outcomes:

After the completion of the Unit II, the student will be able to

- classify batteries into different types.(L2)
- explain the concept involved in the construction of lithium cells.(L2)
- compare the merits of different fuel cells.(L2)
- identify the significance of batteries.(L3)
- apply the redox principles for construction of batteries and fuel cell.(L3

UNITIII **8L**

Renewable Sources of Energy Introduction- sources of renewable energy

Solar energy – Introduction - Physical and Chemical properties of Silicon- Production of Solar Grade SiliconfromQuartz-DopingofSilicon-pandntypesemiconductors-PVcell/solarcell-Manufacturing of Photovoltaic Cells using Chemical Vapor Deposition Technique-applications of solar energy.

Learning outcomes:

After the completion of the Unit III, the student will be able to

- list different renewable sources of energy.(L1)
- explain how photovoltaic cells convert light into energy.(L1)
- compare p and n type semiconductors.(L2)
- illustrate the construction of PV cell.(L2)

UNITIV **9L**

Metal Finishing

Technological importance of metal finishing, methods of metal finishing, manufacturing of electronic components, electrochemical techniques of forming, machining and etching, electrolytic cell, principle ofelectroplating,natureofelectrodeposits,electroplatingprocess,Electroplatingofchromium,goldetc. Electroless plating of copper, nickel.

Learning outcomes:

After the completion of the Unit IV, the students will be able to

- explain the electrochemical techniques of forming.(L2)
- extend it to electroless plating of some metals.(L2)
- identify different methods of metal finishing.(L3)
- apply the methods of metal finishing in the manufacture of electronic components.(L3)

UNITV **8L**

Polymers, Nanomaterials and Molecular Machines & Switches:

Polymers: Introduction, differences between thermoplastic and thermo setting resins, Preparation, properties and uses of polystyrene and Poly phosphazines.

Nanomaterials: Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and

nanowires. Chemical synthesis of nanomaterials: sol-gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM).

Molecular machines & Molecular switches: Rotaxanes and Catenanes as artificial molecular machines; Molecular switches – cyclodextrin-based switches

Learning outcomes:

After the completion of the Unit V, the students will be able to

- explaintheconceptsofartificialmolecularmachinesandmolecularswitches.(L2)
- identify different types of polymers.(L3)
- distinguish between thermoplastic and thermo setting resins.(L4)
- compare nanoclusters and nanowires.(L4)

Text Book(s):

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi,2014.
2. B.K. Sharma, Engineering Chemistry, Krishna Prakashan, Meerut.
3. G Palanna, Engineering Chemistry, Tata McGraw Hill2009.

References:

1. Sashichawla, A Textbook of Engineering Chemistry, Dhanapath Rai andsons,2003.
2. B.SMurthyandP.Shankar,ATextBookofNanoScienceandNanoTechnology,UniversityPress, 2013.
3. S.S. Dara, A Textbook of Engineering Chemistry, S. Chand& Co,2010.
4. N. Krishna Murthy and Anuradha , A text book of Engineering Chemistry, Murthy Publications,2014.
5. K. Sesha Maheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services,2016.

Course Outcomes

After the completion of the course, the student will be able to

- list various sources of renewable energy.(L1)
- compare different types of cells.(L2)
- explain the merits of fuel cells.(L2)
- identify suitable methods for metal finishing.(L3)
- distinguish between nanoclusters and nanowires, polymers, molecular machines &switches(L4)

Engineering Chemistry Laboratory

The course enables the students to gain knowledge on various, instrumental methods of analysis, measurements of physical parameters, volumetric analysis, preparation of polymers, analysis of water, and chromatographic separation techniques.

Course Objectives

- To familiarize the students with the basic concepts of Engineering Chemistry lab.
- To train the students on how to handle the instruments.
- To demonstrate the digital and instrumental methods of analysis.
- To expose the students in practical aspects of the theoretical concepts.

List of Experiments

1. Determination of Mohr's salt by potentiometric method
2. Determination of strength of an acid by pH metric method
3. Determination of conductance by conductometric method
4. Determination of viscosity of a liquid
5. Determination of surface tension of a liquid
6. Determination of sulphuric acid in lead-acid storage cell
7. Determination of chromium (VI) in potassium dichromate
8. Determination of copper in a copper ore
9. Determination of Zinc by EDTA method.
10. Estimation of active chlorine content in Bleaching powder
11. Preparation of Phenol-Formal dehyderesin
12. Preparation of Urea-Formal dehyderesin
13. Thin layer chromatography
14. Preparation of TiO_2/ZnO nanoparticles
15. SEM analysis of nanomaterials

Text Books

1. MendhamJ,DenneyRC,BarnesJD,ThomasMandSivasankarB,Vogel'sQuantitativeChemical Analysis, 6/e, Pearson publishers,2000.
2. N.K Bhasinand SudhaRani Laboratory Manual on Engineering,
3. Chemistry, 3/e, Dhanpat Rai Publishing Company,2007.

Course Outcomes:

After the completion of the laboratory course, the student will be able to

- explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods. (L2)
- identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods).(L3)
- experiment with the physical parameter of organic compounds.(L3)
- compare the viscosities of oils.(L4)
- list the preparation of polymers and nano materials.(L4)

19EID131: PROBLEM SOLVING AND PROGRAMMING

(Common to all)

L	T	P	C
3	1	3	5.5

Thiscoursefocusesonproblemsolvingusingvisualprogrammingandflowcharttools.Pythonbeingsimple and easy to learn syntax, it is used as an introductory coding platform to translate flow charts into programs. The course introduces fundamental programming concepts. Python language is used to present concepts including control structures, functions, data structures followed by important Python packages that will be useful in data analysis.

Course Objectives:

- To introduce programming through Visual programming tool -Scratch
- To teach problem solving through Flow charting tool -Raptor
- To elucidate problem solving through python programming language
- To introduce function-oriented programming paradigm through python
- To train in development of solutions using modular concepts
- To teach practical Pythonic solution patterns

UNIT I: Computational Thinking and Visual Programming Concepts 10 L+6P

Introduction to computational thinking. Visual programming concepts. Scratch environment: sprites -- appearance and motion, angles and directions, repetition and variation, changing costumes, adding background. Input/Output, variables and operators.

Learning Outcomes

After completion of this unit the student will be able to

- develop a program, controlled by a loop.(L3)
- experiment with "costumes" to change the appearance of sprites.(L3)
- perform Input, Output Operations using scratch.(L3)
- perform computation using common mathematical formulas.(L3)
- develop programs by passing messages between sprites.(L3)

UNIT II: Algorithms and Flowchart design through Raptor 10L+6P

Introduction to the idea of an algorithm. Pseudo code and Flow charts. Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, procedure and sub charts.

Example problems – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers

Example problems -- Fibonacci number generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

Learning outcomes:

After completion of this unit the student will be able to

- select flowchart symbols for solving problems.(L1)

- develop basic flowcharts for performing Input, Output and Computations(L3)
- solve numerical problems using Raptor(L3)
- analyze problems by modular approach using Raptor(L4)

UNIT III: Introduction to Python **10L+6P**

Python – Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/Output statements, Conditional If, while and for loops, User defined Functions, parameters to functions, recursive functions, Turtle Graphics.

Learning outcomes:

After completion of this unit the student will be able to

- interpret numbers, strings, variables, operators, expressions and math functions using Python Interactive Mode.(L2)
- solve simple problems using control structures, input and output statements.(L3)
- develop user defined functions (recursive and non-recursive).(L3)
- build Python programs for section 1 raptor flowcharts.(L3)
- develop Python programs for creating various graphical shapes using turtle graphics.(L3)

UNIT IV: Data Structures and Idiomatic Programming in Python **10L+6P**

Lists, Tuples, Dictionaries, Strings, Files and their libraries. Beautiful Idiomatic approach to solve programming problems.

Learning outcomes:

After completion of this unit the student will be able to

- summarize the features of lists, tuples, dictionaries, strings and files.(L2)
- demonstrate best practices of "Beautiful Idiomatic Python".(L2)
- build Python programs for section 2 raptor flowcharts.(L3).

UNITV: Packages **10L+6P**

Numpy -- Create, reshape, slicing, operations such as min, max, sum , search, sort, math functions etc.

Pandas -- Read/write from csv, excel, json files, add/ drop columns/rows, aggregations, applying functions

Matplotlib -- Visualizing data with different plots, use of subplots.

User defined packages, define test cases and perform unit testing

Learning outcomes:

After completion of this unit the student will be able to

- read data from files of different formats and perform operations like slicing, insert, delete, update (L3)
- visualize the data(L4)
- ability to define packages(L2)
- define test cases(L1)

Problem Solving and Programming with Python Laboratory

Laboratory Experiments

1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, Pentagon.
2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.
3. Design a Memory Game in Scratch which allows the user to identify positions of similar objects in a 3 x 3matrix.
4. Construct flowcharts to
    a. calculate the maximum, minimum and average of N numbers
    b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
5. Construct flowcharts with separate procedures to
    a. calculate simple and compound interest for various parameters specified by the user
    b. calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
6. Construct flowcharts with procedures to
    a. generate first N numbers in the Fibonacci series
    b. generate N Prime numbers
7. Design a flowchart to perform Linear search on list of N unsorted numbers (Iterative and recursive)
8. Design a flow chart to perform Binary search on list of N sorted numbers(Iterative and recursive)
9. Design a flowchart to determine the number of characters and lines in a text file specified by the user
10. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
11. Design a Python script to determine if a given string is a Palindrome using recursion
12. Design a Python script to sort numbers specified in a text file using lists.
13. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format (0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
14. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
15. Design a Python Script to determine the time difference between two given times in HH:MM: SS format. (0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <=59)
16. Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e)* of a given number using infinite series of the function.
17. Design a Python Script to convert a given number to words.
18. Design a Python Script to convert a given number to roman number.
19. Design a Python Script to generate the frequency count of words in a text file.
20. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
21. Design a Python Script to implement Gaussian Elimination method.
22. Design a Python script to generate statistical reports (Minimum, Maximum, Count, Average, Sum etc) on public datasets.
23. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.

Text Book(s):

1. Weingart, Dr. Troy, Brown, Dr. Wayne, An introduction to programming and algorithmic reasoning using raptor.

2. T R Padmanabhan, Programming with python, Springer.

3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press.

4. Wes McKinney , Python for Data Analysis, O.Reilly.

Course outcomes:

After the completion of the course, the student will be able to

- create interactive visual programs using Scratch.(L6)
- develop flowcharts using raptor to solve the given problems.(L3)
- build Python programs for numerical and text based problems(L3)
- develop graphics and event based programming using Python(L3)
- build Python programs using beautiful Pythonic idiomatic practices(L3)

19EEE131: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to all)

L	T	P	C
3	1	3	5.5

This course introduces the student, to the fundamental principles and building blocks of electrical and electronics engineering. The first three units cover the electric circuit laws, theorems and principles of electrical machines. The last two units cover semiconductor devices and their applications.

Course Objectives

- TofamiliarizethebasicDCandACnetworksusedinelectricalandelectroniccircuits.
- To explain the concepts of electrical machines and their characteristics.
- To introduce the importance of transformers in transmission and distribution of electric power.
- To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors(MOSFETs).
- ToexposebasicconceptsandapplicationsofOperationalAmplifierandconfigurations.

UNITI **10L**

Basic laws and Theorems: Ohms law, Kirchhoff's Laws, series and parallel circuits, source transformations, delta-wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples.

Learning Outcomes:

After completion of this unit, the student will be able to

- state Ohms law and Kirchhoff's Laws(L1)
- identify and analyze series and parallel connections in a circuit(L4)
- predict the behavior of an electrical circuit(L2)
- determine the current, voltage and power in the given electrical circuit(L3)
- apply various techniques to analyze an electric circuit(L3)

UNITII **10L**

DC Machines: Constructional features, induced EMF and torque expressions, different types of excitation, performance characteristics of different types of dc machines, Starters: 2-point, 3-point starters, losses and efficiency, efficiency by direct loading.

Learning Outcomes:

After completion of this unit, the student will be able to

- describe the constructional features of DC machines(L1)
- analyze EMF and torque expressions of DC machine(L4)
- demonstratetheperformancecharacteristicsofdifferenttypesofdcmachines (L3)
- explain types of starters used for starting of dc motors(L2)
- estimate losses and efficiency of electrical machine(L2)

UNITIII **12L**

Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short-circuit tests and determination of efficiency. **Three Phase Induction Motors**: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.

Learning Outcomes:

After completion of this unit, the student will be able to

- describe the constructional details of transformers(L1)
- demonstrate voltage regulation of transformer(L2)
- discuss about open and short- circuit tests of transformer(L2)
- explain the working principle of three phase induction motor(L5)
- describe torque and torque slip characteristics(L1)
- estimate losses and efficiency of three Phase Induction Motors(L2)

UNITIV **12L**

Semiconductor Devices: p-n Junction diode - Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.

Learning Outcomes:

After completion of this unit, the student will be able to

- describe the device structure and physical operation of a diode(L1)
- discuss V-I characteristics of diodes(L2)
- explain the use of diode as switch and in electronic circuits(L2)
- describetheconstructionandoperationofn-channelandp-channelMOSFETs(L1)
- explain the use of MOSFET as an amplifier and bidirectional switch(L2)

UNIT V **10L**

Operational Amplifiers: The Ideal Op Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non Inverting Configuration, Effect of finite open loop gain, the voltage follower, Difference amplifiers, A Single Op-amp difference amplifier.

Learning Outcomes:

After completion of this unit, the student will be able to

- list the characteristics of an ideal Op Amp(L1)
- explain the Inverting and Noninverting configurations of Op-Amp(L2)
- construct a single Op-amp difference amplifier(L3)

Basic Electrical and Electronics Engineering Laboratory

1. Verification of Kirchhoff's Laws KVL and KCL.
2. Verification of DC Superposition Theorem.
3. Verification of Thevenin's Theorem and Norton's Theorem.
4. OCC and External characteristics of separately excited DC generators.
5. Swinburne's test on a DC shunt motor.
6. OC and SC Tests on single phase transformer.
7. Brake Test on DC shunt motor.
8. Current Voltage Characteristics of a p-n Junction Diode/LED.
9. Diode Rectifier Circuits.
10. Voltage Regulation with Zener Diodes.
11. Design of a MOSTFET amplifier and MOSFET inverter/NOR gate
12. Inverting and Non-inverting Amplifier Design with Op-amps.
13. Simulation experiments using PSPICE
    a. Diode and Transistor Circuit Analysis.
    b. MOSFET Amplifier design.
    c. Inverting and Noninverting Amplifier Design with Op-amps.

Text Book(s):

1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1/e, McGraw Hill Education (India) Private Limited,2017.
2. B.L.Theraja,FundamentalsofElectricalEngineeringandElectronics,1/e,S.ChandPublishing, New Delhi,2006.
3. AdelS.SedraandKennethC.Smith,MicroelectronicCircuits,6/e,OxfordUniversityPress,2014.

References:

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education,2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

Course Outcomes

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

- predict and analyze the behavior of an electrical circuit(L3)
- analyze the performance quantities such as losses, efficiency and identify applications of DC machines(L4)
- explain the use of transformers in transmission and distribution of electric power and other applications(L2)
- demonstratetheoperationandapplicationsofvariouselectronicdevices(L2)
- construct Inverting and Non-inverting configurations of Op-Amp(L3)

19EME121: WORKSHOP
(Common to all)

L T P C
0 0 31.5

The objective of this course is to expose students, common tools in engineering. This course enables the studentstogainhandsonexperienceandskillsnecessarytoperformbasicoperationssuchascarpentry, sheet metal working and fitting. It also familiarizes the students with basic electrical house wiring concepts.

Course Objectives

- Explain different tools used in carpentry.
- Impart the skills to do some carpentry operations.
- Demonstrate different types of tools used in fitting, soldering and brazing.
- Train fitting, soldering and brazing jobs.
- Familiarize different types of basic electric circuit connections.

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint.

b) Mortise and Tenon joint.

c) Corner Dovetail joint or Bridle joint.

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working,
Developments of following sheet metal job from GI sheets
a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a)V-fit b) Dovetail fit c) Semi-circular fit
d) Bicycle tire puncture and change of two wheeler tire

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the
following connections
a) Parallel and series b) Two-way switch

c) Godown lighting d) Tube light
e) Three phase motor f) Soldering of wires

Course Outcomes:

After completion of this lab the student will be able to

- summarizevariouscarpentryoperationrequiredtocreateaproductinrealtimeapplications.(L2)
- develop different parts with metal sheet in real time applications.(L3)
- demonstrate fitting operations in various applications.(L3)
- preform soldering and brazing operations.(L3)
- select different types of electric circuits in practical applications(L3)

19EME131: ENGINEERING GRAPHICS
(Common to all)

L	T	P	C
1	0	3	2.5

This course enables the students to convey the ideas and information graphically that come across in engineering. This course includes projections of lines, planes, solids sectional views, and utility of drafting and modeling packages in orthographic and isometric drawings.

Course Objectives

- Create awareness of the engineering drawing as the language of engineers.
- Familiarize how industry communicates, practices for accuracy in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Demonstrate utility of drafting and modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling software's.
- Impart graphical representation of simple components.

Manual Drawing: **7L**

Introduction to Engineering graphics: Principles of Engineering Graphics and their Significance-Conventions in drawing-lettering - BIS conventions.

a) Conic sections - general method only,

b) Cycloid, epicycloids and hypocycloid

c) Involutes **2L**

Projection of points, lines and planes: Projection of points in different quadrants, lines inclined to one and both the planes, finding true lengths and angles made by line. Projections of regular plane surfaces.

2L

Projections of solids: Projections of regular solids inclined to one and both the reference planes.

1L

Sections of solids: Sectional planes and sectional view of right regular solids-prism, cylinder, pyramid and cone. True shapes of the sections. **1L**

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts. **1L**

Computer Aided Drafting:

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations. **1L**

Orthographic Projections: Systems of projections, conventions and application to orthographic projections. **3L**

Isometric Projections: Principles of isometric projection- Isometric

scale; Isometric views: lines, planes, simple and compound solids. **2L**

Text Book(s):

1. K.L. Narayana &P. Kannaiah, Engineering Drawing, 3/e, SciTech Publishers,2012.
2. N.D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers,2016.

References:

1. Dhanajay A Jolhe, Engineering Drawing, TataMcGraw-Hill,2009.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009.
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers,2000.
4. K.C. John, Engineering Graphics, 2/e, PHI,2013.
5. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill,2008.

Course Outcomes:

After completion of this unit the student will be able to

- utilize Engineering Graphics as Language of Engineers.(L3)
- prepare drawings as per standards (BIS).(L3)
- identify various engineering curves.(L3)
- solve geometrical problems in plane geometry involving lines and plane figures(L3)
- represent solids and sections graphically.(L3)
- develop the surfaces of solids.(L3)
- draw isometric and orthographic drawings using CAD packages.(L3)

19EMC181A – NATIONAL CADET CORPS

L T P C
0 0 2 0

UNITI **5hours**

Aims and objectives of NCC: Organization and training, ncc song, incentives for cadets. national integration and awareness: religion, culture, traditions and customs of India, national integration – importance and necessity, freedom struggle and nationalist movement in India, national interests, objectives, threats and opportunities, problems/ challenges of national integration, national integration and awareness, unity and diversity, national integration council, images/ slogans for national integration, contribution of youth in nation building

UNITII **5hours**

Drill Attention, stand at ease and stand easy, turning and inclining at the at the halt, ceremonial drill-guard mounting, guard of honour, platoon / company drill, instructional practice, weapon training stripping, assembling, care and cleaning and sight setting of .22 rifle, the lying position, holding and aiming, trigger control and firing a shot, short range firing, aiming – alteration of sight

UNITIII **5 hours**

Personality development: Introduction to personality development, factors influencing / shaping personality – physical , social, psychological and philosophical self-awareness – know yourself / insight, change your mindset, interpersonal relationship and communication communication skills – group discussion / lecturettes,leadershiptraits,typesofleadership,attitude–assertivenessandnegotiation,timemanagement, personalitydevelopment,effectsofleadershipwithhistoricalexamples,stressmanagementskills,interview skills, conflict motives – resolution, importance of group – team work, influencing skills, body language, sociability: social skills, values / code of ethics **Disaster Management:** Civil defense organization and its duties – ndma, types of emergencies / natural disasters, fire service and fire fighting, traffic control during disaster under police supervision, essential services and their maintenance, assistance during natural/ other calamities / floods / cyclone / earth quake / accident, setting up of relief camp during disaster management, collection and distribution of aid material

UNITIV **5hours**

Social awareness and community development: Basics of social service, weaker sections of our society and their needs, social/rural development projects–menrega, sgsy, nsapetc, ngos: role and contribution, contribution of youth towards social welfare, family planning, drug abuse and trafficking, civil responsibilities, causes and prevention of hiv/ aids role of youth, counter terrorism, corruption, social evils – dowry / female foeticide / child abuse and trafficking, rti and rte, traffic control organization and anti drunken driving, provision of protection of children from sexual harassment act2012.

UNITV **5hours**

Health and Hygiene: Structure and functioning of the human body, hygiene and sanitation (personal and food hygiene), physical and mental health, infectious and contagious diseases and its prevention, basic of home nursing and first aid in common medical emergencies, wounds and fractures, introduction to yoga andexercises.**Adventuretraining:**Parasailing,slithering,rockclimbing,cycling/trekking,environment awareness and conservation natural resources conservation and management, water conservation and rain

water harvesting, waste management, pollution control, water , air, noise and soil, energy conservation,. wildlife conservation – projects in india. obstacle training, obstacle course, practical training

Text Book(s)

1. Cadet Hand Book (Common Subjects), published by DGNCC.
2. Cadet Hand Book (Specialized Subjects), published by DGNCC.

Reference Book(s)

1. Grooming Tomorrow's Leaders, published by DG,NCC.
2. Youth in Action, published by DG,NCC.
3. The Cadet, Annual Journal of the NCC.

19EMC181B - NATIONAL SERVICE SCHEME (NSS)

L T PC
0 0 2 0

National Service scheme is a public service program encouraged by Ministry of Youth Affairs and Sports of the Government of India. NSS is a voluntary association of young people in Colleges, Universities and at +2 level working for a campus-community linkage. The objective of this course is to expose the students to the activities of National Service Scheme, concept of social Service and principles of health, hygiene and sanitation.

UNITI **2Hours**

Introduction and Basic concepts of NSS: History. Philosophy, aims and Objectives of NSS, Emblem, Flag, Motto, Song, Badge etc.: Organizational structure, role and responsibilities of various NSS Functionaries.

UNITII **2Hours**

Regular activities: College campus activities, NS.S, activities in Urban and Rural areas, NSS Annual Activities Calendar, Suggestive List of Activities, Role of Non-Government Organization (NGO) in social Reforms i) Red Cross ii) Rotary

UNITIII **2Hours**

Special Camp activities: Nature and its objectives: Selection of camp site -Identification of community problems- physical arrangement- Organization of N.S.S. camp through various committees and discipline in the camp-adaption of village-planning for pre-camp during and post campaigning. **Activities-**Activities to be undertaken during the N.S.S. camp- Use of the mass media in the N.S.S activities.

UNITIV **4hours**

Health, Hygiene and Sanitation: Definition, needs and scope of health education, food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan. **Disaster Management:** Introduction to Disaster Management, Classification of Disasters. Role of Youth in Disasters Management, Home nursing, First Aid. **Civil Self Defense:** Civil Defense services, aims and objectives of civil defense, Need for self defence training

UNITV **10hours**

Social Project: Problems Identification - Data Collection- Preparation of a Questionnaire-Observation-Schedule Interview-Qualitative Research-Quantities Research-Major Findings-Suggestions-Conclusion-Report Writing.

Text Book(s):

1) National Service Scheme Manual (Revised) 2006, Government of India, Ministry ofYouth Affairs and Sports, New Delhi
2) NSS Diaries
3) Sanjay Bhattachaya, Social Work Interventions and Management-Deep and Deep Publications, New Delhi

19EMC181C: National Sports Organization (Common to all)

L T P C

0 0 2 0

National Sports Organization is intended by the Government of India to promote the development of athletics and sporting activities of the nation's youth. This activity enables physical fitness, teamwork and mental health within the students. This course teaches the rules and skills of below sports and games to the students. Each student shall be made proficient in one of the chosen sport from the below list:

1. Cricket
2. Volley Ball
3. Table Tennis
4. Foot Ball
5. Throw Ball (Only for Women)
6. Basket Ball
7. Athletics -100 Meters Run, Long Jump, Shot Put
8. Chess
9. Lawn Tennis
10. Kabaddi
11. Aerobics
12. Badminton

Text Book(s):

1. Myles Schrag, The Sport Rules Book, 4/e, Human Kinetics,2018
2. Dhama Prakash Jyoti, Rules. Of. Games. And. Sports, Laxmi Book Publication,2018

19EMC181D: YOGA

(Common to all)

L T P C

0 0 2 0

The course is designed to enable the student to know about yoga an ancient Indian tradition. It embodies unity of mind and body; thought and action; harmony between human and nature and a holistic approach to health and well-being. It is not only exercise but to discover the sense of oneness with ourselves, the world and nature. The student will be able to learn about Yoga and practice different Yoga asana which influences his lifestyle and creating consciousness, it can help a student to deal with health issues and climate change.

Course Objectives:

- Familiarize the student with YOGA and ancient Indian tradition.
- Enable the student to know the different asana their advantages and disadvantages.
- Explain with the features of different Yogaasana.
- Demonstrate and perform Yogaasana.
- Enable the student to perform pranayama and meditation.

- **Introduction to Yoga:** Evolution of Yoga and Schools of Yoga, Origin of Yoga, History and DevelopmentofYoga;EtymologyandDefinitions,Misconceptions,NatureandPrinciplesofYoga.
- **Guidelines to yoga practice:** Prayer, warmup exercises/ loosening exercises
- **Yoga Theory:** Therapeutic Benefits of Yoga – primitive, preventive and curative aspects of Yoga
- **Application of Yoga to students,** Suryanamaskaras, Tadasan, Natarajasan, Vrikshasan, Padahasthasan, Ardhachakrasan, Trikonasan, Bramaripranayama.
- **Yoga for allround fitness,** Bhadrasan, Vajrasan, ArdhaUstrasan, Nadishuddhi pranayama, Navasan, Janusirasan, Paschimotthanasan, Shashankasan, Vakrasan, Bhujangasan,Kapalabhati..
- **Meditative Postures**: Sukhasan, Ardha Padmasan, Padmasan andSiddhasan,Meditation
- **Yoga Practice**: Makarasan, Sethubandhasan, Pavanmuktasan, Sarvangasan, Matsyasan,Halasan.

Text Book(s):

1. Swami MuktibodhandaSaraswathi Shay G.S., Hatha yoga Pradipika, Bihar School of yoga publications, Munger,2000.
2. Hatha Yoga Pradeepika of Svatmarama, MDNY Publication, 2013
3. Svatmarama,Swami,TheHathayogaPradipika/theoriginalSanskrit[by]Svatmarama;anEnglish translation [by] Brian Dana Akers. Woodstock, NY:YogaVidya.com,2002.

References:

3. Bharati,SwamiVedaReddyVenkata:PhilosophyofHathaYoga(Englis),Himalayan,Pensylvania, HathaRatnavali.
4. Swami Satyananda Saraswathi - Asana, Pranayama, Mudra & Bandha. Bihar School of Yoga, Munger
5. B.KS.Iyenger - The Illustrated Light on Yoga. Harper Collins, New Delhi.

Course Outcomes:

After completion of this course the student will be able to

- understand history and evolution of Yoga(L2).
- list different schools of yoga(L2).
- interpret the aim and objectives of yoga to students(L2).
- perform yoga asana, pranayama, and meditation(L3).

19EMA102: ENGINEERING MATHEMATICS-II
ODE, PDE AND MULTIVARIABLE CALCULUS
(Common with AE, CE, ECE and ME)

L T P C
3 0 0 3

This course is designed to impart knowledge on ordinary, partial differential equations and vector calculus to understand the concepts like fluid mechanics, signals and systems etc., in engineering applications.

Course Objectives:

- To familiarize the students in the concepts of linear differential equations.
- To explain the concept of reducing linear differential equations with variable coefficients to constant coefficients and their applications.
- To demonstrate the concepts of partial differential equations.
- To explain the concepts of vector differentiation and integration.

Unit I: Linear Differential Equations of Higher Order **8 L**

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

Learning Outcomes:

After completion of this unit, the student will be able to

- classify the solutions of linear differential equations(L4).
- identify the essential characteristics of linear differential equations with constant coefficients(L3).
- solve the linear differential equations with constant coefficients by appropriate methods(L3).

Unit II: Equations Reducible to Linear Differential Equations and Applications **8 L**

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass-Spring system and L-C-R Circuit.

Learning Outcomes:

After completion of this unit, the student will be able to

- examine the special type of nonlinear differential equations(L4).
- Analyze physical situations using higher order differential equations (L4).

Unit III: Partial Differential Equations **8 L**

Formation of partial differential equations, solutions of first order linear partial differential equations, Charpit's method, solutions to homogenous and non-homogenous linear partial differential equations.

Learning Outcomes:

After completion of this unit the student will be able to

- apply a range of techniques to find solutions of partial differential equations(L3).
- identify the basic properties of partial differential equations(L3).

Unit IV: Multivariable Calculus(Vector Differentiation) **8 L**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

After completion of this unit, the student will be able to

- illustrate the physical interpretation of gradient, divergence and curl (L3).

- apply operator del to scalar and vector point functions(L3).

Unit V: Multivariable Calculus(Vector Integration) 10 L

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Gauss divergence theorem (without proof).

Learning Outcomes:

After completion of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field(L3).
- construct the rate of fluid flow along and across curves(L3).
- apply Green's, Stokes and Gauss divergence theorem in evaluation of line, surface and volume integrals(L3).

Text Book(s):

1. ErwinKreyszig,AdvancedEngineeringMathematics,10/e,JohnWiley&Sons,2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers,2017.

References:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, 4/e, Jones and Bartlett Publishers,2011.
2. MichaelGreenberg,AdvancedEngineeringMathematics,2/e,Pearson,2016.
3. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas' Calculus, 13/e, Pearson Publishers,2014.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd.,2002.
5. GlynJames,AdvancedModernEngineeringMathematics,4/e,PearsonPublishers,2011.

Course Outcomes:

After completion of this course, the student will be able to

- solve the differential equations related to various engineering fields(L3).
- identify methods of solution for partial differential equations(L3).
- interpret the physical meaning of gradient, divergence and curl(L4).
- determinetheworkdoneagainstaforcefield,circulationandfluxusingvector calculus (L4).

19EID132: DESIGN THINKING
(Common to all)

L	T	P	C
2	0	2	3

Design is a realization of a concept or idea into a configuration, drawing or a product. Design Thinking is cognitive and practical processes by which design concepts are developed by designers. Innovation is a new idea or a new concept. Product development is the creation of a new or different product that offers new benefits to the end user. This course introduces the design thinking in product innovation.

Course Objectives:

- To familiarize product design process
- To introduce the basics of design thinking
- To bring awareness on idea generation
- To familiarize the role of design thinking in services design

UNIT I **8 L**

Introduction to design, characteristics of successful product development, product development process, identification of opportunities, product planning, Innovation in product development.

Learning Outcomes:

After completing this unit, the student will be able to

- identify characteristics of successful product development(L3)
- identify opportunities for new product development(L3)
- plan for new product development(L3)

UNIT II **8 L**

Design Thinking: Introduction, Principles, the process, Innovation in Design Thinking, benefits of Design thinking, design thinking and innovation, case studies.

Learning Outcomes:

After completing this unit, the student will be able to

- explain the principles of Design Thinking(L2)
- identify the benefits of Design Thinking(L3)
- use innovations in Design Thinking(L3)

UNIT III **10 L**

Idea generation: Introduction, techniques, Conventional methods, Intuitive methods, Brainstorming, Gallery method, Delphi method, Synectics etc Select ideas from ideation methods, case studies.

Learning Outcomes:

After completing this unit, the student will be able to

- explain the techniques in idea generation(L2)
- select ideas from ideation methods(L3)
- identify the methods used in idea generation in some case studies(L3)

UNIT IV **10 L**

Design Thinking in Information Technology, Design Thinking in Business process model, Design Thinking for agile software development, virtual collaboration, multi user and multi account interaction, need for communication, TILES toolkit, Cloud implementation.

Learning Outcomes:

After completing this unit, the student will be able to

- use Design Thinking in business process model(L3)
- apply Design Thinking for Agile software development(L3)

- use TILES toolkit(L3)

UNIT V **8 L**

Design thinking for service design: How to design a service, Principles of service design, Benefits of service design, Service blueprint, Design strategy, organization, principles for information design, principles of technology for service design.

Learning Outcomes:

After completing this unit, the student will be able to

- use principles of service design(L3)
- explain the benefits of service design(L5)
- apply principles of technology for service design(L3)

Text Book(s):

1. Pahl, Beitz, Feldhusen, Grote – Engineering Design: a systematic approach, Springer, 2007
2. Christoph Meinel and Larry Leifer, Design Thinking, Springer, 2011
3. Aders Riise Maehlum - Extending the TILES Toolkit – from Ideation to Prototyping
4. http://www.algarytm.comA/it-executives-guide-to-design-thinking:e-book.
5. Marc stickdorn and Jacob Schneider, This is Service Design Thinking, Wiely, 2011

Course Outcomes:

At the end of this course, the student will be able to

- innovate new methods in product development(L6)
- apply Design Thinking in developing the new designs(L3)
- select ideas from ideation methods in new product development(L5)
- use Design Thinking in developing software products(L3)
- apply principles of Design Thinking in service design(L3)

19EID134: **AI TOOLS**
(Common to all)

L	T	P	C
2	0	2	3

The surge in the production of data has led to the development of various technologies. The term "Artificial Intelligence (AI)" has become ubiquitous in everyday applications from virtual assistants to self-driving cars. Several applications such as Healthcare, Finance, Bioinformatics etc. are benefitting from the advances in the domain. The global market for artificial intelligence is going to face a phenomenal growth over the coming years with organizations across the world capitalizing on the disruptive technologies that AI is offering. This course introduces the recent applications of AI namely, Virtual Assistants, Computer Vision, along with trending topics such as Deep Learning and Reinforcement Learning. The idea of the course is to introduce the basic concepts of AI as well as latest trends in the domain. This course is envisaged to provide a basic understanding on latest developments of AI to all disciplines engineering undergraduates.

Course Objectives:

- To provide a basic foundation on different concepts of Artificial Intelligence.
- To investigate various applications of AI such as Virtual Assistants, Computer Vision, as well as other Smart Applications.
- Explore the scope, advantages as well as limitations of intelligent systems.
- Experiment with different machine learning concepts such as Deep Learning and Reinforcement Learning
- To expose students to the AI-intensive computing and information system frameworks.

UNIT I **10 L**

Introduction to Artificial Intelligence: Basics of AI. Applications of AI. Advanced search, Constraint satisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilistic reasoning.

Conceptual introduction to **Machine Learning:** Introduction to Neural Networks, Supervised, Unsupervised, and Semi-Supervised Learning, Deep Learning, Reinforcement Learning, Linear Regression.

Conceptual introduction to **Natural Language Processing:** Natural language Understanding, Sentiment Analysis, Segmentation and recognition.

Conceptual introduction to **Speech Recognition & Synthesis:** Speech Fundamentals, Speech Analysis, Speech Modelling, Speech Recognition, Speech Synthesis**,** Text-to-Speech.

Conceptual introduction to **Image Processing & Computer Vision:** Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Segmentation, Edge Detection, Optical Character Recognition, Feature Detection & Recognition

Learning Outcomes:

After completion of this unit, the student will be able to

- recognize various domains in which AI can be applied(L2)
- define machine learning and forms of learning(L1)
- describe natural language processing and concepts for converting speech to different forms(L2)
- identify the concepts of image processing(L3)

UNIT II **12 L**

BOT Technologies and Virtual Assistants: Catboats: Introduction to a Chabot, Architecture of a Chabot. NLP in the cloud, NL Interface, how to Build a Chabot, Transformative user experience of catboats, Designing elements of a Chabot, Best practices for Chabot development. NLP components. NLP wrapper to catboats. Audio bots and Music bots.

Virtual Assistants: Architecture of a Virtual Assistant.

Learning Outcomes:

After completion of this unit, the student will be able to

- analyze the architecture of a Chabot(L4)
- illustrate how to construct a Chabot(L2)
- differentiate various catboats(L4)
- interpret the architecture of a virtual assistant(L3)

UNIT III **12 L**

Image Processing & Computer Vision: Image - Definition and Tagging. Classification of images. Tagging. Image formation, Deep Learning algorithms for Object detection & Recognition. Face recognition, Instance recognition, Feature detection and matching, Segmentation, Recognition Databases and test sets Applications -- Feature extraction, Shape identification. Fane detection.

Applications: Automation, Agriculture [Crop and Soil Monitoring, grading farm produce, Predictive Analytics], Retail and Retail Security [Amazon Go], Autonomous vehicles.

Learning Outcomes:

After completion of this unit, the student will be able to

- classify the properties of images(L3)
- interpret the concepts of image processing(L2)
- implement the methods in processing an image(L3)
- analyze and apply the concepts of image processing in automation and agriculture(L4)

UNIT IV **12 L**

Reinforcement Learning: Introduction to Reinforcement Learning, Game Playing [Deep Blue in Chess, IBM Watson in Jeopardy, Google's Deep Mind in AlphaGo], Agents and Environment, Action-Value Function, Deep Reinforced Learning

Applications: Robotics, Gaming, Diagnostic systems, Virtual Assistants.

Learning Outcomes:

After completion of this unit, the student will be able to

- illustrate reinforcement learning(L2)
- employ the reinforcement learning in game playing(L3)
- use reinforcement learning in agent based environment(L3)
- practice learning process in diagnostic and virtual assistant systems(L3)

UNIT V **10 L**

Smart Applications: Smart Manufacturing, Smart Agriculture, Smart Healthcare, Smart Education, Smart Grids, Smart Transportation and Autonomous Vehicles, Smart Homes, Smart Cities.

Learning Outcomes:

After completion of this unit, the student will be able to

- understand the application of intelligence in various domains(L2)
- apply the artificial intelligence in various applications(L3)
- correlate the intelligence to advanced applications(L4)

Text Book(s)

1. Tom Markiewicz& Josh Zheng, Getting started with Artificial Intelligence, O'Reilly Media, 2017.
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach. Prentice Hall

References

1. AurélienGéron, Hands on Machine Learning with Scikit-Learn and Tensor Flow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media, 2017.
2. Build an AI Assistant with Wolfram Alpha and Wikipedia in Python. **https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe**
3. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv_ Computer Vision Projects with Python-Packt Publishing (2016).
4. Curated Datasets on Kagglehttps://www.kaggle.com/datasets.

AI TOOLS LABORATORY

List of Practical Experiments:

1. Supervisely - Perform Data Labelling for various images using object recognition
2. Lobe.ai - Build custom models using the visual tool for Object recognition and sentiment analysis that can convert facial expressions into emoticons
3. Teachable Machine - In Browser Object Recognition through Brain.JS
4. Liv.ai - App for Speech recognition and Synthesis through APIs
5. Building a Chabot using A WSLex, Pandora bots
6. Configure an existing Neural Network by manipulating various parameters involved
7. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
8. Build a Convolutional Neural Network for Cat vs. Dog Image Classification

Online Resources:

Pytorch:
https://pytorch.org/
https://github.com/pytorch
Keras:
https://keras.io/
https://github.com/keras-team
Theano:
http://deeplearning.net/software/theano/
https://github.com/Theano/Theano
Cafee2:
https://caffe2.ai/
https://github.com/caffe2
Deeplearning4j:
https://deeplearning4j.org/

Scikit-learn:
https://scikit-learn.org/stable/
https://github.com/scikit-learn/scikit-learn
Deep Learning. Ai:
https://www.deeplearning.ai/
OpenCv:
https://opencv.org/
https://github.com/qqwweee/keras-yolo3
YOLO:
https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/
nVIDIA:CUDA:
https://developer.nvidia.com/cuda-math-library

Course Outcomes

After completion of this course, the student will be able to

- distinguish the concepts of artificial intelligence, machine learning, natural language processing, image processing. (L4)
- illustrate the architectures of Chabot and virtual assistant(L2)
- analyze image based applications by using image processing concepts(L4)
- employ reinforcement learning in different applications(L3)
- identify smart applications(L3)

19EHS122: COMPREHENSIVE SKILL DEVELOPMENT – 1

Course Objectives:

- To encourage the all-round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes:

- On completion of the course, student will be able to– Effectively communicate through verbal/oral communication and improve the listening skills
- Write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
- Student will be able to understand the problems and develop his competitive coding skills.
- Apply the skills in various domains and will be able to solve complex problems faced by the industry.
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality

Part-1 **- 3 Hours per week**

A. Verbal and Soft Skills

Self Awareness and Motivation, Goal Setting and Time Management, Interpersonal Skills, Team Work.

	Verbal and Soft Skills	
Unit	Module/ Topics	Hrs
1.	Self-Awareness and Self-Regulation	4
2.	Social Awareness & Relationship Management	4
3.	Conflict Management	3
4.	Team Work	4
	Total	15

B. Quantitative Aptitude and Reasoning

Puzzles, Non-Verbal Reasoning, Data Sufficiency, Analytical Reasoning,

	Quantitative Aptitude and Reasoning	
Unit	**Module/ Topics**	**Hrs**
1.	Verbal Reasoning [Coding decoding, Blood relations, Ranking, Directions, Group Reasoning (Puzzle Test)]	6
2.	Analytical Reasoning [Cubes, Counting of Geometrical Figures)	2
3.	Logical Deductions [Venn diagrams, Syllogisms, Data Sufficiency]	4
4.	Puzzles [Puzzles from books i. Puzzles to puzzle you by Shakunthala devi ii. More puzzles by Shakunthala devi iii. Puzzles and Teasers by George Summers]	3
	Total	**15**

Part-2 **- 3 Hours per week**

Coding: **GitHub** – Accepting assignments pull and push the code or resource, GitHub configuration,

Visual Studio code – Configuring, integrating Git for assignment submission

Online competitive coding platforms – Introduction to online coding platforms to get prepared for competitive coding.

Problem Solving with Python: Collections, Techniques for manipulating Strings, Recursion, Searching, Sorting, Stacks and Queues.

Problem Solving with C: Memory, C Syntax, Conditions and Loops, Functions and Recursion, Arrays, Techniques for manipulating Strings, Searching, Sorting, Stacks and Queues, Structures. sentation of graphs, Breadth First Search, Depth First Search, Dynamic Programming.

Scheme of Evaluation

Internal Assessments by Assignments , Quizzes(multiple Choice questions). All the Students are expected to do at least 5 problems in each topic and they should submit the content written by them in each topic for final evaluation.

Type of Assessment	No.of Marks
At least 5 problems in each topic	15
Assignments	15
Content writing	10
Quizzes	10
Total	**50**

Late Work

Each homework is due in the beginning of the class meeting (that is, at 6:00pm) on the due date. If homework is submitted within seven days after this deadline, the grade will be reduced by 50%. Submission more than seven days after the deadline will not be accepted. If you have a serious reason for requesting an extension, such as illness or family emergency, you should discuss it with one of the instructors as soon as the problem arises, and definitely before the submission deadline.

References:-

The course does *not* have a required textbook. You may optionally use the following textbook and URLs to look up standard algorithms:

1. Data Structures and Algorithms made easy by Narasimha Karumanchi
2. ***Data Structure and Algorithmic Thinking with Python by Narasimha Karumanchi***
3. ***Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide and Conquer and Dynamic Programming by Narasimha Karumanchi***
4. Coding Interview Questions by Narasimha Karumanchi
5. Competitive Programming in Python- 128 Algorithms to develop your Coding Skills by Cristhop Durr & Jill-Jen Vie.
6. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests (Undergraduate Topics in Computer Science) *by* Antti Laaksonen
7. https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/
8. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
9. https://codeforces.com/
10. https://leetcode.com/

VDC111: VENTURE DISCOVERY

L	T	P	C
0	0	4	2

India as part of its Make in India initiative has been focusing on creating incubation centers within educational institutions, with an aim to generate successful start-ups. These start-ups will become employment creators than employment seekers, which is the need of the hour for our country.

This common course for all the disciplines is a foundation on venture development. It is an experiential course that lets students venture and find out what is a business, financial and operating models of a business are. How to design and prototype a solution that meets their customers' needs and generate revenue for the business.

COURSE OBJECTIVES

- Discover who you are – Values, Skills, and Contribution to Society.
- Gain experience in actually going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.
- Understand innovation outcomes: issues around business models, financing for start-ups, intellectual property, technology licensing, corporate ventures, and product line or service extensions.

UNIT I **(6 sessions)**

Personal Values: Defining your personal values, Excite & Excel, build a Team, Define purpose for a venture. Four stages: Personal Discovery, Solution Discovery, Business Model Discovery, Discovery Integration.

UNIT II **(6 sessions)**

Solution Discovery: Craft and mission statement, Experience design, Gaining user insight, Concept design and positioning, Product line strategy, Ideation & Impact.

UNIT III **(6 sessions)**

Business Model Discovery: Prototyping solutions, Reality Checks, understand your industry, Types of business models, Define Revenue Models, Define Operating Models

UNIT IV **(6 sessions)**

Discovery Integration: Illustrate business models, validate business models, Define company impact

UNIT V **(6 sessions)**

Tell a Story: Can you make money, Tell your venture story.

Assessment methods

Task	Task type	Task mode	Weightage (%)
A1. Assignments	Individual	Report/Presentation	20
A2. Case / Project/Assignment	Groups* or Individual	Presentations/Report/Assignment	40
A3. Project	Individual/Group	Report/Pitch	40

Transferrable and Employability Skills

	Outcomes	Assessment

11 1	Know how to use online learning resources: G-Learn, online journals, etc.	A1 & A2
2	Communicate effectively using a range of media	A1 & A2
3	Apply teamwork and leadership skills	A2
4	Find, evaluate, synthesize & use information	A1 & A2
5	Analyze real world situation critically	A3
6	Reflect on their own professional development	A3
7	Demonstrate professionalism & ethical awareness	A2
8	Apply multidisciplinary approach to the context	A2

Learning and teaching activities

Mixed pedagogy approach is adopted throughout the course. Classroom based face to face teaching, directed study, independent study via G-Learn, case studies, projects and practical activities (individual & group)

Teaching and learning resources

Soft copies of teaching notes/cases etc. will be uploaded onto the G-learn. Wherever necessary, printouts, handouts etc. will be distributed in the class. Prescribed text book will be provided to all. However, you should not limit yourself to this book and should explore other sources on your own. You need to read different books and journal papers to master certain relevant concepts to analyze cases and evaluate projects. Some of these reference books given below will be available in our library.

***Prescribed Modules*:**
Access to NU-IDEA online modules will be provided.

***Referential text books and journal papers*:**

Personal Discovery Through Entrepreneurship, Marc H. Meyer and Chaewon Lee, The Institute of Enterprise Growth, LLC Boston, MA.

Suggested journals:

Vikalpa, Indian Institute of Management, Ahmedabad
Journal of General Management, Mercury House Business Publications, Limited
Harvard Business Review, Harvard Business School Publishing Co. USA

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

	COURSE Outcomes	**Assessment**
1	Understand conceptual framework of the foundation of a venture	A1, A2
2	Understand the concept of purpose, mission and value-add service offered by a venture	A3
3	Analyze design and positioning of the product	A3
4	Demonstrate prototyping	A3
5	Analyze business, revenue and operating models	A3

19EEE122: ELECTRICAL WORKSHOP

L	T	P	C
0	0	3	1.5

The objective of this course is to familiarize the students with commonly used components, accessories and measuring equipment in Electrical installations. The course also provides hands on experience in setting up of simple wiring circuits and electric machine wiring.

Course Objectives

- Explain different tools and symbols used in electrical wiring.
- Impart the skills to do few varieties of electric wiring.
- Demonstrate different electrical machines and their wiring arrangement
- Train to operate various electrical machines.

List of Experiments:

1. Study of various electrical tools and symbols.
2. Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.
3. Wiring of light/fan circuit using two way/three way control (Staircase wiring)
4. Go-down wiring / Tunnel wiring
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, Main switch and Energy meter.
6. Measurement of voltage, current, resistance in DC circuit.
7. Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit.
8. Wiring of backup power supply including inverter, battery and load for domestic installations.
9. Starting of DC shunt motor using three point starter.
10. Starting of DC series motor using two point starter.
11. Starting of single phase induction motor.
12. Starting of three phase induction motor.

Course outcome:

After the completion of this course students will be able to

- summarize supply arrangements and their limitations, knowledge of standard voltages and their tolerances, safety aspects of electrical systems and importance of protective measures in wiring systems (L2).
- explain types of wires, cables and other accessories used in wiring. Creating awareness of energy conservation in electrical systems (L1).
- Demonstrate simple lighting circuits for domestic buildings, distinguish between light and power circuits (L3).
- derive electrical circuit parameters and current, voltage and power in a circuit (L2).
- explain with backup power supply in domestic installation (L1).

19EMA203: ENGINEERING MATHEMATICS-III COMPLEX VARIABLES & TRANSFORM TECHNIQUES
(Common to EEE & ECE)

L	T	P	C
3	0	0	3

Preamble : *This course is designed to familiarize the students with complex variables, complex integration, Fourier series expansions of periodic functions and Laplace, Z-transforms to understand the applications in engineering.*

Course Objectives:

- To explain the concepts of complex analysis and their applications.
- To demonstrate the concept of Laplace and inverse Laplace transforms.
- To teach Fourier series and Fourier transforms of functions.
- To teach Z-transforms and its applications.

Unit I: Complex Variables **10 L**

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Cauchy theorem, Caufchy integral formula, Taylor's series, Laurent's series, singularities, residues, Cauchy residue theorem (All theorems without proof).

Learning Outcomes:

After completion of this unit student able to

- Identify continuous and differentiable complex functions (L3)
- apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
- Analyze the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues (L4)
- make use of the Cauchy residue theorem to evaluate certain integrals (L3)

Unit II: Laplace transforms **9L**

Definition of Laplace transform, existence conditions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, convolution theorem, periodic functions, unit step function, unit impulse function, applications to ordinary differential equations. (Without proofs)

Learning Outcomes:

After completion of this unit student able to

- examine the properties of Laplace transformation (L4)
- apply the Laplace and inverse Laplace transformations for different types of functions (L3)
- solve ordinary differential equations by using Laplace transformation technique (L3)

Unit III: Fourier series **6 L**

Fourier series, Dirichlet's conditions, functions of any period, odd and even functions - half range series.

Learning Outcomes:

After completion of this unit student able to

- build the Fourier series expansion for different periodic functions (L3)
- analyze the nature of the Fourier series that represent even and odd functions and how derivation of a Fourier series can be simplified in this way (L4)

Unit IV: Fourier transforms **8 L**

Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform, properties, convolution theorem.

Learning Outcomes:

After completion of this unit student able to

- examine the properties of Fourier transformation (L4)
- apply Fourier transformation for different functions (L3)

Unit V: Z-Transforms **9L**

Definition of Z-transform, elementary properties, linearity property, damping rule, shifting u_n to the right and left, multiplication by n, initial value theorem, final value theorem, inverse Z-transform, convolution theorem, solution of difference equations using Z-transforms.

Learning Outcomes:

After completion of this unit student able to

- summarize the properties of Z-transforms (L3)
- find Z and inverse Z-transformations for different functions (L3)
- solve difference equations by using Z-transforms (L3)

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

Course Outcomes:

At the end of the course students will be able to

- Make use of differentiation and integration of complex functions in engineering problems (L3)
- apply the Laplace transform for solving differential equations (continuous systems) (L3)
- find the Fourier series of periodic signals (L3)
- know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- solve discrete time systems using Z transform techniques (L3)

19EEE231: ELECTRICAL CIRCUIT ANALYSIS

L	T	P	C
3	0	3	4.5

This course is aimed to introduce the basic concepts of electric circuits which are needed for the circuit analysis and has potential applications in various subjects that include design and development. This is base course for subjects like electrical machines, power systems and power electronics. The students are provided with hands on experience in verification of various network theorems and evaluation of network parameters.

Course Objectives:

- **To familiarize** various circuit elements, basic laws and theorems.
- **To appraise** the behavior of RLC networks for DC excitation.
- **To teach** the concepts of sinusoidal steady state analysis and resonance.
- **To familiarize** concepts of magnetic coupling in coupled circuits.
- **To acquire** two-port network parameters and the relations between them.
- **To solve** three phase balanced and Unbalanced circuits.

UNITI: ***(8L+12P)***

Introduction: Ohms law, Kirchhoff's laws, series and parallel circuits, source transformations, delta–wye conversion, linearity and superposition theorem with simple examples, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples, compensation theorem, reciprocity theorem, Milliman's theorem, mesh analysis and nodal analysis with simple examples, concepts of super node and super mesh.

Learning outcomes:

After completion of this unit, the student will be able to

- **classify** various circuit elements(L2).
- **determine** node voltages and mesh currents using nodal and mesh analysis(L2).
- **solve** electric circuits involving d.c. sources using basic laws and theorems(L3).
- **simplify** electrical circuits using various reduction methods(L4).

UNITII: ***(6L+3P)***

DC Transients: source free response of RL, RC and RLC circuits, forced response of RL, RC and RLC for DC excitation.

Learning outcomes:

After completion of this unit, the student will be able to

- **calculate** the initial conditions of given RL, RC and RLC circuits(L3).
- **determine** transient response of source free RL,RC and RLC circuits(L3).
- **analyze** forced response of RL,RC and RLC circuit elements(L4).

UNITIII: ***(8L+6P)***

Sinusoidal steady-state analysis: sinusoidal functions and complex functions, instantaneous power, average power, effective values of current and voltage, apparent power and power factor, complex power, concept of phasors, phasor relationships for RL, RC and RLC circuits and steady-state analysis of RL, RC and RLC circuits.

Learning outcomes:

After completion of this unit, the student will be able to

- **solve** AC circuits for finding various quantities associated with each element(L3).

- **sketch** phasor diagram for various configurations of RLC circuits (L3).
- **examine** the real, reactive power and power factor in ac circuits(L4).

UNITIV: ***(8L+12P)***

Coupled circuits, Resonance and Two-port Networks: magnetically coupled circuits, mutual inductance, coupling coefficient, parallel resonance, series resonance, bandwidth, quality factor, two port networks, impedance parameters, admittance parameters, hybrid parameters and transmission parameters, relationships between parameters.

Learning outcomes:

After completion of this unit, the student will be able to

- **calculate** mutual inductance and coefficient of coupling in coupled circuits(L2).
- **outline** the concepts of resonance in electric circuits(L2).
- **solve** circuits involving magnetically coupled elements(L3).
- **determine** various parameters for two port networks(L5).

UNITV: ***(6L+3P)***

Three-phase circuits: voltage, current and power in star connected and delta connected 3-phase circuits (for balanced and unbalanced loads).

Learning outcomes:

After completion of this unit, the student will be able to

- **compare** star and delta connected 3-phase systems(L2).
- **determine** the line and phase voltages, line and phase currents, for various configurations of three phase circuits(L3).
- **solve** real power, reactive power and power factor in 3-phase circuits(L3).

Electrical Circuit Analysis Laboratory

List of Experiments:

1) Verification of Thevenin's and Norton's theorems.

2) Verification of superposition theorem and maximum power transfer theorem.

3) Verification of compensation theorem.

4) Verification of reciprocity, Milliman's theorems.

5) Locus diagrams of RL and RC series circuits.

6) Series and parallel resonance.

7) Determination of self, mutual inductances and coefficient of coupling.

8) Determination of Z and Y parameters.

9) Determination of transmission and hybrid parameters.

10) Measurement of reactive power for star and delta connected balanced loads.

11) Determination of time response of RL & RC network.

12) Determination of form factor of non sinusoidal waveform.

Text book(s):

1. William H. Hayt Jr., Jack E. Kemmerly, Engineering Circuit Analysis, 8/e, McGrawHill,2013
2. Van ValkenburgM.E, NetworkAnalysis, 3/e, PrenticeHallIndia, 2014

Reference book(s):

1. Sudhakar and Shyam Mohan ,Network Theory, 2/e, TMH,2012.
2. Schaum's outline series, Basic circuit analysis, McGraw-Hill Professional,2012
3. A.Chakrabarti, Circuit Theory Analysis & Synthesis, 6/e, DhanpatRai and Company,2014.
4. Robert L Boylestad, Introductory Circuit Analysis,12/e, Pearson Publications,2013.

Course Learning Outcomes:

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

- **solve** various electric circuits using basic laws and thermos(L3).
- **examine** the behavior of RC and RL networks for DC excitation(L4).
- **calculate** voltage, current, real power, reactive power and power factor in electric circuits with sinusoidal excitation(L3).
- **apply** concepts of coupled circuits, resonance and two port networks(L5).
- **determine** voltages, currents and their phase relation in balanced and unbalanced 3--phase circuits (L3).

19EEE233: ELECTRO MAGNETIC FIELDS

L	T	P	C
2	0	2	3

This course provides scientific, mathematical and engineering principles that enable the students to understand forces, fields, and waves. The students need to understand the fundamental principles and laws of electromagnetism to develop and implement better analog and digital electronic system that take into account electromagnetic wave propagation and radiation effects. This course is base for other subjects like Electrical circuits, Electrical Machines and Power systems.

Course Objectives:

- **To introduce** various concepts of vector calculus and coordinate systems.
- **To expose** different concepts of electrostatic, magneto static and time varying electromagnetic systems.
- **To familiarize** the concepts of conductors, and dielectrics.
- **To impart** the concepts of Magnetic materials, magnetic forces and inductance.
- **To expose** the students the ideas of electromagnetic waves.

UNITI: **(8L)**

Review of vector calculus:

Vector addition, subtraction, components of vectors, scalar and vector multiplications, triple products, Vector differentiation, partial differentiation, integration, vector operator- del, gradient, divergence and curl, integral theorems of vectors, three orthogonal coordinate systems (rectangular, cylindrical and spherical), conversion of a vector from one coordinate system to another.

Static electric field:

Coulomb's law, Electric field intensity, electrical field due to point charges, line, surface and volume charge distributions, electric flux, flux density, Gauss law and its applications, Absolute electric potential, potential difference, electric dipole- electric field and potential due to dipole, torque on a dipole, electrostatic energy and energy density.

Learning Outcomes:

After completion of this unit, the student will be able to

- **demonstrate** electric dipole and energy density(L2).
- **apply** the concept of Gauss law for different field configurations(L3).
- **apply** the concepts of vector calculus and different types of coordinate system(L3).
- **Determine** the electric field for different configurations, potential and potential difference(L3).

UNIT II: ***(8L)***

Conductors, dielectrics and capacitance: Behavior of conductors and dielectrics in an uniform electric field, current and current density, Ohm's law in point form, continuity equation, boundary conditions of perfect dielectric materials, permittivity of dielectric materials, capacitance of parallel plate and spherical capacitors, Poisson's and Laplace's equations in electric field and solution of Laplace's equation.

Learning Outcomes:

After completion of this unit, the student will be able to

- **determine** current density and capacitance(L3).
- **classify** conductors and dielectrics(L2).
- **apply** Laplace and Poisson's equations for capacitance calculations(L3).
- **differentiate various** types of capacitors(L4).

UNITIII: ***(8L)***

Static Magnetic Fields: Biot-Savart law, Ampere law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Magnetic Forces, Materials and Inductance: force on a moving charge, force on a differential current element, force between differential current elements, nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, self-inductance of solenoid and toroid, Neumann's formula for mutual inductance.

Learning Outcomes:

After completion of this unit, the student will be able to

- **demonstrate** magnetic boundary conditions(L2).
- **apply** Biot-Savart law and Ampere law for magnetic field calculations(L3).
- **differentiate** scalar and vector magnetic potentials (L4).
- **determine** the force on different elements, self and mutual inductance(L3).

UNITIV: ***(6L)***

Time Varying Fields and Maxwell's Equations: Faraday's laws of electromagnetic induction, static and motional electromotive forces, displacement current, point and integral forms of Maxwell equations, time varying fields.

Learning Outcomes:

After completion of this unit, the student will be able to

- **explain** Faraday's law for electromagnetic induction(L2).
- **demonstrate** displacement current(L2).
- **explain** Maxwell's equations in integral and point forms(L2).

UNITV: ***(6L)***

Electromagnetic waves: Derivation of wave equation, uniform plane waves, Maxwell's equation in phasor form, wave equation in phasor form, plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Poynting theorem.

Learning Outcomes:

After completion of this unit, the student will be able to

- **explain** skin effect and Poynting theorem(L2).
- **demonstrate** wave propagation in conductors, perfect dielectrics and lossy dielectrics(L2).
- **apply** Poynting theorem to derive power equation(L3).
- **use** the wave equation in phasor form(L3).

Text Book(s):

1. A.Pramanik, Electromagnetism-Theory and Applications, PHI Learning Pvt. Ltd,2009.
2. A. Pramanik, Electromagnetism-Problems with Solution, Prentice Hall India,2012.

Reference Book(s):

1. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Publication,2014.
2. W. Hayt, Engineering Electromagnetics, McGraw Hill Education,2012.
3. Joseph Edminister , Vishnu Priye, Electromagnetics, Schaum's Outline Series,2017.

Course Learning Outcomes:

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

- **determine** the electric fields for different geometric configurations(L3).
- **calculate** capacitance using Poisson's and Laplace equations(L3).
- **determine** the magnetic fields for different geometric configurations(L3).

- **determine** and solve the Maxwell‟s equations(L5).
- **demonstrate** wave propagation in different media(L2).

19EEC233: ELECTRONIC DEVICES AND AMPLIFIER CIRCUITS

L	T	P	C
3	0	3	4.5

This course familiarizes the student with structure, operation, modeling and design of semiconductor devices and circuits. Laboratory experiments of this course include hardware experiments, SPICE simulations and end-to-end circuit design using EDA/PCB design software. Study of these basic circuits is helpful to train the student to design amplifier circuits, digital switches and balanced amplifiers.

Course Objectives:

- To introduce the physical construction, device operation, large signal and small signal models of bipolar junction transistors (BJTs) and metal oxide field effect transistors (MOSFETs).
- To impart the knowledge on design and simulation of current mirror circuits for a given voltage overhead, output resistance and required current sinking/sourcing capability.
- To familiarize the analysis of the input impedance, output impedance, voltage gain and bandwidth of MOSFET amplifier configurations.
- To explain the analysis and design of differential amplifiers for given gain, power dissipation, linearity, CMRR characteristics.
- To expose the student to semiconductor technology evolution, amplifier design principles and circuit analysis techniques.

Unit I: Bipolar Junction Transistors ***(8L + 6P)***

Device structure and physical operation, current-voltage characteristics, the BJT as an amplifier and as a switch, BJT circuits at dc, biasing in BJT amplifier circuits, small-signal operation and models.

Learning Outcomes

After completion of this unit the student will be able to

- describe the device structure, physical operation and current-voltage characteristics of a BJT(L1).
- appreciate the use of BJT in an amplifier and logic gates as switch(L3).
- derive the small signal parameters of a BJT at a given operating point(L2).

Unit II: MOS Field-Effect Transistors ***(8L + 9P)***

Device structure and physical operation, current-voltage characteristics, MOSFET circuits at dc, the MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation and models.

Learning Outcomes

After completion of this unit the student will be able to

- describe the device structure, physical operation and current-voltage characteristics of MOSFET (L1).
- appreciate the use of MOSFET as a trans conductor in an amplifier and switch in a logic gates (L3).
- derive the small signal parameters of a MOSFET at a given operating point(L3).

Unit III: ***(8L + 6P)***

IC Design Philosophy, Comparison of the MOSFET and the BJT, IC biasing-current sources, current mirrors and current-steering circuits, current-mirror circuits with improved performance.

Learning Outcomes

After completion of this unit the student will be able to

- compare the relative merits and demerits of MOSFETs and BJTs in terms of transconductance, output resistance, intrinsic gain and transition frequency(L2).

- design a MOSFET current sink/source for desired current, voltage headroom, output current and output resistance(L5).
- analyze the voltage headroom, output resistance of cascode current mirror and Wilson current mirror (L4).

Unit IV: Single Stage MOSFET Amplifiers ***(8L + 9P)***

Basic MOSFET amplifier configurations, MOSFET internal capacitances and high frequency model, Frequency Response of the CS amplifier, Discrete circuit MOS Amplifiers.

Learning Outcomes

After completion of this unit the student will be able to

- describe the dominant pole approach, open circuit time constants method for estimating 3dB frequency of amplifiers(L1).
- derive the input impedance, output impedance and voltage gain of common source/common gate and common drain amplifiers using small signal models(L3).
- design a source follower circuit for given output impedance or required level shift(L5).
- analyze the 3dB frequency of MOSFET amplifier circuits using open circuit time constants method (L4).

Unit V :Differential Amplifiers ***(8L + 6P)***

The MOS differential pair, small-signal operation of the MOS differential pair, other non-ideal characteristics of MOS differential amplifier, the MOS differential amplifier with active load.

Learning Outcomes

After completion of this unit the student will be able to

- define single ended signaling and differential signaling and compare their merits/demerits(L1).
- draw the circuit diagram of a MOS differential pair and explain its basic operation w.r.t common mode voltage change and differential input change(L1).
- derive the differential mode gain, common mode gain and CMRR using small signal analysis(L3).
- explain the source of offset voltages in MOS differential pairs and their analysis(L2).

List of Experiments:

1. Current-Voltage Characteristics of BJT / Measurement of scale current & common emitter current gain.
2. Measurement of small signal parameters (g_m, r_o, r_π, r_e) of BJT at a given operating point Ic.
3. Design, Simulate and Implement BJT amplifier and Inverter logic gate Current-Voltage Characteristics of MOSFET / Measurement of threshold voltage.
4. Measurement of small signal parameters (g_m, r_o, g_{mb}) of MOSFET at a given operating point (I_d, V_{ds}).
5. Design and simulation of basic NMOS current mirror, cascode NMOS current mirror and current steering circuit.
6. Design, Simulation and Implementation of Common Source Amplifier for Gain, Power dissipation requirements.
7. Design, Simulation and Implementation of Common Drain Amplifier (Voltage Buffer) for Gain, Output Impedance, Level Shift requirements.
8. Analysis and Verification of Basic NMOS Differential Pair for Gain, Input Common Mode Range, Maximum Input differential voltage requirements.
9. Design, Simulation and Implementation of Differential Amplifier with active current mirror load for gain, power dissipation CMRR requirements.
10. Design, Simulation and PCB fabrication of BJT Astable Multivibrator Circuit.

Text Book:

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, "Microelectronic Circuits", 6/e, Oxford University Press, 2013.

References:

1. BehzadRazavi, “Fundamentals of Microelectronics”, 2/e, Wiley Student Edition,2013.
2. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuits Theory”, 10/e, Pearson Education,2009.
3. Dharma Raj Cheruku, B T Krishna, “Electronic Devices and Circuits”, 2/e, Pearson Education,2008.

Course Outcomes:

After completion of the course, the student will be able to

- describe the device structure/physical operation, analyze BJT/MOSFET circuits using their large signal and small signal models(L1).
- distinguish between discrete component circuit design and integrated circuit design and appreciate the relative merits and demerits of BJT and MOSFET devices(L2).
- design current mirror circuits given the output resistance, voltage headroom and output current requirements(L5).
- derive the low frequency and high frequency characteristics of common source, common gate, common drain amplifiers (L4).
- analyze and design differential amplifier circuits for gain and linearity requirements(L4/L6).

19EEC235: SIGNALS AND SYSTEMS

L	T	P	C
2	0	2	3

Signals contain information about the behavior or nature of some phenomenon and are functions of one or more independent variables. A system processes the signal for producing desired behavior. Signal processing plays an extremely important and continually growing role in areas of science and technology as communications, aeronautics and astronautics, acoustics, seismology, biomedical engineering and speech processing. This course introduces the basic concepts and theory required for analog and digital signal processing.

Course Objectives

- To explain the mathematical representation /classification of continuous-time and discrete-time signals and systems
- To provide understanding of characterization of linear-time invariant systems using impulse response and convolution function.
- To familiarize the application of Fourier series, Fourier transform and their properties to continuous-time and discrete time signals and systems.
- To impart the knowledge of Laplace and Z-transform and their properties to analyze continuous-time and discrete-time signals respectively.

Unit I ***(8L)***

Signals and Systems: Continuous-time and Discrete-time signals, Transformations of the independent variable, Exponential and sinusoidal signals, The unit impulse and unit step functions, Continuous-time and Discrete-time systems, Basic System properties.

Learning Outcomes:

After completion of this unit, the students will be able to

- express continuous and discrete time signals and systems in mathematical form(L1).
- perform mathematical operations on the signals. The operations should include operations on the dependent as well as independent variables(L1).
- classify continuous and discrete time signals and systems based on their properties(L3).

Unit II ***(7L)***

Linear Time Invariant Systems: Discrete-time LTI systems: The Convolution sum, Continuous time LTI systems: The Convolution Integral, Properties of Linear Time-Invariant Systems

Learning Outcomes:

After completion of this unit, the students will be able to

- represent continuous and discrete time signals in terms of impulses(L1).
- describe how to find output response of continuous time and discrete time LTI systems using convolution integral and convolution sum(L2).
- explain the property of a continuous time and discrete time system based on the impulse response of the system(L2).

Unit III ***(11L)***

Fourier analysis of Continuous Time Signals and Systems: Fourier series representation of continuous time periodic signals, convergence of the Fourier series, Properties of continuous-time Fourier series.
Representation of Aperiodic signals**:** The Continuous-Time Fourier Transform, The Fourier transform for periodic signals. Properties of the Continuous-time Fourier transform, Systems characterized by linear

constant-coefficient differential equations.

Learning Outcomes:

After completion of this unit, the students will be able to

Compute the continuous time Fourier series (CTFS) and continuous Time Fourier Transform (CTFT) of a set of well-defined continuous time periodic and aperiodic signals(L2).

- apply the properties of CTFT to compute the Fourier transform of a broader class of continuous time signals(L3).
- analyze continuous time LTI systems described by linear constant coefficient differential equations using CTFT(L4).

Unit IV ***(8L)***

Fourier analysis of Discrete Time Signals and Systems: Representation of Aperiodic signals: The Discrete-Time Fourier Transform, Properties of the Discrete-time Fourier transform, The Fourier transform for periodic signals, Systems characterized by linear constant-coefficient difference equations.

Learning Outcomes:

After completion of this unit, the students will be able to

- compute the discrete Time Fourier Transform (DTFT) of discrete time aperiodic and periodic signals (L2).
- apply DTFT and its properties to broader class of discrete time signals(L3).
- analyse LTI systems described by linear constant coefficient difference equations using DTFT(L4).

Unit V ***(8L)***

Analysis of Continuous time and Discrete time signals using Laplace Transform and Z Transform: The Laplace Transform: The Region of convergence for Laplace transforms, the Inverse Laplace transform, Properties of the Laplace Transform.

The Z-Transform: The Region of Convergence for the z-transform, The Inverse-z transform, Properties of the z-transform.

Learning Outcomes:

After completion of this unit, the students will be able to

- apply Laplace Transform/ Z Transform equations and their properties to continuous time/ discrete time signals(L3).
- explain ROC of Laplace Transform/ Z Transform(L2).
- construct continuous time and discrete time signals from their transforms(L3).

Text Book:

Alan V. Oppenheim, Alan S. Wilsky with S.Hamid Nawab, „Signals and Systems", 2/e, Pearson Education, 1997.

References:

1. Bhagawandas P. Lathi, „Linear Signals and Systems", Oxford University Press,2009
2. Simon Haykin, Barry Van Veen, „Signals and Systems", 2/e, Wiley Student Edition.

Course Outcomes

After completion of the course, the student will be able to

- describe the mathematical model of continuous time/discrete time signals and systems and perform mathematical operations on signals(L2).
- Classify signals determine the output response of continuous time/ discrete time LTI system using convolution integral and convolution sum(L2).
- apply the mathematical tools like Fourier series/Transform and Laplace/Z transform and their properties to solve/analyze signals and systems in frequency domain(L3).
- determine the output response of LTI systems using CTFT and DTFT(L2).

19EMC281: CONSTITUTION OF INDIA (Elective)

L	*T*	*P*	*C*
3	**0**	**0**	**0**

Unit I **10L**

Introduction to Indian Constitution: Constitutional history, constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.

Unit II **8L**

Rights and Duties: Citizenship, fundamental rights and directive principles, fundamental duties.

Unit III **8L**

Union Government: President and vice president, election, removal and powers, prime minister and council of ministers, parliament, supreme court, union, state relations, emergency provisions.

Unit IV **8 L**

State and Local Governments: Governor, state legislature, assembly and council, chief minister and council of ministers, high court, rural and urban local governments with special reference to 73rd and 74th constitutional amendment acts.

Unit V **8L**

Other Constitutional and Statutory Bodies: Comptroller and auditor general, election commission, finance commission, attorney general and advocate general, union public service commission (UPSC), state public service commissions (SPSCs), tribunals, national human rights commission (NHRC).

Text Book(s)

1. J. C. Johari, Indian Government and Politics, Vishal Publications, Delhi,2009.
2. M. V. Pylee, Introduction to the Constitution of India, 5/e, Vikas Publishing House, Mumbai,2007.

References

1. D.D. Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis, Gurgaon, India,2011.
2. Subhas C. Kashyap, Our Constitution, 2/e, National Book Trust India, New Delhi,2013.

19EMC282 - ENVIRONMENTAL SCIENCES
(COMMON SYLLABUS FOR ALL BRANCHES)

L T P C
3 0 00

The course enables the students to adapt eco-centric thinking and actions rather than human-centric thinking on natural resources, their utilization and conservation. The course also focuses on the importance of ecosystems, biodiversity and their degradation leads to pollution, finding solutions through application of control measures to combat pollution and legal measures to achieve sustainable development.

Course Objectives:

- To familiarize the students about the importance of the environmental studies.
- To acquaint with different natural resources and their associated problems.
- To introduce various ecosystems, values of biodiversity and their conservation.
- To expose to today's pollution levels and their impacts.
- To create awareness on different social issues such as conservation of water, green building concept.
- To impart knowledge on present population scenario, its impacts and role of informational technology on environment and human health.

Unit I: **10 L**

Introduction to environment and natural resources: Introduction to environment: Definition, scope and importance, multidisciplinary nature of environment, need for public awareness. Natural Resources: Renewable and non-renewable resources, natural resources and associated problems. Forest resources: Uses, Reasons for over-exploitation, deforestation effects, timber extraction, case studies. Water resources: Use and over – utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral resources: Uses, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, Impacts of overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, use of renewable and non-renewable energy sources, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Learning outcomes:

After the completion of this unit the student will be able to

- list different renewable and non-renewable resources(L1).
- learn how the over-exploitation of natural resources impact human life(L1).
- demonstrate the role of an individual in the conservation of natural resources(L1).
- explain the equitable use of natural resources for sustainable lifestyles(L2).

Unit II: **9 L**

Ecosystems and biodiversity: Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem (10% law), Ecological succession. Biogeochemical cycle: (Nitrogen, carbon, Phosphorus cycle). Introduction, types, structure and function of the following eco system:- Forest ecosystem. Grassland ecosystem. Desert ecosystem. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity: Definition, Levels of biodiversity: genetic, species and ecosystem diversity. Biogeographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega – diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ conservation of biodiversity.

Learning outcomes:

After the completion of this unit the student will be able to

- learn how ecosystem functions(L1).
- explain the structure and function of terrestrial and aquatic ecosystems(L2).
- illustrate the values and threats to biodiversity(L2).
- explain the importance of conservation of biodiversity(L2).

Unit III: **8 L**

Environmental pollution and control: Environmental Pollution: Definition, causes, effects and control measures: Air Pollution, Water pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards, Solid waste Management, e-waste, Hazardous waste management. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: floods, earthquake, cyclone and landslides.

Learning outcomes:

After the completion of this unit the student will be able to

- list causes, effects and control measures of pollution (air, water &soil)(L1).
- classify different types of pollutants(L2).
- explain disaster management of floods, earthquake, cyclone and landslides(L2).
- identify the pollution related case studies(L3).
- demonstrate the role of an individual in prevention of pollution(L3).

Unit IV: **9L**

Social issues and global environment problems and efforts: From unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rainwater harvesting, watershed management, Remote sensing and GIS methods. Resettlement and rehabilitation of people: its problems and concerns. Case Studies, Environmental ethics: Issues and possible solutions. Green building concept, Environmental Impact Assessment (Checklists, matrix methods), Environmental Management Plan, Climate change: global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Learning outcomes:

After the completion of this unit the student will be able to

- explain different water conservation methods(L2).
- compare remote sensing and GIS methods (L2).
- apply green building concept(L3).
- demonstrate the consequences of global warming, acid rains and ozone layer depletion(L3).
- analyze environmental impact assessment and management plan(L4).

Unit V: **6 L**

Human population and environment legislation: Population growth, variation among nations. Family Welfare programme. Environment and human health. HIV/AIDS, Human rights. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Environmental Protection Act, Pollution prevention act. Issues involved in enforcement of environmental legislation. Public awareness. Project Work.

Learning outcomes:

After the completion of this unit the student will be able to

- compare population growth and variation among nations(L2).
- apply value education(L3).
- classify women and child welfare(L3).
- distinguish different environmental legislation acts and issues involved in enforcement of legislation(L4).
- analyze the role of information technology in environment and human health(L4).

Text Book (s):

1. Anubha Kaushik and C.P. Kaushik, Text book of environmental studies New Age International Publisher (2014).
2. Erach Barucha, Text book of environmental studies for undergraduates courses, published by – University Grants Commission, University Press(2005)
3. Anindita Basak, Environmental Studies. Pearson (2009)

References:

1. D.K. Asthana and Meera Asthana, A Text book of Environmental Studies, S. Chand(2010).
2. P.M Cherry Solid and Hazardous waste Management, CBS Publisher(2016).
3. Charles H. Ecclestion, Environmental Impact Assessment, CRC Press(2011).

4. K.K. Singh, Natural Resources Conservation and Management, MD Publications(2008).
5. J. Jeffrey Peirce, Ruth F. Weiner and P. Aarne Vesilind, Environmental Pollution and Control, Butterworth-Heinemann(1998).
6. James Maclaurin and Kim Sterelny, What is Biodiversity, The University of Chicago Press(2008).
7. R.B. Mandal, Introductory Methods in Population Analysis, Concept Publishing Co,(2007).

Course Outcomes:

After the completion of this course, the student will be able to

- explain about environment and natural resources(L2).
- illustrate the values and threats to biodiversity(L2).
- identify the pollution related case studies(L3).
- demonstrate the consequences of global warming, acid rains and ozone layer depletion(L3).
- analyze the role of information technology in environment and human health(L4).

19EHS221: COMPREHENSIVE SKILL DEVELOPMENT II

L T P A C
0 0 0 6 1

Course Objectives:

- To encourage the all round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes:

- On completion of the course, student will be able to– Effectively communicate through verbal/oral communication and improve the listening skills
- Write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
- Student will be able to understand the problems and develop his competitive coding skills.
- Apply the skills in various domains and will be able to solve complex problems faced by the industry.
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality

Part-1 **3 Hours per week**

A. Verbal and Soft Skills:

Communication Skills, Presentation Skills, Decision Making and Problem-Solving, Group Discussion.

Unit	**Module/ Topics**	**Hrs**
1.	Communication Skills	4
2.	Presentation Skills	4
3.	Decision Making and Problem-Solving	3
4.	Group Discussion	4
	Total	**15**

B. Quantitative Aptitude and Reasoning

Puzzles, Numbers, Arithmetic, Data Interpretation.

Unit	**Module/ Topics**	**Hrs**
1.	Non-Verbal Reasoning	5
2.	Data Sufficiency	2
3.	Analytical Reasoning	3
4.	Puzzles	5
	Total	15

Unit	**Module/ Topics**	**Hrs**
1.	Numbers [Number System, Divisibility rules, Remainders, LCM & HCF]	3
2.	Numerical Computation and Estimation-1 [i. Chain Rule ii. Ratio Proportions iii. Partnerships & Averages iv. Percentages v. Profit-Loss, and discounts vi. Mixtures]	6
3.	Data Interpretation [Pie diagrams, Line Graph, Bar Graph, Tabular forms, and Caselets]	3
4.	Progressions and Series	3
	Total	15

Part-2 **3 Hours per week**

Coding: Complex problem solving using Data Structures in terms of improving efficiency:
Time Complexity and Space Complexity, Linked List, Stacks and Queues using Linked List, Binary Trees, Binary Search Trees, Trie, Representation of graphs, Breadth First Search, Depth First Search, Dynamic Programming.

Scheme of Evaluation

Internal Assessments by Assignments, Quizzes (multiple Choice questions). All the Students are expected to do at least 5 problems in each topic and they should submit the content written by them in each topic for final evaluation.

Type of Assessment	No.of Marks
At least 5 problems in each topic	15
Assignments	15
Content writing	10
Quizzes	10
Total	**50**

Late Work

Each homework is due in the beginning of the class meeting (that is, at 6:00pm) on the due date. If homework is submitted within seven days after this deadline, the grade will be reduced by 50%. Submission more than seven days after the deadline will not be accepted. If you have a serious reason for requesting an extension, such as illness or family emergency, you should discuss it with one of the instructors as soon as the problem arises, and definitely before the submission deadline.

References:-

The course does *not* have a required textbook. You may optionally use the following textbook and URLs to look up standard algorithms:

1. Data Structures and Algorithms made easy by Narasimha Karumanchi
2. ***Data Structure and Algorithmic Thinking with Python by Narasimha Karumanchi***
3. ***Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide and Conquer and Dynamic Programming by Narasimha Karumanchi***
4. Coding Interview Questions by Narasimha Karumanchi
5. Competitive Programming in Python- 128 Algorithms to develop your Coding Skills by Cristhop Durr & Jill-Jen Vie.
6. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests (Undergraduate Topics in Computer Science) *by* Antti Laaksonen
7. https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/
8. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
9. https://codeforces.com/
10. https://leetcode.com/

19EMA202: ENGINEERING MATHEMATICS - IV

Numerical Methods, Probability and Statistics

L	T	P	C
3	0	0	3

UNITI: Solution to algebraic equations **8hrs**

Solution of polynomial and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method, finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT II: Numerical differentiation and integration **8 hrs**

Numerical differentiation, numerical integration- trapezoidal rule, Simpson's 1/3rd and 3/8 rules, Ordinary differential equations-Taylor's series, Euler, modified Euler's and Runge-Kutta methods of fourth order for solving first order equations.

UNITIII: Probability **10hrs**

Probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous)**,** probability distribution: Binomial , Poisson and normal distributions-their properties.

UNIT IV: Testing of Hypothesis **7 hrs**

Formulation of null hypothesis, critical regions, level of significance, Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means-confidence intervals.

UNIT V: Small Sample Tests **7 hrs**

Student t-distribution (single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Textbooks:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2/e, Reprint2012.
2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson,2008.

References:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, 5/e, PHI Learning private limited, New Delhi,2012.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications,2012.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons,2011.
4. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers,2017.

19EID232 : **INTERNET OF THINGS**
(Common to all)

L	T	P	C
2	0	2	3

The Internet of Things (IoT) is a network of a wide variety of devices like vehicles, humans, soil etc. These devices gather data using sensors, which can be used for monitoring or control. This course is an introduction to the embedded devices, communication protocols and APIs used in IoT.

Course Objectives

- Introduce the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT Platforms
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with application program interfaces for IoT.
- Enable students to create simple IoT applications.

UNIT I **5 L**

Overview of IoT: The Internet of Things: An Overview, The Flavor of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? Design Principles for Connected Devices, Calm and Ambient Technology, Privacy, Keeping Secrets, Whose Data Is It Anyway? ,Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet, Graceful Degradation, Affordances.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain IoT architecture(L2)
- interpret the design principles that govern connected devices(L2)
- summarize the roles of various organizations for IoT(L2)

UNIT II **6 L**

Embedded Devices - I: Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the basics of microcontrollers(L2)
- outline the architecture of Arduino(L2)
- develop simple applications using Arduino(L3)

UNIT III **6 L**

Embedded Devices - II: Raspberry Pi , Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness, Other notable platforms, Mobile phones and tablets, Plug Computing: Always-on Internet of Things.

Learning Outcomes:

After completion of this unit, the student will be able to

- outline the architecture of Raspberry Pi(L2)
- develop simple applications using Raspberry Pi(L3)
- select a platform for a particular embedded computing application(L3)

UNIT IV **6 L**

Communication in the IoT: Internet Principles, Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6,

MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols- HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.

Learning Outcomes:

After completion of this unit, the student will be able to

- interpret different protocols and compare them(L2)
- select which protocol can be used for a specific application(L3)
- utilize the Internet communication protocols for IoT applications(L3)

UNIT V **5 L**

Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, ReaL Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.

Learning Outcomes:

After completion of this unit, the student will be able to

- select IoT APIs for an application(L3)
- design and develop a solution for a given application using APIs(L6)
- test for errors in the application(L4)
- judge the security issues in Real time applications. (L5)

INTERNET OF THINGS LABORATORY

List of Practical Experiments:

1. Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.
2. Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.
3. Control any two actuators connected to the development board using Bluetooth.
4. Read data from sensor and send it to a requesting client. (using socket communication)
   Note: The client and server should be connected to same local area network.
5. Create any cloud platform account, explore IoT services and register a thing on the platform.
6. Push sensor data to cloud.
7. Control an actuator through cloud.
8. Access the data pushed from sensor to cloud and apply any data analytics or visualization services.
9. Create a mobile app to control an actuator.
10. Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it (Mini Project).

Text Book(s):

1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley Publications, 2012.

References

1. ArshdeepBahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2014.
2. Pethuru Raj, Anupama C. Raman, The Internet of Things, Enabling technologies and use cases –CRC Press, 2017.

Web Sources

https://www.arduino.cc/

https://www.raspberrypi.org/

Course Outcomes:

After completion of this course, the student will be able to

- choose the sensors and actuators for an IoT application(L1)
- select protocols for a specific IoT application(L2)
- utilize the cloud platform and APIs for IoT application(L3)
- experiment with embedded boards for creating IoT prototypes(L3)
- design a solution for a given IoT application(L6)

19EID234: **LIFE SCIENCES FOR ENGINEERS**
(Common to all)

L	T	P	C
2	0	2	3

Life sciences have been introduced in to curriculum of all engineering branches. Students in engineering programs should be aware of fundamentals of biology so as to relate to their field. This course is a critical application area for engineering analysis and design, emphasizing concepts, technology, and the utilization of living things. Further it is important to know how living things work and act.

Course Objectives

- Introduce the molecular basis of life.
- Provide the basis for classification of living organisms.
- Describe the transfer of genetic information**.**
- Introduce the techniques used for modification of living organisms**.**
- Describe the applications of biomaterials

UNIT I **10 L**

Introduction to Biology: Comparison of eye and camera, flying bird and aircraft, Biological observations and major discoveries- genera, species and strains, and Classification of living organisms: Cellularity, Ultrastructure, carbon and energy sources, excretion, habitat and molecular taxonomy.

Learning Outcomes:

After completing this unit, the student will be able to

- summarize the basis of life (L2).
- distinguish prokaryotes from eukaryotes (L4).
- compare biological organisms and manmade systems (L2).
- classify organisms (L2).

UNIT II **12 L**

Water, Biomolecules: sugars, starch and cellulose, Amino acids and proteins, lipids, Nucleotides and DNA/RNA, structure and functions of proteins and nucleic acids, hemoglobin, antibodies and enzymes, Industrial applications of enzymes, Fermentation and its industrial applications.

Learning Outcomes:

After completing this unit, the student will be able to

- outline the importance of water (L2).
- explain the relationship between monomeric units and polymeric units (L2).
- explain the relationship between the structure and function of proteins (L2).
- interpret the relationship between the structure and function of nucleic acids (L2).
- summarize the applications of enzymes in industry (L2).
- explain the applications of fermentation in industry (L2).

UNIT III **12 L**

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis, Human physiology, neurons, synaptic and neuromuscular junctions.

Learning Outcomes:

After completing this unit, the student will be able to

- apply thermodynamic principles to biological systems (L3).
- explain the mechanism of respiration and photosynthesis (L2).
- summarize the principles of information transfer and processing in humans (L2).

UNIT IV **12 L**

Mendel's laws, gene mapping, Mitosis and Meiosis, Epistasis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

Learning Outcomes:

After completing this unit, the student will be able to

- define Mendel's laws (L1).
- demonstrate the mapping of genes (L2).
- explain interactions among genes and their significance (L2).
- differentiate the mitosis and meiosis (L4).
- explain the medical importance of gene disorders (L2).
- Identify DNA as a genetic material in the molecular basis of information transfer (L3).

UNIT V **10 L**

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

Learning Outcomes:

After completing this unit, the student will be able to

- outline the principles of recombinant DNA technology (L2).
- appreciate the potential of recombinant DNA technology (L2).
- summarize the use of biological materials for diagnostic devises (L2).

Lab Experiments (Virtual or Field Experiments)

1. Microscopy, Mendel's laws, mapping, interactions, - 4 lab experiments
2. Nitrogen cycle, Species interactions, Sterilization, Bacterial population growth, - 4 lab experiments

Text Book(s):

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.

Reference Books:

1. Alberts et.Al., The molecular biology of the cell, 6/e, Garland Science, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.

Course Outcomes

After studying the course, the student will be able to:

- explain catalytic properties of enzymes (L2).
- summarize application of enzymes and fermentation in industry (L2).
- identify DNA as a genetic material in the molecular basis of information transfer (L3).
- apply thermodynamic principles to biological systems. (L3)
- analyze biological processes at the reductionistic level (L4).
- appreciate the potential of recombinant DNA technology (L2).

19EEE232: ELECTRICAL MACHINES –I

L	T	P	C
3	0	3	4.5

This course is aimed to introduce the principles and applications of dc machines and transformers. Construction, working and testing of dc Machines are discussed in detail. The students are provided with hands on experience in testing the performance of various types of DC machines and transformers.

Course Objectives:

- **To familiarize** the basic concepts and analysis of magnetic circuits.
- **To teach** principles and working of dc Machines and transformers.
- **To demonstrate** the performance and control of dc machines and transformers.
- **To appraise** the testing methods of dc machines and transformers.
- **To focus** on the applications of electrical machines in industry.

UNITI: ***(6L+0P)***

Magnetic circuits: Definition of magnetic quantities, analysis of magnetic circuits- series, parallel, leakage flux, comparison of magnetic and electric circuits, review of Ampere's Law and Biot Savart law. B-H curve of magnetic materials, flux- linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits, energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element, torque as a partial derivative of stored energy with respect to angular position of a rotating element.

Learning outcomes:

After completion of this unit, the student will be able to

- **explain** the terminology of magnetic field, magnetic flux density, magnetic flux and magnetizing force (L2).
- **calculate** various parameters in magnetic circuits(L3).
- **evaluate** various parameters in the composite magnetic circuits(L4).

UNITII: ***(8L+9P)***

DC Generators: Basic construction of a dc machine: magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, commutator, armature winding and - lap and wave windings, operation of dc generator, emf equation, methods of excitations - separately and self-excitations, armature reaction, compensating winding, commutation, methods of improving commutation, characteristics of dc generators, voltage build-up in a shunt generator, critical field resistance and critical speed, parallel operation

Learning outcomes:

After completion of this unit, the student will be able to

- **explain** the construction and working principle of DC Generators(L2).
- **classify** DC generators(L2).
- **illustrate** the characteristics of DC generators(L2).

UNITIII: ***(8L+15P)***

DC Motors: Operation of dc motors, back emf, torque equation, characteristics of different types of dc motors, starting methods, speed control methods, losses in dc machine, testing of dc machine - Swinburne's test, Hopkinson's test , load test, retardation test and field test.

Learning outcomes:

After completion of this unit, the student will be able to

- **outline** the working principle of DC motors(L2).
- **determine** the losses and efficiency of a DC motor(L3).
- **explain** DC motor starting methods(L2).
- **demonstrate** the performance characteristics of DC machine(L4).

UNITIV: ***(8L+9P)***

Single-Phase Transformers: Principle, construction and operation of single-phase transformers, emf equation, transformer on no load, and on load, equivalent circuit, phasor diagram, losses , efficiency and voltage regulation, all day efficiency. Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses, Parallel operation of single-phase transformers.

Learning outcomes:

After completion of this unit, the student will be able to

- **explain** the working principle of single-phase transformer(L2).
- **determine** the losses and efficiency of a single-phase transformer(L3).
- **obtain** the characteristics of single-phase transformers(L3).

UNITV: ***(6L+3P)***

Three-Phase Transformers: construction, types of connection and their comparative features, Scott connection, tap-changing transformers - no- load and on-load tap-changing of transformers, auto-transformers - construction, principle, applications and comparison with two winding transformers.

Learning outcomes:

After completion of this unit, the student will be able to

- **classify** three phase transformers(L2).
- **explain** construction and working of tap changing transformers(L2).
- **outline** the working principle of autotransformers(L2).
- **compare** autotransformer with two winding transformer (L2)**.**

Electrical machines –I Laboratory

List of experiments:

1. Open circuit characteristics (OCC) and external characteristics of separately excited dc Generator.
2. Swinburne's test on a dc shunt motor.
3. OC and SC tests on single phase transformer.
4. Brake test on dc shunt motor.
5. Load test on Single phase transformer.
6. Scott connection of transformers.
7. Characteristics of dc series generator.
8. Characteristics of dc compound generator.
9. Separation of losses in dc shunt machine.
10. Speed control methods of dc shunt motor.
11. Hopkinson "test.
12. Separation of losses in single phase transformer.

Textbook(s):

1. A.E. Fitzgerald, Charles Kingsley Jr. Stephen D. Umans, Electric Machinery, 7/e, McGraw Hill.,

2013
2. I.J. Nagarath and D.P. Kothari, Electric Machines, 4/e, McGraw Hill,2010.

Reference Book(s):

1. A.E. Clayton and N.N.Hancock, Performance and Design of DC Machines, Oxford,1987.
2. Chakrabarthy, Electrical Machines, 1/e, McGraw Hill,2013.
3. S.J. Chapman, Electric Machine Fundamentals, 5/e, McGraw Hill,2011.

Course Learning Outcomes:

Upon successful completion of this course, the student will be able to

- **summarize** principles, laws, and working of dc machines(L2).
- **analyze** the characteristics and application of various types of dc generators(L4).
- **analyze** the construction, characteristics and application of various type of dc motors and testing of motors(L4).
- **explain** the working of 1- phase and 3- phase transformers(L2).
- **apply** the principles of 3 phase transformer to multi-phase transformer(L3).

19EEE234: POWER SYSTEMS-I

L	T	P	C
2	0	2	3

In this course it is aimed to introduce to the students the working principles of various power generating sources and detail analysis of faults occurrences in practical power systems. The basic concepts of solar energy, wind energy, biomass energy, geothermal energy and ocean energy are explained. Transmission line modeling parameters, fault conditions and mechanical conditions of transmission lines are analyzed.

Course Objectives:

- To Study various basic concepts of conventional power sources, power grids and microgrids.
- To Expose various basic concepts of renewable energy sources.
- To Familiarize various parameters in transmission lines
- To Interpret the effect of sag and usage of underground cables
- To Expose various AC and DC distributions systems

Unit I: Conventional Power Generation ***8L***

Hydroelectric Power Generation: Plant layout, working of hydroelectric power plant and selection of site.
Thermal Power Generation: Plant layout, working of thermal power plant and selection of site.
Nuclear Power Generation: Plant layout, working of nuclear power plant and selection of site.

Learning outcomes:

After completion of this UNIT student will be able to

- **define** the concepts of power grid and micro grid(L1)
- **contrast** the difference between power grid and micro grid(L2)
- **identify** the different conventional sources for generating power(L3)
- **compare** thermal, hydro-electric and nuclear powerplant(L4)
- **justify** the use of thermal, hydro-electric and nuclear power plant .(L5)

Unit II: Renewable Energy sources ***8L***

Solar Power Generation: Physical principles of conversion of solar radiation into heat, working principle of Flat plate collectors and Photovoltaic Cell.
Wind power generation: Basic components of Wind energy conversion systems, working principle of HAWT and VAWT.
Energy from Biomass: Biomass conversion technologies, working principle of Floating drum and fixed dome plants.
Geothermal energy: Working principle of Vapor and Liquid dominated systems
Energy from Oceans: Working principle of closed cycle OTEC. Basic components of Tidal power plant

Learning outcomes:

After completion of this UNIT student will be able to

- **define** the need of renewable energy sources(L1)
- **demonstrate** the availability of solar, wind, geothermal, biomass and tidal energy sources(L2)
- **identify** the different renewable sources for generating power(L3)

- **compare** solar, wind, geothermal, biomass and tidal powerplant(L4)
- **justify** the use of solar, wind, geothermal, biomass and tidal power plant. (L5)

Unit III: Transmission line Parameters ***10L***

Overhead Transmission Lines: Capacitance and Inductance calculations for single phase two wire line, three phase lines, proximity effect, skin effect.

Sinusoidal Steady state representation of Lines: Short, medium and long lines, Characteristics of transmission lines. Surge Impedance Loading.

Learning outcomes:

After completion of this UNIT student will be able to

- **list** the various transmission line parameters(L1)
- **develop** expressions for all transmission line parameters(L3)
- **analyze** line parameters for single phase and three phase systems(L4)
- **evaluate** short, medium and long transmission lines(L5)
- **solve** various problems on transmission line parameters and modeling. (L6)

Unit IV: Mechanical design of overhead lines ***8L***

Sag and insulators: Line supports, insulators, voltage distribution in suspension-type insulators. Testing of insulators, String efficiency, tension and sag calculation, effects of wind and ice loading.

Underground cables: Comparison with overhead line. Types of cables, Insulation resistance, potential gradient, Capacitance of single core cables.

Corona: Formation of corona. Critical voltages, effect on line performance.

Learning outcomes:

After completion of this UNIT student will be able to

- **list** out various line supports used in transmission lines(L1)
- **demonstrate** effect of sag on transmission lines(L2)
- **categorize** various insulators used in transmission lines(L4)
- **justify** the use of Underground cables(L5)
- **estimate** the effect of corona.(L6)

Unit V: Distribution Systems ***8L***

Overview of Distribution systems, Types of DC & AC Distributors: Radial, and Ring systems. Voltage drop calculation with concentrated loads and uniformly distributed loads.

Learning outcomes:

After completion of this UNIT student will be able to

- **define** various components in distribution systems(L1)
- **illustrate** various DC and AC Distributors(L2)
- **analyze** DC and AC Distributors for uniformly distributed loads(L4)
- **evaluate** DC and AC Distributors for concentrated distributed loads(L5)
- **solve** various problems on AC and DC Distributors. (L6)

Text books:

1. S. N. Singh, “Electric Power Generation, Transmission and Distribution”, PHI Learning,2010.
2. GD Rai, “Non-conventional Energy sources”,4/e,Khannapublishers,2012

3. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education,1994.

References:

1. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education,1995.
2. Gerald B Sheble, Bruce F Wollenberg Allen J Wood, “Power Generation, Operation, and Control”, 3/e, Wiley Interscience,2010.
3. A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc.,1999.
4. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education,2003.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.
6. C.L.Wadhwa, “Electrical Power Systems”, 7/e, New Academic Science publications,2017.

Course Outcomes:

Upon completion of the course, the students would be able to

- correlate various conventional power sources, power grids and microgrids.
- identify various renewable energy sources for power generation.
- estimate the various parameters in transmission lines
- appraise the effect of sag on transmission lines
- assess various AC and DC distribution systems for concentrated and uniformly distributed loads

19EEC232: DIGITAL LOGIC DESIGN

L	T	P	C
3	0	3	4.5

Digital Logic Design is an introductory course which provides the basic concepts used in the design and analysis of digital circuits. A digital circuit is constructed using logic gates which are the basic building blocks. This course deals with the design of various combinational and sequential circuits used in the present day world. This course is a prerequisite to many other courses like Digital Communications, Computer Organization, Digital System design, Digital IC design, etc.

Course objectives:

- To introduce number systems, conversion used for representing numbers in computational structures.
- To familiarize the implementation of simple logical operations using Combinational circuits
- To acquaint the student with the design of combinational and sequential logic circuits with practical design examples
- To expose different types of memories used in digital systems.
- To impart the design of synchronous and asynchronous digital systems.

Unit I: ***8L+6P***

Binary Systems: digital systems, binary numbers, number base conversions, octal and hexadecimal numbers, complements, signed binary numbers, binary codes, binary logic. **Boolean Algebra and Logic Gates:** basic definitions, axiomatic definition of boolean algebra, basic theorems and properties of boolean algebra, boolean functions, canonical and standard forms, digital logic gates.

Learning outcomes:

After completion of this unit the student will be able to

- identify the symbols of different logic gates and write their truth tables(L1).
- convert a number into different base representations(L2).
- construct the given Boolean function using logic gates(L3).

Unit II: ***8L+3P***

Simplification of Boolean functions

the map method, four-variable map, five-variable map, product of sums simplification, don't-care conditions, NAND and NOR implementation, exclusive-OR function.

Learning outcomes:

After completion of this unit the student will be able to

- determine the simplified Boolean expression using map method(L3).
- construct digital circuits using only NAND/NOR logic gates(L3).
- design parity generator and checker circuits using exclusive-OR function(L5).

Unit III: ***10L+9P***

Combinational Logic: combinational circuits, analysis procedure, design procedure, binary adder-subtractor, decoders, encoders, multiplexers. **Memories: r**andom-access memory, memory decoding, error detection and correction, read-only memory.

Learning outcomes:

After completion of this unit the student will be able to

- analyze the truth table of a given combinational logic circuit(L3).
- design combinational circuit from the given specifications(L5).
- correct the bit error in the given data word using Hamming code(L5).

Unit IV: ***8L+3P***

Synchronous Sequential Logic: sequential circuits, latches, flip-flops, analysis of clocked sequential circuits, state reduction and assignment, design procedure.

Learning outcomes:

After completion of this unit the student will be able to

- explain the operation of latches and flip flops(L2).
- analyze the behavior of sequential circuits(L4).
- evaluate a clocked sequential circuit from its state diagram(L6).

Unit V: ***8L+6P***

Registers and Counters: registers, shift registers, ripple counters, synchronous counters, ring counter.
Digital Integrated circuits: special characteristics, complementary MOS(CMOS), CMOS transmission gate circuits.

Learning outcomes:

After completion of this unit the student will be able to

- differentiate asynchronous and synchronous counters(L4).
- design Synchronous and Ripple counters using D, JK and T flip-flops (L5).
- construct multiplexer and D-latch using CMOS transmission gates circuits(L5).

Text Book(s):

1. Michael D. Ciletti, M. Morris Mano, Digital Design, 4/e, Pearson Education, 2007.

References:

1. Zvi Kohavi, Switching and Finite Automata Theory, 2/e, Tata McGraw-Hill,2008.
2. John F. Wakerly, Digital Design Principles and Practices, 4/e, Pearson Education,2008.
3. Frederick J. Hill and Gerald R. Peterson, Introduction to Switching Theory and Logic Design, 3/e, John Willey and Sons,1981.
4. Charles Roth, Jr., Larry Kinney, Fundamentals of Logic Design, 7/e, Cengage Learning, India,2013.

Digital Logic Design Laboratory

List of Experiments:

1. Verification of Truth Tables of Logic gates and implementation of Basic gates using Universal Gates
2. Implementation of the given Boolean functions using logic gates in both SOP and POS form.
3. Simplification of the given Boolean function using K-map and implement using logic gates.
4. Realization and verification of Full adder and Full Subtractor using logic gates.
5. Implementation of the given function using decoder and logic gates.
6. Implementation of the given function using Multiplexer and logic gates.
7. Verification of State Tables of SR, D, JK and T-Flip-Flops.
8. Verify the operation of Shift Registers using D flip-flops.
9. Design and Verify the operation of 4-bit and Mod-N Ripple Counters using JK flip-flops.
10. Mini Project.

Course Outcomes:

After completion of this course, the student will be able to

- convert any number into different base representations(L2).
- simplify logic expressions using Boolean laws and realize using basic and universal logic gates(L3).
- design combinational circuits for the given specifications(L4).
- design synchronous sequential circuits for the given specifications(L4).

- differentiate asynchronous and synchronous counters and implement Multiplexers and D flip flops using CMOS technologies(L3).

19EEC234: ANALOG CIRCUITS

L	T	P
C 3	0	3
4.5		

This course equips the student with design principles of electronic system building blocks including amplifiers, oscillators, negative feedback based operational amplifiers. Laboratory experiments of this course shall include hardware experiments, SPICE simulations and end-to-end circuit design using EDA/PCB design software. Skills learnt in this course shall help the student in improving existing circuits using negative feedback, building power Amplifiers, op-amp signal processing circuits etc.

Course Objectives

- To acquaint the students with the advantages and techniques of different negative feedback circuit configurations.
- To introduce the basic principles of oscillator circuits and design/simulate discrete component and op-amp oscillator circuits.
- To impart knowledge on analysis of the linearity, power efficiency and power dissipation of different output stages/power amplifiers.
- To explain the configuration and use of operational amplifier in designing several signal processing building blocks.
- To familiarize the analysis and classification of different ADC/DAC architectures based on working principle, conversion time and resolution characteristics.

Unit I: ***8L + 3P***

Feedback Amplifiers: the general feedback structure, properties of negative feedback, basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, shunt-shunt and shunt-series feedback amplifiers, determining loop gain.

Learning Outcomes:

After completion of this unit the student will be able to

- summarize the basic building blocks of negative feedback systems and list their properties(L2).
- classify the different negative feedback topologies and identify/quantify the improvement in their characteristics(L2).
- determine the input impedance, output impedance, gain and bandwidth of feedback amplifiers(L4).
- identify the kind of feedback configuration employed in a given circuit(L3).

Unit II: ***8L + 9P***

Oscillators: basic principles of sinusoidal oscillators, op amp RC oscillator circuits, LC and crystal oscillators. **Power amplifiers:** Classification of output stages, class A output stage, class B output stage, class AB output stage, class C output stage.

Learning Outcomes:

After completion of this unit the student will be able to

- explain Barkhuizen's criteria for sustained oscillations(L2).
- explain the operation of RC phase shift and op-amp RC oscillators(L1).
- identify the usage of RC, LC and Crystal oscillators (L3).
- classify different output stages based on linearity, power efficiency and conduction angle(L2).
- analyze the transfer function, signal waveforms and power efficiency of Class A/B/AB output stages (L4).

Unit III: ***10L + 9P***

Operational Amplifiers: The ideal op-amp, the inverting and non-inverting configuration, difference and instrumentation amplifiers, summing, scaling and averaging amplifiers, integrators, differentiators, logarithmic amplifiers, V/I and I/V converters, Comparator, regenerative comparator, Astable and Monostable multivibrators, Triangular wave generator.

Learning Outcomes:

After completion of this unit the student will be able to

- list the characteristics of ideal Op-amp(L1).
- draw the op-amp inverting and non-inverting configurations and analyze them for their closed loop gain under ideal and non-ideal conditions(L2).
- describe the use of Op-amp in building analog signal processing blocks(L3).
- summarize the characteristics of comparators and analyze the Op-amp based comparators(L2).

UnitI V: ***8L + 9P***

IC Timers (555): Introduction, Description of functional diagram, Monostable operation, Astable operation. **Active Filter Design:** LPF, HPF, BPF, BEF, all-pass filters. **Voltage Regulators:** Fixed voltage Regulators, Adjustable voltage Regulators.

Learning Outcomes:

After completion of this unit the student will be able to

- describe the architecture and list the operating modes of 555 timer(L1).
- design an active low- pass, high-pass, band-pass filter for given specifications(L5).
- describe the characteristics of voltage regulators and corresponding Op-amp based circuits(L2).

Unit V: ***8L + 6P***

Data Converters: Introduction, DAC characteristics, digital to analog conversion process, voltage output DACs, multiplying DAC, 8-bit digital to analog converter DAC-08. **Analog to Digital Converters**: ADC characteristics, integrating ADC, successive approximation ADC, Flash converters: Principle of operation, conversion time.

Learning Outcomes:

After completion of this unit the student will be able to

- list the characteristics and operation of DACs and ADCs(L1).
- classify different DAC and ADC configurations(L2).
- explain the operation of voltage output and multiplying DACs(L1).
- describe the principle of operation of flash converters and analyze its conversion time(L1).

Analog Circuits Laboratory

List of Experiments

1. Feedback Amplifier - calculation of gain, input resistance, output resistance with and without feedback, frequency response characteristic.
2. Design and Implementation of Two stage RC Coupled amplifier.
3. Oscillators (Colpitts, RC phase-shift, Wein-bridge)
4. Class A power amplifier.
5. Class B Push - pull power amplifier.
6. Tuned voltage amplifier.
7. Analysis and simulation of RC differentiator/integrator

8. Bistable/Monstable/Astable multivibrators with 555timer
9. Operational Amplifier Circuits (Adders, Integrators, Differentiators, Filters).
10. Op-amp based AM/FM Modulator/Demodulator Circuits.
11. Data Converters
12. Active Filter Design

Text Book(s):

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press,2013.
2. D Choudhury Roy, Shail B. Jain, Linear Integrated Circuits, New Age International,2003.
3. Ramakanth Gayakward, Op-Amps and Linear Integrated Circuits, 4/e, Pearson Education,2007.

References:

1. Behzad Razavi, Fundamentals of Microelectronics, 2/e, Wiley Student Edition,2013.
2. R.F Coughlin, F.F Driscoll, Op-Amps and Linear Integrated Circuits, 6/e, Pearson Education,2008.
3. S. Salivahanan, V.S. KanchanBhaskaran, Linear Integrated Circuits, Tata Mc- Graw Hill,2008.
4. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata Mc-Graw Hill,2002.

Course Outcomes:

After completion of this course, the student will be able to

- analyze the characteristics of different negative feedback amplifier configurations(L4).
- choose and design negative feedback circuits to improve the characteristics of given open loop amplifier(L3).
- describe the basic principle of sinusoidal oscillators and identify the usage of different oscillator circuits(L1).
- design active filters for the given design specification(L5).
- describe different DAC/ADC architectures and their design issues(L2).

19EEE292: COMPREHENSIVE SKILL DEVELOPMENT III

L T P A C
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Course Objectives:

- To encourage the all round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes:

- On completion of the course, student will be able to– Effectively communicate through verbal/oral communication and improve the listening skills
- Write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
- Student will be able to understand the problems and develop his competitive coding skills.
- Apply the skills in various domains and will be able to solve complex problems faced by the industry.
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality

Part-1 **- 3 Hours per week**

A. Verbal and Soft Skills:

Vocabulary Builder, Reading Comprehension, Fill-in-the-Blanks, General Usage

Unit	Module/ Topics	Hrs
1.	Vocabulary Builder	4
2.	Reading Comprehension	4
3.	Paragraph Jumbles	3
4.	General Usage	4
	Total	**15**

B. Quantitative Aptitude and Reasoning

Puzzles, Arithmetic, Geometry, Mensuration.

Unit	Module/ Topics	Hrs
1.	Numbers	3
2.	Arithmetic	6
3.	Data Interpretation	3
4.	Puzzles	3
	Total	15

Unit	Module/ Topics	Hrs
1.	Numerical Computation and Estimation-2. [i. Time and Work, ii. Pipes and Cisterns, iii. Time and Distance, iv. Problems on trains, Boats and Streams, v. Races and Games of skill, vi. SI & CI]	6
2.	Geometry [i. Lines and Angles ii. Triangles iii. Quadrilaterals & Polygons iv. Circles]	4
3.	Mensuration [i. 2-Dimensional Mensuration (Triangles, Quadrilaterals and Circles), ii. 3-Dimentional Mensuration (Cubes, Cuboids, Cylinder, Cone, Sphere)]	3
4.	Data Sufficiency on Quantitative Reasoning	2
	Total	15

Part-2 **- 3 Hours per week**

Coding: -Medium Level problem solving techniques:
Permutations and Combination, Probability, Hash Tables, Heap, Greedy Method, Backtracking

Scheme of Evaluation

Internal Assessments by Assignments, Quizzes (multiple Choice questions). All the Students are expected to do at least 5 problems in each topic and they should submit the content written by them in each topic for final evaluation.

Type of Assessment	No.of Marks
At least 5 problems in each topic	15
Assignments	15
Content writing	10
Quizzes	10
Total	**50**

Late Work

Each homework is due in the beginning of the class meeting (that is, at 6:00pm) on the due date. If homework is submitted within seven days after this deadline, the grade will be reduced by 50%. Submission more than seven days after the deadline will not be accepted. If you have a serious reason for requesting an extension, such as illness or family emergency, you should discuss it with one of the instructors as soon as the problem arises, and definitely before the submission deadline.

References:-

The course does *not* have a required textbook. You may optionally use the following textbook and URLs to look up standard algorithms:

1. Data Structures and Algorithms made easy by Narasimha Karumanchi
2. ***Data Structure and Algorithmic Thinking with Python by Narasimha Karumanchi***
3. ***Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide and Conquer and Dynamic Programming by Narasimha Karumanchi***
4. Coding Interview Questions by Narasimha Karumanchi
5. Competitive Programming in Python- 128 Algorithms to develop your Coding Skills by Cristhop Durr & Jill-Jen Vie.
6. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests (Undergraduate Topics in Computer Science) *by* Antti Laaksonen
7. https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/
8. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
9. https://codeforces.com/
10. https://leetcode.com/