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

B.Tech Computer Science and Engineering

(w.e.f 2019-20 admitted batch)

A University Committed to Excellence

B.Tech Computer Science and Engineering

REGULATIONS

(w.e.f. 2019-20 admitted batches)

1. ADMISSION

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

2. ELIGIBILITY CRITERIA

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) are considered. For Bengaluru CET and COMEDK instead of EAMCET (AP & TS) are considered. The rules of reservation of statutory bodies, wherever applicable, will be followed.

3. CHOICE BASED CREDIT SYSTEM

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
- 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 THE PROGRAM

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

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses	Basic Sciences	Mathematics, physics, chemistry and life sciences.
		Engineering Sciences	Fundamental engineering courses
		Humanities and Social Sciences	Related to English, humanities, social sciences and management
2	Core Courses	Program Core	Branch specific and mandatory core courses
3	Elective Courses	Program Electives	Supportive to the discipline with expanded scope in a chosen track of specialization or cross track courses
		Interdisciplinary Electives	Interdisciplinary exposure to nurture the interest of a student in other department courses
		Open Electives	Common to all disciplines that nurtures general interest of a student
4	Core Activities	Project Work	University or industry
		Internship	Training in industry or research organization
5	Mandatory Courses		Non-credit mandatory courses on Induction Program, Environmental Sciences, Indian Constitution, Essence of Indian Traditional Knowledge.

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.

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

5. MEDIUM OF INSTRUCTION

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

6. REGISTRATION

Every student has to register for the courses in each semester at the time specified in the academic calendar.

7. ATTENDANCE REQUIREMENTS

7.1 A student whose attendance is less than 85% in all the courses put together in any semester will not be permitted to attend the end semester examination and will not be allowed to register for subsequent semester of study. He/she has to repeat the same 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 75% and 84% on medical grounds and on payment of prescribed fee.

8. EVALUATION

8.1 Assessment of the performance of a student in theory courses shall be based on two components: Continuous Evaluation (40 marks) and Semester-end Examination (60 marks).

8.2 A candidate has to secure a minimum of 40% in any theory course in the two components (ref 8.1) put together to be declared to have passed the course, subject to the condition that the student 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 student has to obtain a minimum of 40% to secure pass grade.

8.4 For courses having both theory and practical components, 70% of the weightage will be given for theory component and 30% weightage for practical component. The student has to acquire 40% in the semester end theory examination. However, student 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 student has to obtain a minimum of 40% to secure pass grade.

8.6 Mandatory courses are assessed for PASS or FAIL only. No credits will be assigned to these courses. If a student secures more than 40 out of 100 marks, he / she will be declared PASS, else FAIL. PASS grade is necessary to be eligible to get the degree.

8.7 Mandatory courses Induction Program/Environmental Sciences/Indian Constitution/Essence of Indian Traditional Knowledge are assessed for satisfactory or not satisfactory only. No grade will be assigned. A student has to undergo two hours training per week in any one of the above in both I and II semesters and should obtain satisfactory grade to be eligible to get degree.

The 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, records 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. (b)Practical component: continuous evaluation Total	100 100 200	70% of the weightage will be given for theory component. Evaluation for theory component shall be same as S. No 1 as above. 30% weightage for practical components. Evaluation for practical component shall be same as S. No 2 as above
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 by a panel of examiners. iii) Thirty (30) marks for final report, presentation and Viva-voce by a panel of examiners.

5	Industrial Internship (VI&VII Semester)	Continuous Evaluation	100	i) Thirty (30) marks for 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	Sixty (60) marks for midterm semester examinations. Three midterm examinations shall be conducted for 30 marks each; performance in best two shall be taken into consideration. Forty (40) marks for Quizzes, Assignments and Presentations.

9. RETOTALING and REVALUATION

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

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

9.4 A student 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 examinations held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

9.6 A student 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 VERIFICATION OF ANSWER BOOK AND CHALLENGEEVALUATION

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

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

11. SUPPLEMENTARYAND SPECIAL EXAMINATIONS

11.1 The odd (I, III, V, VII) semester supplementary examinations will be conducted after conducting regular even semester examinations during April/May.

11.2 The even (II, IV, VI, VIII) semester supplementary examinations will be conducted after conducting regular odd semester examinations during October/November.

11.3 A student who has completed period of study and still has "F" grade in final semester courses is eligible to appear for special examination.

12. PROMOTION TO THE NEXT YEAR OF STUDY

12.1 A student shall be promoted to the next academic year only if he/she passes60% of the credits till that academic year.

12.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new

syllabus and regulations after detention as per the equivalency established by the BoS to continue his/her further studies.

13. MASSIVE OPEN ONLINE COURSES

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 for these courses will be decided by the respective Board of Studies (BoS).

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

14.1 The curriculum of the eight semesters B.Tech. program is designed to have a total of 162 credits for the award of B.Tech. degree.

14.2 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.

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

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

i) Registered and successfully completed all the courses and project as per the curriculum.

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.

15. B. Tech (HONORS)

A student who secured 8.0 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 DC to secure B. Tech (Honors). The courses will be approved by DC of respective campuses.

16 GRADING SYSTEM

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 CGPA of 5.0 at the end of the program to declare pass in the B. Tech program.

17. GRADE POINT AVERAGE

17.1 A Grade Point Average (GPA) for a semester is calculated as follows:

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

where,

C = number of credits for the course.

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

17.2 The Cumulative Grade Point Average (CGPA), is calculated using the above formula considering the grades obtained in all the courses, in all the semesters up to that particular semester, in all the semesters upto that particular semester.

17.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

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 in the first attempt.

18. BETTERMENT OF GRADES

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

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

19. DISCRETIONARY POWER

Not withstanding 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 Computer Science and Engineering
B.Tech in Computer Science and Engineering
Syllabus Structure
(Effective from the academic year 2019-20 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	0	3	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2	0	3	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics / Engineering Chemistry	BS/BS	3	0	3	0	4.5	Common to all
4.	19EID131	Problem Solving and Programming**	ES	3	1	3	0	5.5	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES/ES	0/ 1	0	3	0	1.5/2.5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NSS/ NCC/NSO/YOGA	MC	0	0	2	0	0	Common to all
7.	VDC111	Venture Discovery***	PW	0	0	4	0	2	Common to all
						Total		**19.5/20.5**	

Note:

1.Communicative English*: For the admitted batch of 2019-20, the students were offered Communicative English I

2. Problem Solving and Programming**: For the admitted batch of 2019-20, the students were offered Problem Solving and Programming using C (19EID131).

3. Venture Discovery***: This course is introduced from 2020-21 onwards.

Semester II

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA104	Engineering Mathematics-II (Probability and Statistics)	BS	3	0	0	0	3	Branch Specific
2.	19EID134/ 19EID234	AI Tools/ Life Sciences for Engineers	ES/BS	2	0	2	0	3	Common to all
3.	19ECY131/ 19EPH131	Engineering Chemistry / Engineering Physics	BS/BS	3	0	3	0	4.5	Common with ECE &EEE
4	19EEE131	Basic Electrical and Electronics Engineering	ES	3	1	3	0	5.5	Common to all
5	19EME131/ 19EME121	Engineering Graphics / Workshop	ES/ES	1/0	0	3	0	2.5/ 1.5	Common to all
6.	19ECS134	Data Structures with python[#]	PC	2	1	3	0	3.5	Branch Specific
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NSS/ NCC/NSO/YOGA	MC	0	0	2	0	0	Common to all
8.	19EHS122	Comprehensive Skill Development I[##]	HS	0	0	0	6	1	Common to all
						Total	**23/22**		

Note:

1. Data Structures with python[#]: For the admitted batch of 2019-20, this course was offered in Semester III and 0.5 credits allotted for Fundamental of python as a bridge course.

2. Comprehensive Skill Development I[##]: This course is introduced from 2020-21 onwards.

Semester- III

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA205	Engineering Mathematics- III (Discrete Mathematical Structures)	BS	3	0	0	0	3	Branch specific
2.	19EID234/ 19EID134	Life Sciences for Engineers/ AI Tools[$]	BS/ES	2	0	2	0	3	Common to all
3.	19EID132	Design Thinking	ES	2	0	2	0	3	Common to all
4.	19ECS201	Fundamentals of Digital Logic Circuits	PC	3	0	0	0	3	Branch specific
5.	19ECS231	Object Oriented Programming Through Java[$$]	PC	2	0	3	0	3.5	Branch specific
6.	19ECS203	Data Communications	PC	2	0	0	0	2	Branch specific
7.	19ECS221	Computer Engineering Workshop	PC	0	0	4	0	2	Branch specific
8.	19EMC281/ 19EMC282	Constitution of India/ Environmental Sciences	MC	3	0	0	0	0	Common to all
9.	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	Common to all
						Total		**20.5[$]**	

Note:

1. Life Sciences for Engineers/ AI Tools[$]: For the admitted batch of 2019-20, AI Tools are made compulsory in Semester-III and Life Sciences for Engineers are offered in Open Elective-I (Compulsory Subject) in Semester- V

2. Object Oriented Programming Through Java[$$]: For the admitted batch of 2019-20, this course (with Course ID 19ECS132) was offered in Semester- II.

3. [$]**:** The total credits for 2019-20 admit batch will be 21 credits, since 0.5 credit for Bridge course on Python.

Semester IV

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA202	Engineering Mathematics-IV (Numerical methods)	BS	3	0	0	0	3	Branch Specific
2.	19EID232	Internet of Things	ES	2	0	2	0	3	Common to all
3.	19ECS202	Computer Organization and Architecture	PC	3	0	0	0	3	Branch Specific
4.	19ECS204	Operating Systems	PC	3	0	0	0	3	Branch Specific
5.	19ECS232	Computer Networks	PC	3	0	2	0	4	Branch Specific
6.	19ECS234	Design and Analysis of Algorithms	PC	3	0	2	0	4	Branch Specific
7.	19EMC282/ 19EMC281	Environmental Sciences/Constitution of India	MC	3	0	0	0	0	Common to all
8.	19ECS292	Comprehensive Skill Development III	PW	0	0	0	6	1	Common to all
						Total		**21**	

Semester V

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECS331	Software Engineering	PC	2	0	2	0	4	Branch Specific
2.	19ECS305	Cryptography and Network Security	PC	3	0	0	0	3	Branch Specific
3.	19ECS333	Database Management Systems	PC	3	0	2	0	4	Branch Specific
4.	19ECS303	Formal Languages and Automata Theory	PC	3	0	0	0	3	Branch Specific
5.	19ECS3XX	Program Elective I	PE	2	0	2	0	3	Branch Specific
6.	19EOE3XX	Open Elective I[@]	OE	3	0	0	0	3	Common to all
7.	19EID3XX	Inter Disciplinary Elective I	ID	2	0	2	0	3	
8.	19ECS391	Comprehensive Skill Development IV	PW	0	0	0	6	1	Common to all
						Total		**24**	

Note: Open Elective I[@]: For the admitted batch of 2019-20, Life Sciences for Engineers is Compulsory

Semester VI

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECS332	Compiler Design	PC	2	0	2	0	4	Branch Specific
2.	19ECS302	Artificial Intelligence	PC	3	0	0	0	3	Branch specific
3.	19ECS334	Web Application Development	PC	2	0	2	0	3	Branch specific
4.	19ECS3XX	Program Elective II	PE	2	0	2	0	3	
5.	19ECS3XX	Program Elective III	PE	2	0	2	0	3	
6.	19EOE3XX	Open Elective II	OE	3	0	0	0	3	
7.	19EHS302	Engineering Economics and Management	HS	3	0	0	0	3	
8.	19EMC382	Engineering Ethics	MC	2	0	0	0	0	Mandatory Course
9.	19ECS392	Comprehensive Skill Development V	PW	0	0	0	6	1	Department Specific
						Total		**23**	

Semester VII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECS431	Embedded Systems	PC	2	0	2	0	3	Branch specific
2.	19ECS4XX	Inter Disciplinary Elective II	ID	2	0	2	0	3	
3.	19ECS4XX	Program Elective IV	PE	2	0	2	0	3	
4.	19ECS4XX	Program Elective V	PE	2	0	2	0	3	
5.	19EHS403	HS - II (Organizational Behaviour)	HS	3	0	0	0	3	
6.	19ECS491	Project Phase –I	PW	0	0	2	0	1	Branch specific
7.	19ECS493	Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions	PW	0	0	0	0	1	Branch specific
8.	19ECS495	Comprehensive Skill Development VI	PW	0	0	0	6	1	Department Specific
						Total		**18**	

Semester VIII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EID4XX	Inter Disciplinary Elective III	ID	2	0	2	0	3	
2.	19ECS4XX	Program Elective VI	PE	2	0	2	0	3	Branch specific
3.	19ECS492	Project Phase – II	PW	0	0	12	0	6^{+}	Branch specific
4.	GSS115	Gandhi for the 21st Century	HS					1	
							Total	**13**	

Total Credits 162

Total Number of Credits

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19.5/20.5	23/22	20.5	21	24	23	18	13	**162**

Category and Credits

Category	Code	Courses	Credits GITAM	Credits suggested by AICTE
Humanities & Social Sciences	HS	Communicative English	**12**	**12**
		HS1 and HS2 (elective)		
		Gandhi for the 21st Century		
		Comprehensive Skill Development I		
		Comprehensive Skill Development II		
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		
		Internet of Things		
Open Electives	OE	OE1, OE2	**6**	**18**
Inter Disciplinary Electives	ID	ID1 - ID3	**9**	
Program Electives	PE	PE1 - PE6	**18**	**18**
Program Core	PC	PC1 – PC17	**55**	**48**
Project	PW	Venture Discovery		
		Comprehensive Skill Development III	**14**	**15**
		Comprehensive Skill Development IV		
		Comprehensive Skill Development V		
		Comprehensive Skill Development VI		
		Internship		
		Project Phase I		
		Project Phase II		
Mandatory	MC	Environmental Science, Constitution of India, Engineering Ethics	**-**	**-**
Total			**162**	**160**

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 and CE
2.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	3	Offered for CSE
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 and CE
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
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/ 19EMA104	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 Process)	BS	3	0	0	3	Offered for ECE
3.	19EMA206/ 19EMA202/ 19EMA210	Engineering Mathematics IV (Number Theory and Its Applications/ Numerical methods/ Differential equations)	BS	3	0	0	3	Offered for CS/ CSE/ AIML
4.	19EMA208	Mathematics for Biotechnology IV	BS	3	0	0	3	Offered for BT
5.	19EMA212/ 19EMA214	Engineering Mathematics IV (Descriptive Statistics/ Applied Statistics for Data Science)	BS	3	0	0	3	Offered for DS/IoT

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 ECE, CSE, EEE
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 ECE, CSE, EEE
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	19MOE303	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
14	19EOE224	Virtual Reality	OE	1	0	4	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	19MOE305	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

PROGRAM ELECTIVES

Program Elective-I

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Data Science	19ECS341	Programming with R	PE	2	0	2	3
2	AI & Machine Learning	19ECS343	Advanced Data Structures for Machine Learning	PE	2	0	2	3
3	Network Security	19ECS345	Advanced Computer Networks	PE	2	0	2	3
4	Distributed and Cloud Computing	19ECS347	Distributed Systems	PE	2	0	2	3
5	Image Processing and Graphics	19ECS349	Computer Graphics	PE	2	0	2	3
6	Software Engineering	19ECS351	Software Requirements Management	PE	2	0	2	3

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

Program Elective-II

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Data Science	19ECS342	Data Warehousing and Mining	PE	2	0	2	3
2	AI &Machine Learning	19ECS344	Machine Learning	PE	2	0	2	3
3	Network Security	19ECS346	Information Security	PE	2	0	2	3
4	Distributed and Cloud Computing	19ECS348	Advanced Operating Systems	PE	2	0	2	3
5	Image Processing and Graphics	19ECS352	Image Processing	PE	2	0	2	3
6	Software Engineering	19ECS354	Design Patterns	PE	2	0	2	3

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

Program Elective-III

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Data Science	19ECS356	Social Network Analysis	PE	2	0	2	3
2	AI & Machine Learning	19ECS356	Social Network Analysis	PE	2	0	2	3
3	Network Security	19ECS358	Cyber Security	PE	2	0	2	3
4	Distributed and Cloud Computing	19ECS362	Cloud Computing	PE	2	0	2	3
5	Image Processing and Graphics	19ECS364	Introduction to Pattern Recognition and Machine Learning	PE	2	0	2	3
6	Software Engineering	19ECS366	Software Metrics	PE	2	0	2	3

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

Program Elective-IV

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Data Science	19ECS441	Information Retrieval Systems	PE	2	0	2	3
2	AI &Machine Learning	19ECS443	Natural Language Processing	PE	2	0	2	3
3	Network Security	19ECS445	Adhoc and Sensor Networks	PE	2	0	2	3
4	Distributed and Cloud Computing	19ECS447	Parallel Computing	PE	2	0	2	3
5	Image Processing and Graphics	19ECS449	Augmented Reality and Virtual Reality	PE	2	0	2	3
6	Software Engineering	19ECS451	Agile Software Development	PE	2	0	2	3

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

Program Elective- V

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Data Science	19ECS453	Neural Networks and Deep Learning	PE	2	0	2	3
2	AI &Machine Learning	19ECS453	Neural Networks and Deep Learning	PE	2	0	2	3
3	Network Security	19ECS457	Cyber Forensics	PE	2	0	2	3
4	Distributed and Cloud Computing	19ECS459	Block Chain Technology	PE	2	0	2	3
5	Image Processing and Graphics	19ECS461	Multimedia Processing	PE	2	0	2	3
6	Software Engineering	19ECS463	Software Testing Methodologies	PE	2	0	2	3

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

Program Elective- VI

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Data Science	19ECS442	Big Data	PE	2	0	2	3
2	AI &Machine Learning	19ECS442	Big Data	PE	2	0	2	3
3	Network Security	19ECS444	Advances in Internet of Things	PE	2	0	2	3
4	Distributed and Cloud Computing	19ECS442	Big Data	PE	2	0	2	3
5	Image Processing and Graphics	19ECS446	Game Programming	PE	2	0	2	3
6	Software Engineering	19ECS448	Secure Software Engineering	PE	2	0	2	3

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

INTERDISCIPLINARY ELECTIVES

Interdisciplinary Elective I

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EEC371	Fundamentals of Communication Systems	ID	2	0	2	3
2		19EIE371	Qualitative Techniques	ID	2	0	2	3
3		19EEI371	Sensors & Technology	ID	2	0	2	3
4	Basic Science Courses	19ECY371	Applications of Chemistry in Electronics	ID	2	0	2	3
5	Management Courses	19EIE373	Operation Research	ID	3	0	0	3
6		19ECE371	Disaster Management	ID	3	0	0	3

Interdisciplinary Elective II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EEC475	Microcontrollers and Interfacing	ID	2	0	2	3
2		19EEI471	Robotics & Automation	ID	2	0	2	3
3		19EEC473	Fundamentals of Digital Signal Processing	ID	2	0	2	3
4	Basic Science Courses	19EPH471	Quantum Computing	ID	2	0	2	3
5		19EBT463	Introduction To Bioinformatics	ID	2	0	2	3
6	Management Courses	19EME471	Optimization Techniques	ID	3	0	0	3

Interdisciplinary Elective III

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EPH472	Semiconductor Physics	ID	2	0	2	3
2		19ECE472	Remote Sensing and GIS	ID	2	0	2	3
3		19EEI477	Industrial Automation	ID	2	0	2	3
4	Management Courses	19EIE472	Total Quality Management	ID	3	0	0	3
5		19EIE474	Supply Chain Management	ID	3	0	0	3

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	0	3	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2	0	3	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics / Engineering Chemistry	BS/BS	3	0	3	0	4.5	Common to all
4.	19EID131	Problem Solving and Programming**	ES	3	1	3	0	5.5	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES/ES	0/1	0	3	0	1.5/ 2.5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NSS/ NCC/NSO/YOGA	MC	0	0	2	0	0	Common to all
7.	VDC111	Venture Discovery***	PW	0	0	4	0	2	Common to all
						Total		**19.5/20.5**	

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:

- To familiarize the students with the theory of matrices and quadratic forms.
- 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.

UNIT I: Matrices **10 L**

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, diagonalisation 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 **6 L**

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

- demonstrate the given function as series of Taylor's and Maclaurin's with remainders (L2)
- illustrate series expansions of functions using mean value theorems (L2)

UNIT III: Multivariable Calculus **8 L**

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 **8 L**

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: Multiple Integrals-II **8 L**

Evaluation of triple integrals, change of variables (cartesian, cylindrical and spherical polar co-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. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science 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 them in various activities such as just a minute (JAM), group discussions, oral presentations, and role plays.
- To expose learners to key Reading techniques such as Skimming and Scanning for comprehension of 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 forge a path in 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)
- apply various note-making techniques while comprehending the reading text to present a complete 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

- notice and understand effective listening strategies to identify discourse markers in presentations. (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 College Press,2019.
2. Raymond Murphy, "English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English, Cambridge University Press,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 BlackSwan, (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 & EEE)

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 behaviour of dielectric materials.
- To demonstrate the properties of magnets.
- To introduce semiconductor physics and devices.

UNIT I: Basics of Electromagnetics 9 L

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, divergence and curl of magnetic fields, Faraday's and Ampere's laws in integral and differential form, displacement current, continuity equation, Maxwell's equations.

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-Savarts' law to derive magneto static 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 7 L

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 **10 L**

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 **8 L**

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 semiconductors.

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 semiconductors with
- temperature (L5)

UNIT V: Semiconductor devices **8 L**

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)
- illustrate and interpret the V-I characteristics of a p-n junction diode(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", Wiley Publications,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-H curve).
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)
- understand the characteristics of photodiode, p-n junction diode and solar cell (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).
- determine hysteresis losses by B-H curve and measure magnetic parameters using hysteresis loop (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 & EEE)

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 photovoltaic 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).

UNIT I **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)

UNIT II **8L**

Battery Technology

Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zinc air, lithium cells-Li MnO_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

UNIT III **8L**

Renewable Sources of Energy Introduction- sources of renewable energy

Solar energy – Introduction - Physical and Chemical properties of Silicon- Production of Solar Grade Silicon from Quartz - Doping of Silicon- p and n type semiconductors- PV cell / solar cell- 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)

UNIT IV **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 of electroplating, nature of electrodeposits, electroplating process, Electroplating of chromium, gold etc. 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)

UNIT V **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

- explain the concepts of artificial molecular machines and molecular switches. (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 Hill 2009.

References:

1. Sashichawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons,2003.
2. B.S Murthy and P. Shankar, A Text Book of Nano Science and Nano Technology, University Press, 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-Formaldehyde resin
12. Preparation of Urea-Formaldehyde resin
13. Thin layer chromatography
14. Preparation of TiO_2/ZnO nano particles
15. SEM analysis of nano materials

Text Book(s)

1. Mendham J, Denney RC, Barnes JD, Thomas M and Sivasankar B , Vogel's Quantitative Chemical 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**

(w.e.f 2020-21 admitted batch, Common to all)

L	T	P	C
3	1	3	5.5

This course focuses on problem solving using visual programming and flowchart tools. Python being simple 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).

UNIT V: 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 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 3 matrix.
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 flowchart 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)

19EID131: PROBLEM SOLVING AND PROGRAMMING

(for the admitted batch of 2019-20, Common to all)

L	T	P	C
3	1	3	5.5

The course is designed to enable the student to write programs for problem solving. After an introduction to program logic design using algorithms and flowcharts, converting the logic into programs is taught. The features of structured programming are explained with the C programming language as an example. This course lays the foundation both for developing program logic and for writing programs in C according to the developed logic.

Course Objectives:

- Familiarize the student with the steps involved in writing and running a compiled program.
- Enable the student to build program logic with algorithms and flowcharts.
- Explain with the features and constructs of C programming such as data types, expressions, loops, functions, arrays, pointers and files.
- Demonstrate the handling of variables and input-output operations in C.
- Train the student to convert program logic into C language code using
- a top-down approach.

UNIT I **9L**

Introduction to Computer Problem-Solving– Introduction, The Problem- Solving Aspect, Top-Down Design, Implementation of Algorithms.

Fundamental Algorithms – Exchanging the values of two variables, Counting, Summation of a Set of Numbers, Factorial Computation, Sine Function Computation, Generation of the Fibonacci Series. Basics of Flow Charts.

Introduction to C Language – Structure of a C Program, Keywords, Identifiers, Data Types and Variable declaration, Constants, Input / Output function.

Learning Outcomes:

After completion of this unit the student will be able to

- understand a problem and build an algorithm/flowchart to solve it (L2).
- list the steps involved in writing and running a program (L1).
- interpret the structure of C program and various key features of C (L2).

UNIT II **9L**

Operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions.

Control Structures:

Selection Statements (making decisions) – if, if-else, nested if, else if ladder and switch statements.

Repetition statements (loops)-while, for, do-while statements, Nested Loops.

Unconditional statements-break, continue, goto.

Pointers – Pointer variable, pointer declaration, Initialization of pointer, accessing variables through pointers, pointers to pointers, pointers to void.

Learning Outcomes:

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

- translate mathematical expressions to C notation using operators (L2).
- construct C programs using various conditional statements (L3).
- develop C programs using loops and nested loops (L6).
- demonstrate the usage of pointers (L2).

UNIT III **9L**

Arrays – Declaration and Definition of Array, accessing elements in array, Storing values in array, linear search, binary search, bubble sort, Two – dimensional arrays, multidimensional arrays. Arrays and Pointers, Pointer Arithmetic and arrays, array of pointers.

Strings – Declaration and Definition of String, String Initialization, arrays of strings, string manipulation functions, string and pointers, unformatted I/O functions.

Learning Outcomes:

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

- develop programs for storing and managing collections of items using arrays (L3).
- make use of the in-built functions to manipulate strings (L3).
- solve problems related to arrays and strings (L3).

UNIT IV **9L**

Functions-Designing Structured Programs, user defined function- function definition, function prototype, function call, Types of functions. Parameter Passing by value, parameter passing by address, Passing array to function, Recursive functions. Dynamic Memory Allocation Functions, pointers to functions.
Storage classes-auto, register, static, extern.

Learning Outcomes:

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

- understand the concept of subprograms and recursion (L2).
- apply the in-built functions to develop custom functions for solving problems (L3).
- make use of parameter passing mechanisms (L3).
- infer the effect of storage classes on variables (L2).

UNIT V **6L**

Structures–Declaration, initialization, accessing structures, operations on structures, structures containing arrays, structures containing pointers, nested structures, self-referential structures, arrays of structures, structures and functions, structures and pointers, unions.

Files – Concept of a file, Opening and Closing files, file input / output functions (standard library input / output functions for text files).

Learning Outcomes:

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

- develop programs using structures and unions for storing dissimilar data items (L6).
- compare the utilization of memory by structures and unions (L5).
- make use of files and file operations to store and retrieve data (L3).

Problem Solving & Programming Laboratory List of Experiments

1. Introduction to Raptor tool for drawing flowcharts for Problem Solving.
2. Conversion of an upper-case character to a lower-case character.
3. Print sizes and ranges of different data types.
4. Find Roots of a Quadratic Equation using 'if'.
5. Find minimum among three numbers.
6. Check whether the given number is perfect
7. Print Twin Primes up to a Specified limit.
8. Find GCD of two numbers.
9. Swap two numbers using pointers.
10. Performs all the five arithmetic operations using Pointers.
11. Implement linear search.
12. Sort an array in descending order.
13. Reverse the given string without using String handling functions.
14. Sort strings in dictionary order.
15. Use a function to perform addition and multiplication of two matrices.
16. Use a function to perform transpose of a given Matrix
17. Read an array of elements of size 'n' and find the largest and smallest number using functions
18. Find the sum of digits of a number. Number must be passed to a function using pointers.
19. Print the first n Fibonacci numbers.
20. Reverse a string.
21. Calculate the percentage of marks of three different subjects of each student using array of structures.
22. Demonstrates the memory allocation done by a structure and a union (declare Structure and Union in the same program).
23. Demonstrate member access in a union (declare three different types of variables in union, assign values and print them).
24. Accepts the names of two files and copies the first file into the second, line by line using fgets() and fputs() functions.
25. Store the data of 'n' employees in a file, where 'n' is given by the user.
26. Count number of characters, words and lines in a given file.

Text Book(s):

1. R.G. Dromey, How to Solve it By Computer, 1/e, Pearson Education,2006.
2. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007.

References:

1. Jeri R Hanly, Elliot B Koffman, Problem Solving and Program Design in C, 7/e, Pearson Education, 2012.
2. P. Dey and M Ghosh, Programming in C, 2/e, Oxford University Press, 2011.
3. B.W. Kernighan and Dennis M. Ritchie, The C Programming Language,2/e, Pearson education, 1988.
4. B. Gottfried, Programming with C, 3/e, Schaum's outlines, McGraw Hill (India), 2017.

Course Outcomes:

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

- explain the basics of computers (L2).
- build logic for solving a problem and translate it into a program. (L3).
- define variables and construct expressions using C language (L1).
- utilize arrays, structures and unions for storing and manipulating data (L3).
- develop efficient, modular programs using functions (L3).
- write programs to store and retrieve data using files (L3).

19EME121: WORKSHOP
(Common to all)

L	T	P	C
0	0	3	1.5

The objective of this course is to expose students, common tools in engineering. This course enables the students to gain hands on experience and skills necessary to perform basic operations such as carpentry, 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 trayb) 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

- summarize various carpentry operation required to create a product in real time applications. (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 softwares.
- Impart graphical representation of simple components.

Manual Drawing: **7 L**

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: **6L**

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 presentations. **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 AJolhe, Engineering Drawing, Tata McGraw-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 SERVICE SCHEME (NSS)

L T P C
0 0 2 0

National Service scheme is a public service program encouraged by Ministry of Youth Affairs [1] 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.

UNIT I **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 variousNSSFunctionaries.

UNIT II **2Hours**

Regular activities: College campus activities, NSS, 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

UNIT III **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 mediain theN.S.S activities.

UNIT IV **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

UNIT V **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 of Youth Affairs and Sports, New Delhi
2) NSS Diaries
3) Sanjay Bhattacharya, Social Work Interventions and Management-Deep and Deep Publications, New Delhi

19EMC181B – NATIONAL CADET CORPS

L T P C
0 0 2 0

UNIT I **5 hours**

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

UNIT II **5 hours**

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

UNIT III **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, leadership traits, types of leadership, attitude – assertiveness and negotiation, time management, personality development, effects of leadership with historical examples, stress management skills, interview skills, conflict motives – resolution, importance of group – team work, influencing skills, body language, sociability: social skills, values / code of ethics **Disaster Management:** Civil defence 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

UNIT IV **5 hours**

Social awareness and community development: Basics of social service, weaker sections of our society and their needs, social/ rural development projects – menrega , sgsy , nsap etc, 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 act 2012.

UNIT V **5 hours**

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 and exercises. **Adventure training:** Para sailing, slithering, rock climbing, 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 DG NCC.
2. Cadet Hand Book (Specialized Subjects), published by DG NCC.

Reference Books

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.

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 Yoga asana.
- Demonstrate and perform Yoga asana.
- Enable the student to perform pranayama and meditation.

- **Introduction to Yoga:** Evolution of Yoga and Schools of Yoga, Origin of Yoga, History and Development of Yoga; Etymology and Definitions, Misconceptions, Nature and Principles of Yoga.
- **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, Bramari pranayama.
- **Yoga for allround fitness,** Bhadrasan, Vajrasan, ArdhaUstrasan, Nadishuddhi pranayama, Navasan, Janusirasan, Paschimotthanasan, Shashankasan, Vakrasan, Bhujangasan, Kapalabhati..
- **Meditative Postures**: Sukhasan, Ardha Padmasan, Padmasan and Siddhasan,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, The Hatha yoga Pradipika/ the original Sanskrit [by] Svatmarama; an English translation [by] Brian Dana Akers. Woodstock, NY:YogaVidya.com, 2002.

References:

1. Bharati, Swami Veda Reddy Venkata: Philosophy of Hatha Yoga (Englis), Himalayan, Pensylvania, Hatha Ratnavali.
2. Swami Satyananda Saraswathi - Asana, Pranayama, Mudra & Bandha. Bihar School of Yoga, Munger
3. 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).

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
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 Outcome	**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

Semester II

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA104	Engineering Mathematics-II (Probability and Statistics)	BS	3	0	0	0	3	Branch Specific
2.	19EID134/ 19EID234	AI Tools/ Life Sciences for Engineers	ES/BS	2	0	2	0	3	Common to all
3.	19ECY131/ 19EPH131	Engineering Chemistry / Engineering Physics	BS/BS	3	0	3	0	4.5	Common with ECE &EEE
4	19EEE131	Basic Electrical and Electronics Engineering	ES	3	1	3	0	5.5	Common to all
5	19EME131/ 19EME121	Engineering Graphics / Workshop	ES/ES	1/0	0	3	0	2.5/ 1.5	Common to all
6.	19ECS134	Data Structures with python[#]	PC	2	1	3	0	3.5	Branch Specific
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NSS/ NCC/NSO/YOGA	MC	0	0	2	0	0	Common to all
8.	19EHS122	Comprehensive Skill Development I[##]	HS	0	0	0	6	1	Common to all
						Total	**23/22**		

19EMA104: ENGINEERING MATHEMATICS-II
(PROBABILITY AND STATISTICS)

L	T	P	C
3	0	0	3

This course is designed to impart knowledge on the concepts of Data Science, fundamental properties of probability, distributions, correlation, regression, testing of hypothesis for small and large samples in engineering applications.

Course Objectives:

- To familiarize the students with the foundations of Data Science, probability and statistical methods.
- To explain the concepts in random variables and several distributions in engineering applications.
- To teach the concepts of correlation, regression and estimations and their properties.
- To explain the concept of testing of hypothesis for large samples.
- To impart knowledge on small sample tests.

UNIT I: Data Science and Probability 10 L

Data Science: Introduction to statistics, population vs sample, collection of data, primary and secondary data, types of variables: dependent, independent, categorical and continuous variables, data visualization, measures of central tendency, measures of dispersion (variance).

Probability: Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem (without proof).

Learning Outcomes:

After completion of this unit the student will be able to

- summarize the basic concepts of data science and its importance in engineering (L2)
- analyze the data quantitatively or categorically, measure of averages, variability (L4)
- define the terms trial, events, sample space, probability and laws of probability (L2)
- make use of probabilities of events in finite sample spaces from experiments (L3)
- apply Baye's theorem to practical problems (L3)

UNIT II: Random Variable and Probability Distributions 8 L

Random variables (discrete and continuous), probability mass and density functions, probability distribution Binomial, Poisson, normal distribution- and their properties (mathematical expectation and variance).

Learning Outcomes:

After completion of this unit the student will be able to

- explain the notion of random variable, distribution functions and expected value (L2)
- apply Binomial and Poisson distributions to compute probabilities, theoretical frequencies (L3)
- explain the properties of normal distribution and its applications (L3)

UNIT III: Correlation, Regression and Estimation **8 L**

Correlation, correlation coefficient, rank correlation, regression, lines of regression, regression coefficients, principle of least squares and curve fitting (straight line, parabola and exponential curves).

Estimation: Parameter, statistic, sampling distribution, point estimation, properties of estimators, interval estimation.

Learning Outcomes:

After completion of this unit the student will be able to

- identify different trends in scatter plots, strengths of association between two numerical variables (L3)
- make use of the line of best fit as a tool for summarizing a linear relationship and predicting future observed values (L3)
- estimate the value of a population parameter, computation of point and interval estimation (L3)

UNIT IV: Testing of Hypothesis and Large Sample Tests **8 L**

Formulation of null hypothesis, alternative hypothesis, critical region, two types of errors, level of significance and power of the test. **Large Sample Tests**: Test for single proportion, difference of proportions, test for single mean and difference of means confidence interval for parameters in one sample and two sample problems.

Learning Outcomes:

After completion of this unit the student will be able to

- identify the difference between one-tailed and two-tailed hypothesis tests (L3)
- analyze the testing of hypothesis for large samples (L4)

UNIT V: Small Sample Tests **6 L**

Student t-distribution (test for 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.

Learning Outcomes:

After completion of this unit the student will be able to

- analyze the testing of hypothesis for small samples (L4)
- test for the $\chi 2$ square goodness of fit and independence of attributes (L4)

Text Book(s):

1. Richard A. Johnson, Iswin Miller and John Freund, Miller &Freund's probability & statistics for engineers, 7/3, Pearson, 2008.
2. Miller and Freunds, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Educational Publications, 2012.

References:

1. S. Ross, A First Course in Probability, Pearson, 2002.
2. W. Feller, An Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

Course Outcomes:

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

- classify the concepts of Data Science and its importance (L2)
- apply discrete and continuous probability distributions (L3)
- explain the association of characteristics through correlation and regression tools (L3)
- identify the components of a classical hypothesis test (L3)
- use the statistical inferential methods based on small and large sampling tests (L4)

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. Audiobots and Musicbots.

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 AWSLex, 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)

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).

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

- To familiarize the basic DC and AC networks used in electrical and electronic circuits.
- 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).
- To expose basic concepts and applications of Operational Amplifier and configurations.

UNIT I **10L**

Basic laws and Theorems: Ohms law, Kirchoff'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)

UNIT II **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)
- demonstrate the performance characteristics of different types of dc machines (L3)
- explain types of starters used for starting of dc motors (L2)
- estimate losses and efficiency of electrical machine(L2)

UNIT III **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)

UNIT IV **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)
- describe the construction and operation of n-channel and p-channel MOSFETs (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, Fundamentals of Electrical Engineering and Electronics, 1/e, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C.Smith, Microelectronic Circuits, 6/e, Oxford University Press, 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)
- demonstrate the operation and applications of various electronic devices (L2)
- construct Inverting and Noninverting configurations of Op-Amp (L3)

19ECS134: DATA STRUCTURES WITH PYTHON

L	T	P	C
2	1	3	3.5

The study of data structures, a fundamental component of a computer science education, serves as the foundation upon which many other computer science applications are built. Knowledge of data structures is a must for students who wish to work in design, implementation, testing or maintenance of any software system. Organization of data in an efficient way for application, is the major focus of the course.

Course Objectives

- Introduce various data representation methods and searching methods.
- Familiarize with linear data structures and operations on them.
- Demonstrate the organization of data as trees and various operations on trees.
- Teach various graph representations.
- Enable to perform graph traversal and find shortest path and minimal spanning tree for a graph
- Expose common sorting techniques and their complexities.

UNIT I **10 L**

Python Primitives: Python overview, Objects in Python, Expressions, Operators and Precedence, Control Flow, Functions, Simple Input and Output, Exception handling, Iterators and Generators, Collections [Strings, Lists, Tuples, Dictionaries].

Learning Outcomes:

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

- summarize various ways of representing data (L2)
- explain the working of linear and binary search algorithms (L2)
- compare various data representations and search algorithms (L2)

UNIT II **10 L**

Algorithm Analysis: Asymptotic Analysis and Big O Notation **Recursion**: What is recursion, examples [Factorial functions, Fibonacci series]. **Array Based Sequences**: Python Sequence types, low-level arrays, dynamic arrays, efficiency of python's sequences, using array-based sequences. **Searching:** Sequential Search, binary search and algorithmic analysis. **Sorting:** Insertion sort, selection sort, bubble sort

Learning Outcomes:

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

- summarize various ways of representing data (L2)
- explain the working of linear and binary search algorithms (L2)
- compare data representations and sorting algorithms (L5)

UNIT III **10L**

Sorting: quick sort, merge sort and their algorithmic analysis. **Linked lists: S**ingle linked list, double linked list, circular linked list **Stacks:** Definition, operations: array implementation, linked list implementation. **Queues:** Definition, operations: array implementation, linked list implementation and applications, Priority Queue. Double-Ended Queues.

Learning Outcomes:

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

- discuss how stacks and queues are implemented using arrays and linked lists (L2)
- explain the implementation of priority queues (L2)
- list the applications of stacks, queues and priority queues (L1)
- compare different types of linked lists (L5)

UNIT IV **10 L**

Trees: Definition, Tree properties, **Binary trees**: properties, implementation, tree traversals, Heap tree, Heap sort **Search Trees**: binary search tree, AVL trees and operations on AVL trees, and (2,3)-Trees

Learning Outcomes:

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

- discuss the properties of trees, binary, binary search and AVL trees (L2)
- explain how operations such as insertion, deletion and traversal are performed on different types of trees (L2)
- analyze the complexity of operations on different tree types (L4)

UNIT V **10 L**

Graphs: ADT**,** data structure for graphs, graph traversal, Transitive closure, directed acyclic graph, shortest paths [weighted graphs, dijkstra's algorithm], minimum spanning trees [Prim's, Kruskal's, disjoint partitions, union-find structures].

Learning Outcomes:

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

- demonstrate different graph representations and operations (L2)
- illustrate the working of common sorting algorithms (L2)
- analyze the computational efficiency of algorithms for sorting (L4)

Text Book(s):

1. Michel T. Goodrich, Roberto Tamassia, Michel H. Goldwasser, **Data Structures & Algorithms in Python**, Willey March, 2013. ISBN: 978-1-118-29027-9.
2. Rance D. Necaise, **Data Structures & Algorithms using Python**, John Willey & Sons, India. ISBN 9788126562169.

References

1. Wesly J.Chun, Core Python Programming, 2/e, Prenctice Hall.
2. Manohar Swmynathan , Mastering Machine Learning with Six Steps , Apress, ISBN-13: 978-1-4842-2866-1
3. José Unpingco, Python for Probability, Statistics, and Machine Learning, Springer ISBN 978-3-319-30717-6 (eBook)
4. Reema Thareja, Python Programming using problem solving Approach, Oxford University, Higher Education Oxford University Press, First edition, ISBN-10: 0199480173,10 June 2017.
5. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.
6. Kenneth A Lambert, Fundamentals of Python first Programmes, Copyrighted material, 1/e, Course Technology Inc., 6th February 2009.
7. John B. Schneider Shira Lynn Broschat Jess Dahmen, Algorithmic Problem Solving with Python.

Course Outcomes:

After Completion of this course, the student will be able to:

- explain various ways of representing data in a computer (L2)
- demonstrate operations on linear data structures (L2)
- illustrate the mechanisms for creating, altering and traversing various types of trees (L2)
- explain the representations, traversals and applications of graphs (L2)
- analyze common sorting algorithms (L4)
- choose a data structure that gives the best performance for a given application (L6)

DATA STRUCTURES WITH PYTHON LABORATORY

This Lab provides hands-on experience in designing, implementing, and using the most – commonly used data structure including arrays, stacks, queues, linked lists, trees, hash tables and graphs. Implementation of different searching and sorting algorithms is also done.

List of Practical Experiments:

1. Python sample programs for practice
    - Find minimum among three numbers.
    - Find the GCD and LCM of two/three numbers
    - Check whether the given number is perfect
    - Print Twin Primes up to a Specified limit.
    - Print the prime numbers up to a specified limit.
    - Find the sum of digits of a number. Check whether given number is Armstrong number or not.
    - Swapping of two numbers
    - Performs all the five arithmetic operations.
2. Write a program to read a linear list of items and store it in an array.
    - Copy the contents from one array to another array
    - Copy the contents from one array to another array in reverse order
    - Delete the duplicate elements from an array.
3. Write programs for:

- Representing sparse matrix
- Sparse matrix addition
- Sparse matrix transpose

4. Write a program to Perform Linear Search and Binary Search on a list stored in an array.
5. Write a program to create a singly linked list for the following operations
    - Insert a Node at Beginning, at Ending and at a given Position
    - Delete a Node at Beginning, at Ending and at a given Position
    - Search, Count the Number of Nodes and Display
6. Write a program to create a doubly linked list for the following operations
    - Insert a Node at Beginning, at Ending and at a given Position
    - Delete a Node at Beginning, at Ending and at a given Position
    - Search, Count the Number of Nodes and Display
7. Write a program to create a Circular singly linked list for adding and deleting a Node.
8. Write a program to create a stack and perform various operations on it.
9. Write a program to convert the infix expression into postfix form.
10. Write a program to create a queue and perform various operations on it.
11. Write a program to create a binary tree and perform various traversals.
12. Write a program to create a binary search tree and perform search operation.
13. Write a program to implement Depth First Search, Breadth First Search traversals on a graph.
14. Write a program to implement Dijkstra's Shortest Path Algorithm
15. Write a program to implement various sorting techniques: [Compare with Python's Built-In Sorting Functions also]
    - Insertion sort
    - Selection Sort
    - Bubble Sort
    - Merge Sort
    - Quick Sort

19ECS132: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(CSE)

L	T	P	C
2	0	2	3

This course enables the students to gain knowledge on various object oriented aspects of Java. The course tours the students through classes, inheritance, interfaces, packages, exceptions, generics, graphical programming concepts. The knowledge gained in this course can be applied to develop standalone applications for Android, Real Time Programming etc.

Course Objectives:

- To familiarize object-oriented programming concepts and techniques.
- To illustrate classes and class libraries, developing classes for simple
- applications.
- To demonstrate various types of Inheritance mechanisms.
- To introduce diverse software packages applicability and usage of Exceptions and Generics.
- To train designing graphical effects through Applets.

UNIT I **7L**

Java Programming Fundamentals: Java Language, Key Attributes of Object-Oriented Programming, Java Development Kit, Simple Program, Create Blocks of Code, Keywords, Identifiers, The Java Class Libraries.

Data Types and Operators: Java's Primitive Types, Literals, Variables, Scope and Lifetime of Variables, Operators- Arithmetic, Relational, Logical, Bitwise, Assignment. Type conversion in Assignments, Using a Cast, Operator Precedence.

Program Control Structures: if, switch, for, enhanced for, while, do-

while, break, continue.

Learning Outcomes:

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

- explain attributes of object oriented programming (L2).
- write a basic program (L2).
- apply various data types and operators specific to Java (L3).
- implement control structures and extended structures specific to Java (L3).

UNIT II **10L**

Introduction to Classes, Objects And Methods: Class Fundamentals, Objects creation, Reference Variables and Assignment, Methods, Returning a Value, Using Parameters, Constructors, Parameterized Constructors, new Operator, this Keyword, finalize() method.

Arrays: 1D Arrays, Multidimensional Arrays, Irregular Arrays, Array References, Using the Length Member.

Strings: String Fundamentals, Literals, String Arrays, Concatenation, toString(), length(), obtaining characters within a string, String comparison, picking indexes, modifying string, Command-Line Arguments, Scanner

Class, Vector class, Wrapper Classes, Parsing, Auto boxing and Unboxing.

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

- identify the advantages of using classes (L3).
- demonstrate the knowledge on Arrays and irregular arrays (L3).
- implement classes that support user input (L3).

UNIT III **7L**

A Closer Look into Methods and Classes: Controlling Access to Class Members, Passing objects to methods, Passing arguments, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Variable-Length Arguments.

Inheritance: Basics, Member Access and Inheritance, Constructors and Inheritance, Using Super, Multilevel Hierarchy, Constructor execution hierarchy, Superclass References and Subclass Objects, Method Overriding, Abstract Classes, Using final, Object Class.

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

- interpret knowledge on method usage variants in classes (L2).
- use various types of inheritances (L3).

UNIT IV **8L**

Interfaces: Fundamentals, Creating and Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Extending Interfaces, Nested Interface.

Packages: Package Fundamentals, Member Access, Importing Packages,
Static import.

Exception Handling: Exception Hierarchy, Fundamentals, Consequences of an Uncaught Exception, Handling errors, Multiple Catch, Throwing and Rethrowing an Exception, Throwable, using finally, using throws, Creating Exception Subclasses.

Learning Outcomes:

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

- implement Multiple inheritance through interfaces (L3).
- develop packages (L3).
- employ exceptions originated in various scenarios (L3).

UNIT V **8L**

Multi-Threading: Introduction to threads, creating a thread, extending the Thread class, implementing Runnable interface, life cycle of a thread, priority of a thread, synchronization and deadlock.

Applet Programming: Introduction, how applets differ from applications, building applet code, applet life cycle, about HTML, designing a web page, passing parameters to applets, getting input from the user.

Learning Outcomes:

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

- illustrate streams and their contribution towards I/O mechanism (L2).
- explain the concept of generic programming (L2).
- develop graphics with the support of Applets (L3).

Text Book(s):

1. Herbert Schildt, Dale Skrien, Java Fundamentals A Comprehensive Introduction, 1/e, Tata McGraw Hill, 2017.

References:

1. Herbert Schildt, The Java complete References, 9/e, Tata McGraw Hill,2014.
2. Y.DanielLiang, An Introduction to JAVA Programming, 10/e, Tata
3. McGraw Hill.
4. Kathy Sierra, Head First Java, 2/e, Shroff Publishers, 2012.
5. Balagurusamy, Programming with JAVA, 2/e, Tata McGraw Hill, 2014.

Course Outcomes:

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

- describe the data types, operators and control structures (L2).
- understand the concepts of Object Oriented Programming (L2).
- apply attributes of OOP to reap its benefits (L3).
- demonstrate the ease of handling various scenarios of program execution without abrupt interruption (L2).
- explain the flavour of generics (L2).
- construct standalone applications for various platforms (L3).

Object Oriented Programming Through Java Lab List of Experiments:

1. Develop a program that will take a string from a command line argument and check whether it is a palindrome or not.
2. Given two single dimensional arrays A and B which are sorted in ascending order. Write a program to merge them into a single sorted array C that contains every item from arrays A and B in ascending order.
3. Develop a program to implement the following string methods.
   a) equals() b) compareTo() c) substring() d) indexOf() e) toLowerCase()
4. Develop a program to demonstrate constructor overloading.
5. Design a vehicle class hierarchy in Java, and develop a program to demonstrate Polymorphism.
6. Develop a program to demonstrate multiple inheritance through interface.
7. Write a program to find the roots of a quadratic equation using interface and packages.
   • Declare an interface in package Quad1
   • Declare another package Quad2 and implement the interface
8. Develop a program to demonstrate exception handling by using FINALLY & MULTIPLE CATCH statements.
9. Write a program to throw a user defined exception for employee details
   • If an employee age is greater than 50, an age exception must be thrown
10. Develop an applet that receives three numeric values as input from the user and then display the largest of the

three.

11. Design a HTML page (web page) describing your profile in one paragraph. Design in such a way that it has a heading, a horizontal rule, three links and a photo of your institution.
12. Create an applet program for drawing colour lines, rectangle, filled rectangle, rounded rectangle, filled rounded rectangle, oval, filled oval, arc, fill arc and polygon. Every drawing shape should be in different colour. Write a text "hello everyone" at the center.
13. Develop a program to illustrate the concept of generic class.

Case Study:

- Consider a Library Management System where in Books are issued and received back after the due date. The data available with the Library would be the Title of the book, author and number of copies available with the library, date of issue. Each book is given a unique identification number and similarly the members of the library are also given a unique identification number. A book can be retained for 15 days with the member after issue. Implement code to:
  - Find whether a particular book is available in the library: search by Title or by author.
  - Post a Reminder to the member when his book is due a day before. The remainder would state the name of the book and the due date.

19EHS122: COMPREHENSIVE SKILL DEVELOPMENT I

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

Stream	Course Code	Course Title	Category	L	T	P	C
Comprehensive Skill Development	19EHS122	Soft Skills And Quantitative Aptitude	HS	1	2		1
		Coding	HS			3	
Total number of hrs per week						6	

Part-1

A. Verbal and Soft Skills

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

B. Quantitative Aptitude and Reasoning

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

Part-2

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.

Course Outcomes:

On completion of the course, student will be able to

- effectively communicate through verbal/oral communication and improve the listening skills. (L3)
- 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. (L6)
- understand the problems and develop his competitive coding skills. (L2)
- apply the skills in various domains and will be able to solve complex problems faced by the industry(L3).
- function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality. (L4)

Semester- III

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA205	Engineering Mathematics- III (Discrete Mathematical Structures)	BS	3	0	0	0	3	Branch specific
2.	19EID234/ 19EID134	Life Sciences for Engineers/ AI Tools[$]	BS/ES	2	0	2	0	3	Common to all
3.	19EID132	Design Thinking	ES	2	0	2	0	3	Common to all
4.	19ECS201	Fundamentals of Digital Logic Circuits	PC	3	0	0	0	3	Branch specific
5.	19ECS231	Object Oriented Programming Through Java[$$]	PC	2	0	3	0	3.5	Branch specific
6.	19ECS203	Data Communications	PC	2	0	0	0	2	Branch specific
7.	19ECS221	Computer Engineering Workshop	PC	0	0	4	0	2	Branch specific
8.	19EMC281/ 19EMC282	Constitution of India/ Environmental Sciences	MC	3	0	0	0	0	Common to all
9.	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	Common to all
						Total		**20.5[$]**	

19EMA205: ENGINEERING MATHEMATICS- III

(DISCRETE MATHEMATICAL STRUCTURES)

L	T	P	C
3	0	0	3

This course is exclusively designed for the students of Computer Science and Information Technology branches to understand the logic gates, the analytic approach of fibonacci recurrence relations, algebraic structures for Cryptography and Network Security & Graphs, Trees for data structures in their core subjects.

Course Objectives

- To explain the logical operations and validity of statements
- To familiarize with the solution of linear recurrence relations by various methods.
- To introduce basics of group theory and its applications.
- To demonstrate the basic concepts of graphs and its applications.
- To train the students on the topics: trees, spanning trees, shortest spanning trees and justification of Kruskal's algorithm.

UNIT I **10 L**

Mathematical Logic: Connectives, negation, conjunction, disjunction, conditional and bi-conditional, well-formed formulae, tautologies, equivalence of formulae, duality, tautological implications, functionally complete set of connectives, principal disjunctive and conjunctive normal forms, inference calculus, rules of inference, indirect method of proof, conditional proof.

Learning Outcomes:

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

- find equivalence formulae, implement the logic with mathematical proofs (L2)
- apply inference theory to verify the consistency of data (L3)

UNIT II **8 L**

Recurrence Relations: Recurrence relations, solving linear recurrence relations by characteristic roots method, system of recurrence relations, non-linear recurrence relations.

Learning Outcomes:

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

- construct recurrence relations of the sequences (L3)
- solve homogeneous linear recurrence relations (L3)
- solve complementary function and particular integral for non-homogeneous linear recurrence relations(L3)

UNIT III **8 L**

Group Theory: Groups, subgroups, Lagrange's theorem on finite groups, normal subgroups, permutation groups, cyclic groups (definition and examples), Group codes (single error detection and correction).

Learning Outcomes:

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

- test whether the given algebraic structure is a group or not(L4)
- identify different types of groups (L3)
- examine single error detection and correction (L4)

UNIT IV **8 L**

Graph Theory: Definitions, finite and infinite graphs, incidence and degree, isolated pendant vertices, isomorphism, sub graphs, walk, path and circuit, connected and disconnected graphs, components, Euler graphs, Euler graph theorem, operations on graphs, decomposition of Euler graphs into circuits, arbitrarily traceable Euler graphs, Hamiltonian paths and circuits, travelling salesman problem.

Learning Outcomes:

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

- identify different graphs and their properties (L3)
- construct Euler and Hamiltonian graphs (L3)

UNIT V **6 L**

Trees: Some properties of trees, pendant vertices, distance and centers, rooted and binary trees, spanning trees, shortest spanning trees, Kruskal's algorithm.

Learning Outcomes:

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

- construct the spanning tree and binary tree from graphs (L3)
- build minimal spanning tree using different algorithms (L3)

Text Book(s):

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.

2. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2012.

References

1. Keneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill, 2009.
2. Richard Johnsonburg, Discrete mathematics, 7/e, Pearson Education, 2008.
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2006.

Course Outcomes:

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

- identify through enhanced logical capabilities (L3)
- find a general solution of recurrence (L3)
- build algebraic structures and relations (L3)
- analyze the concepts in graph theory (L4)
- apply graph theory concepts in core subjects such as data structures and network theory effectively (L3)

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)

19ECS201: FUNDAMENTALS OF DIGITAL LOGIC CIRCUITS

L	T	P	C
3	0	0	3

Digital logic circuits are the basic building blocks of modern computers. To understand the working of computers, one needs to know how numbers are represented and processed using digital logic circuits. This course first teaches number representation in computers and Boolean algebra. After covering minimization of expressions and basic logic gates, the design of combinational and sequential circuits that perform a specific function are discussed. The aim of the course is to provide the student with an understanding of how data is represented and processed at the hardware level. This course acts as a foundation for a course on Computer Architecture and Organization.

Course Objectives

- Facilitate the student to represent numbers in different number systems and convert numbers from one number system to another.
- Introduce logic gates and theorems and properties of Boolean algebra.
- Familiarize the student with techniques for minimization expression and establish its necessity.
- Demonstrate the design of combinational and sequential logic circuits.

UNIT I **8 L**

Binary Systems: Positional representation of numbers, Decimal, Octal, Hexadecimal number systems, General radix 'r' system, Conversions, Complements, Binary codes, Arithmetic with signed and unsigned numbers (addition, subtraction), Introduction to error detection and error correction.

Learning Outcomes:

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

- explain different number systems(L2)
- solve the number system conversion problems (L3)
- apply arithmetic operations on signed and unsigned binary numbers (L3)
- explain basic error detection and correction methods(L2)

UNIT II **8 L**

Boolean Algebra and Logic Circuits: Axiomatic definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean Functions, Minterms and Maxterms, Canonical and Standard Forms, Digital logic gates, Synthesis using AND, OR and NOT gates, NAND and NOR logic networks.

Learning Outcomes:

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

- summarize the properties of Boolean algebra (L2**)**
- solve expressions in the canonical and standard forms (L3**)**
- construct logic circuits with logic gates (L3**)**
- construct any Boolean function using Universal gates (L3**)**

UNIT III **8 L**

Gate-Level Minimization: The K-Map method, two variable K-Map, three variable K-Map, four variable K-Map, five variable K-Map, six variable K-Map, K-Maps with don't care conditions (incompletely specified functions), Tabular method for minimization (Quine McCluskey Method), Sum of products (SOP) and Product of sums (POS) simplification.

Learning Outcomes:

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

- illustrate the representation of Boolean expression as a K-map (L2)
- translate the Boolean expression into its minimal form using K-maps (L2)
- translate the given expression into its minimal form using QMC method (L2)

UNIT IV **8 L**

COMBINATIONAL LOGIC: Design procedures, Adders, Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Priority encoder, Code converters, Seven segment display, Magnitude comparator, Decimal adder (BCD adder), Binary Multiplier.

Learning Outcomes:

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

- explain the working of basic combinational circuits (L5)
- distinguish between the functions of different combinational circuits (L4)
- build combinational circuits to perform a required function (L6**)**

UNIT V **8 L**

SEQUENTIAL CIRCUITS: Flip Flops, Basic latch, R-S flip flop, D flip flop, T flip flop, JK flip flop, Registers, Shift registers, Synchronous and Asynchronous (ripple) counters, BCD counter (synchronous and asynchronous), Ring counter, Johnson counter, Registers and Shift Registers.

Learning Outcomes:

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

- distinguish between combinational circuits and sequential circuits (L2)
- explain the working of different flip-flops (L5)
- design registers and counters to perform a given function (L6)

Text Book(s):

1. M Morris Mano, Michael D. Ciletti Digital Design, 5/e, Pearson Education, 2011.

References

1. Z.V. Kohavi, Switching Theory and Finite Automata, 2/e, McGraw Hill, 1978.
2. Stephen Brown & Zvonko Vranesic, Fundamental of digital logic with Verilog Design, 2/e, Tata McGraw Hill,2007.

Course Outcomes:

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

- interpret a given number in different number systems (L2)
- design logic circuits using gates to perform a Boolean function (L6)
- solve Boolean expressions into their simplified form (L3)
- explain the working of combinational and sequential circuits (L5)
- design a combinational or sequential circuit to perform a given function (L6)

19ECS231: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

L	T	P	C
2	0	3	3.5

This course enables the students to gain knowledge on various object oriented aspects of Java. The course tours the students through classes, inheritance, interfaces, packages, exceptions, generics, graphical programming concepts. The knowledge gained in this course can be applied to develop standalone applications for Android, Real Time Programming etc.

Course Objectives

- To familiarize object-oriented programming concepts and techniques.
- To illustrate classes and class libraries, developing classes for simple applications.
- To illustrate the usage of Arrays and Strings.
- To demonstrate various types of Inheritance mechanisms.
- To introduce packages applicability and usage of Exceptions.

UNIT I **7 L**

Java Programming Fundamentals: Java Language, Key Attributes of Object-Oriented Programming, Java Development Kit, Simple Program, Create Blocks of Code, Keywords, Identifiers, The Java Class Libraries.
Data Types and Operators: Java's Primitive Types, Literals, Variables, Scope and Lifetime of Variables, Operators- Arithmetic, Relational, Logical, Bitwise, Assignment. Type conversion in Assignments, Using a Cast, Operator Precedence.
Program Control Structures: if, switch, for, enhanced for, while, do-while, break, continue.

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

- explain attributes of object oriented programming. (L2)
- write a basic program: (L2)
- apply various data types and operators specific to Java (L3)
- implement control structures and extended structures specific to Java (L3)

UNIT II **8 L**

Introduction to Classes, Objects And Methods: Class Fundamentals, Objects creation, Reference Variables and Assignment, Methods, Returning a Value, Using Parameters, Constructors, Parameterized Constructors, new Operator, this Keyword, finalize() method, Wrapper Classes, Parsing, Auto boxing and Unboxing. **I/O**: Command-Line Arguments, Scanner and BufferedReader Classes,

A Closer Look into Methods and Classes: Controlling Access to Class Members, passing objects to methods, passing arguments, Returning Objects, Method Overloading, Overloading Constructors, Understanding Static, Variable-Length Arguments.

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

- identify the advantages of using classes (L3)
- implement classes that support user input (L3)
- implement polymorphism through overloading (L3)
- interpret knowledge on method usage variants in classes (L2)

UNIT III **10 L**

Arrays: 1D Arrays, Multidimensional Arrays, Irregular Arrays, Array References, Using the Length Member.Arrays class of util package, Array Lists,Vector class

Strings: String class, constructors, length(), string literals, concatenation, toString(), Character extraction, string comparison, searching strings, modifying, data conversion, changing the case, joining, split(). **StringBuffer** class: constructors, length(), capacity(), ensureCapacity(), setLength(), charAt(), setCharAt(), getChars(), append(), insert(), reverse(), delete(), deleteCharAt(), replace().

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

- demonstrate the knowledge on Arrays and irregular arrays (L2)
- interpret the usage of Arrays, Array Lists and Vectors (L2)
- choose methods for performing various operations on strings(L1)

UNIT IV **8 L**

Inheritance: Basics, Member Access and Inheritance, Constructors and Inheritance, Using Super, Multilevel Hierarchy, Constructor execution hierarchy, Superclass References and Subclass Objects, Method Overriding, Abstract Classes, Using final.

Interfaces: Fundamentals, Creating and Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Extending Interfaces, Nested Interface.

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

- use various types of inheritances (L3)
- implement multiple inheritance through interfaces (L3)

UNIT V **7 L**
Packages: Package Fundamentals, Member Access, Importing Packages, Static import.

Exception Handling: Exception Hierarchy, Fundamentals, Consequences of an Uncaught Exception, Handling errors, Multiple Catch, Throwing and Rethrowing an Exception, Throwable, using finally, using throws, Creating Exception Subclasses.

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

- develop packages (L3)
- employ exceptions originated in various scenarios (L3)

Course Learning Outcomes
At the end of the course, students will be able to

- describe the data types, operators and control structures (L2)
- understand the concepts of Object Oriented Programming (L2)
- make use of Arrays and Strings related operations (L3)
- apply features of OOP to reap its benefits (L3)

- demonstrate the ease of handling various scenarios of program execution without abrupt interruption (L2)

Text Book(s)

1. Herbert Schildt, Dale Skrien, Java Fundamentals A Comprehensive Introduction, 1/e, Tata McGraw Hill, 2017.
2. Herbert Schildt, The Java complete References, 9/e, Tata McGraw Hill,2014.

References

1**.** Y.DanielLiang , An Introduction to JAVA Programming, 10/e, Tata McGraw Hill.
2.Kathy Sierra, Head First Java, 2/e, Shroff Publishers, 2012.
3. Balagurusamy , Programming with JAVA, 2/e, Tata McGraw Hill, 2014.

Programs for practical sessions: 21P

1. Develop a program to demonstrate the use of labelled break and continue statements.
2. Develop a program to demonstrate the use of for each loop.
3. Develop a program to sort an array in ascending and descending order.
4. Develop a program to create a student class and display his details.
5. Develop a program to create an array of objects for employee class.
6. Develop a program that will take a string from a command line argument and check whether it is a palindrome or not.
7. Write a program for finding area of different geometric shapes (Circle, Rectangle and Cube) using method overloading.
8. Write a Program to generate Fibonacci Series by using Constructor to initialize the Data Members.
9. Develop a program to demonstrate constructor overloading.
10. Develop a program to accept a sentence and display the words in it.
11. Design a vehicle class hierarchy in Java, and develop a program to demonstrate Polymorphism.
12. Develop a program to demonstrate multiple inheritance through interface.
13. Write a program to find the roots of a quadratic equation using interface and packages.
    - Declare an interface in package Quad1
    - Declare another package Quad2 and implement the interface
14. Develop a program to demonstrate exception handling by using THROW, MULTIPLE CATCH &FINALLY statements.
15. Write a program to throw a user defined exception for employee details
    - If an employee name is a number, a name exception must be thrown.

- If an employee age is greater than 50, an age exception must be thrown

Case Study:

Consider a Library Management System where in Books are issued and received back after the due date. The data available with the Library would be the Title of the book, author and number of copies available with the library, date of issue. Each book is given a unique identification number and similarly the members of the library are also given a unique identification number. A book can be retained for 15 days with the member after issue. Implement code to:

- Find whether a particular book is available in the library: search by Title or by author.
- Post a Reminder to the member when his book is due a day before. The remainder would state the name of the book and the date due

19ECS203: DATA COMMUNICATIONS

L	T	P	C
2	0	0	2

A large majority of computer applications require communication of data from one device to another. As such, this course deals with data communications, including conversion of data into a signal, propagation of the signal through a medium and conversion of the signal back into data. Proper communication also requires the two communicating devices to follow a common protocol. This course covers the concepts of layered network architecture, properties of different transmission media and data communication principles. Various signal encoding techniques and their merits and demerits are taught, together with basic error and flow control techniques and multiplexing. The course acts as a foundation for later courses.

Course Objectives

- Introduce the concepts of Data Communications and different models
- Impart the characteristics of various transmission media.
- Familiarize different analog and digital transmission techniques.
- Expose the basic error control and flow control techniques.
- Acquaint with static channel allocation using TDMA and FDMA.

UNIT I **4 L**

Data communication, Data networking and the Internet: A communication model, data communications, networks, the Internet. Protocol Architecture: Need for protocol architecture, TCP/IP protocol architecture, OSI model, TCP/IP Vs OSI model.

Learning Outcomes:

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

- explain basic working of the computer network(L2)
- infer the necessity of layered protocol architecture(L2)
- compare the OSI and TCP/IP architectures(L2)

UNIT II **6 L**

Data transmission: Concepts and terminology, analog and digital data transmission, transmission impairments, channel capacity. Transmission Media: Guided and unguided

Learning Outcomes:

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

- summarize various transmission impairments(L2)
- describe analog transmission, digital transmission and channel capacity(L2)
- compare guided and unguided media(L2)

UNIT III **6 L**

Signal encoding techniques: Digital data to digital signals, digital data to analog signals, analog data to digital signals, analog data to analog signals.

Learning Outcomes:

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

- illustrate various signal encoding techniques(L2)
- analyze signal encoding techniques(L4)
- select an encoding technique for a given network scenario(L3).

UNIT IV **6 L**

Digital Data Communication Techniques: Asynchronous and synchronous transmission, types of errors, error detection techniques, error correction techniques (single bit)

Data link control protocols: Flow control, error control, high level data link control (HDLC) protocol.

Learning Outcomes:

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

- compare synchronous and asynchronous transmission(L2)
- test for errors in a given data stream(L4)
- analyze various flow control techniques(L4)
- summarize the working of the HDLC protocol(L2)

UNIT V **6 L**

Multiplexing: Frequency division multiplexing, characteristics, synchronous time division multiplexing, characteristics. statistical time division multiplexing, characteristics.

Learning Outcomes:

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

- explain the need for multiplexing(L2)
- summarize the characteristics of multiplexing techniques(L2)
- compare the performance of multiplexing techniques under different conditions(L2)

Text Book(s):

1 William Stallings, Data and Computer Communications, 8/e, Pearson Education., 2013.

References:

1. Fred Harshall, Data Communications, Computer Networks and Open systems,4/e, Pearson Education, 2005.

2. Behrouz A Forouzan, Data Communications and Networking, 4/e, McGraw Hill, 2012.

Course Outcomes:

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

- illustrate and summarize the OSI and TCP/IP network architectures(L2)
- compare the properties of various transmission media(L2)
- utilize error correction and detection techniques to detect or correct errors(L3)
- analyze flow control schemes for data transmission(L4)
- explain basic signal encoding and multiplexing techniques(L2)

19ECS221: COMPUTER ENGINEERING WORKSHOP

L	T	P	C
0	0	4	2

The Computer Engineering Workshop course enables the students to gain practical knowledge of PC Hardware and Software, Software installation, troubleshooting aspects, working with Internet, Excel and PowerPoint tools. This is spread over 14 weeks of duration.

Course Objectives

- Demonstrate assembly and disassembly of a Personal Computer.
- Installation of an Operating System.
- Train to troubleshoot either Hardware or Software.
- Enable to work with Internet and Search Engines.
- Familiarize with MS-Office Tools (Excel and PowerPoint).

List of Practical Experiments:

PC Hardware and Software **6 P**

Week 1: Task 1: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a viva. Students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Week 2: Task 2: Every student should individually install MS-Windows on the personal computer. Lab instructor should assist and verify the installation and the teachers follow it up with a viva.

Week 3: Task 3: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should assist and verify the installation and the teachers follow it up with a viva.

Week 4: Task 4: This task covers basic commands and system administration in Linux which includes: Basic Linux commands in bash, Create hard and symbolic links, Text processing and usage of wildcards.

Hardware and Software Troubleshooting **9 P**

Week 5: Task 5: **Hardware Troubleshooting:** Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Week 6: Task 6: **Software Troubleshooting:** Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a viva.

Internet and World Wide Web **9P**

Week 7: Task 7: **Orientation and Connectivity Boot Camp:** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity, preparations need to be made by the instructors to simulate the WWW on the LAN.

Week 8: Task 8: **Web Browsers and Surfing the Web:** Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Plug-ins like Macromedia Flash and JRE for applets should be configured.

Week 9: Task 9: **Search Engines and Netiquette:** Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors.

Week 10: Task 10: **Cyber Hygiene:** Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install an anti-virus software, configure their personal firewall and windows update on their computer. Then they need to customize their browsers to block pop-ups, block ActiveX downloads to avoid viruses and/or worms.

Excel **9P**

Week 11: Task 11: Excel Orientation: The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool.

Week 12: Task 12: **Using Excel:** Accessing, overview of toolbars, saving excel files, using help and resources, creating a Scheduler: Features to be covered: Gridlines, Formatting Cells, Summation, Auto fill, Formatting Text.

Week 13: Task 13: Calculating GPA: Features to be covered: Cell Referencing, Formulae in excel: Count, Average, Standard deviation etc., Charts, Renaming and Inserting worksheets, Hyper linking, LOOKUP/VLOOKUP, Sorting, Conditional formatting.

Power Point **9 P**

Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic include:

Week 14: Task-14: **PPT Orientation:** Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows.

Week 15: Task-15: **Making interactive presentations:** Hyperlinks, Inserting Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Text Book(s):

1. Vikas Gupta, Comdex Information Technology Course Tool Kit, Wiley Dreamtech, 2009.

2. Cheryl A Schmidt, The Complete Computer upgrade and repair book, Wiley,3/e, Dreamtech, 2002.

3. ITL Education Solutions limited, Introduction to Information Technology, Pearson Education,

2006.

4. Kate J. Chase, PC Hardware and A+ Handbook, PHI (Microsoft), 2000.

Course Outcomes:

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

- identify various hardware components of a Personal Computer(L3)
- install Operating System(L3)
- troubleshoot hardware and software(L3)
- work with Internet and Search engines(L4)
- make use of Excel and PowerPoint(L3)

19EMC281: CONSTITUTION OF INDIA

(Common to all)

L	T	P	C
3	0	0	0

UNIT I **10 L**

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

UNIT II **8 L**

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

UNIT III **8 L**

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 **8 L**

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 to all)

L	T	P	C
3	0	0	0

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 (L2)
- 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 ecosystem: - 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 (L2)

UNIT IV **9 L**

Social issues and global environment problems and efforts: From unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water 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 (L2)
- 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 (L2)
- 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 (L2)
- 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

Stream	Course Code	Course Title	Category	L	T	P	C
Comprehensive Skill Development	19EHS221	Soft Skills And Quantitative Aptitude	HS	1	2		1
		Coding	HS			3	
Total number of hrs per week						6	

Part-1

A. Verbal and Soft Skills:

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

B. Quantitative Aptitude and Reasoning

Puzzles, Numbers, Arithmetic, Data Interpretation.

Part-2

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.

Course Outcomes:

On completion of the course, student will be able to

- effectively communicate through verbal/oral communication and improve the listening skills. (L3)
- 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. (L6)

- understand the problems and develop his competitive coding skills. (L2)
- apply the skills in various domains and will be able to solve complex problems faced by the industry(L3).
- function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality. (L4)

Semester IV

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA202	Engineering Mathematics-IV (Numerical methods)	BS	3	0	0	0	3	Branch Specific
2.	19EID232	Internet of Things	ES	2	0	2	0	3	Common to all
3.	19ECS202	Computer Organization and Architecture	PC	3	0	0	0	3	Branch Specific
4.	19ECS204	Operating Systems	PC	3	0	0	0	3	Branch Specific
5.	19ECS232	Computer Networks	PC	3	0	2	0	4	Branch Specific
6.	19ECS234	Design and Analysis of Algorithms	PC	3	0	2	0	4	Branch Specific
7.	19EMC282/ 19EMC281	Environmental Sciences/Constitution of India	MC	3	0	0	0	0	Common to all
8.	19ECS292	Comprehensive Skill Development III	PW	0	0	0	6	1	Common to all
						Total		**21**	

19EMA202: ENGINEERING MATHEMATICS-IV
(NUMERICAL METHODS)

L	T	P	C
3	0	0	3

This course is designed to enhance problem solving skills of engineering students using a powerful problem solving tool namely numerical methods. The tool is capable of handling large systems of equations, nonlinearities and complicated geometries that are common in engineering practice but often impossible to solve analytically.

Course Objectives:

- To familiarize the students with numerical solutions of equations.
- To get exposed to finite differences and interpolation.
- To demonstrate the numerical differentiation and integration.
- To explain the numerical solutions of ordinary differential equations.

UNIT I **8 L**

Solution of algebraic and transcendental equations: Regula falsi method, Newton Raphson method, **Solution of linear system of equations: Direct Methods:** Gauss elimination method, Gauss Jordan method, **Iterative methods**: Gauss Jacobi method, Gauss Seidel method, finding the eigenvalues of a matrix by Power method.

Learning Outcomes:

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

- find approximate roots of an equation by using different numerical methods (L3).
- solve system of linear equations using various techniques (L3).
- find eigenvalues of a matrix (L3).

UNIT II **8 L**

Interpolation: Difference operators and relations, difference tables, Newton's forward and backward interpolation formulae, divided difference formula, Lagrange's interpolation formula.

Learning Outcomes:

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

- examine the relation between various operators (L4).
- find a function using various methods (L3).

UNIT III **8 L**

Numerical Differentiation: Derivatives using forward, backward and central difference formulae.

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule.

Learning Outcomes:

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

- find differentiation of a function by using different numerical methods (L3)
- find integration of a function by using different numerical methods (L3)
- solve ordinary differential equations by using different numerical schemes (L3)

UNIT IV **10 L**

Numerical solutions of ordinary differential equations-1: Picard's method, -Taylor's series method- Euler's method –Modified

Euler's method, -Runge-Kutta method - Predictor-Corrector method

Learning Outcomes:

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

- solve first order differential equation using various methods (L3).

UNIT V **8 L**

Numerical solutions of ordinary differential equations-2: Simultaneous first order differential equations, second order differential equations, boundary value problems, finite-difference method.

Learning Outcomes:

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

- solve simultaneous first order differential equations (L3).
- solve second order differential equations (L3)
- solve boundary value problems using finite-difference method (L3).

Text Book(s):

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

References:

1. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5/e, New Age International(P) Limited, 2007.
2. S.S. Sastry, Introductory methods of Numerical Analysis,4/e,PHI Learning Publications,2009.

3. H.C Saxena, Finite Differences and Numerical Analysis, Chand and Company Pvt. Ltd., New Delhi.

Course Outcomes:

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

- analyze how root finding techniques can be used to solve practical engineering problems (L4).
- apply various interpolation techniques to solve practical problems (L3).
- apply numerical differentiation and integration whenever and wherever routine methods are not applicable (L3).
- solve differential equations using various numerical methods (L3).
- know the strengths and weaknesses of the various methods and be able to decide which ones are appropriate for a particular problem (L3)

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, ReaLTime 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):

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)

19ECS202: COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

Computer Architecture and Organization provides a comprehensive knowledge on the structure and behavior of computer hardware architecture and application of the design concepts. The basic concepts of this course can have a view as to how a computer system works. This course enables the students to learn the basics of hardware components from basic gates to memory and I/O devices and instruction set architectures.

Course Objectives

- Attain the knowledge of fundamental circuit components and techniques for designing the circuits
- Describe and understand the processor memory hierarchy
- Understand the concepts of interrupts and I/O devices
- Attain the general knowledge of advances in microprogramming and their implementation in computer design
- Experience the design process in the context of a reasonable size hardware system

UNIT I **8 L**

Register Transfer and Micro operations: Register transfer language, register transfer, bus and memory transfers, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic shift unit

Learning Outcomes:

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

- demonstrate the register transfer language(L2)
- learn different types of micro operations(L2)

UNIT II **10 L**

Basic Computer Organization and Design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory-references instructions, input-output and interrupt, complete computer description. Design of the basic computer, design of accumulator logic.

Micro programmed Control: Control memory, address sequencing, micro program example, design of control unit.

Learning Outcomes:

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

- learn different types of memory-reference instructions(L2)
- construct the micro programmed control unit(L3)

UNIT III **10 L**

Central Processing Unit: Introduction, general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control.

Pipeline and Parallel Processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline.

Computer Arithmetic: Introduction, addition and subtraction, decimal arithmetic unit, Booth's multiplication algorithm.

Learning Outcomes:

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

- illustrate different types of addressing modes(L2)
- understand the concepts of pipelining and parallel processing(L2)
- solve and practice computer arithmetic algorithms(L3)

UNIT IV **8 L**

Input-Output Organization: Peripheral devices, I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, I/O Processor, Serial Communication.

Learning Outcomes:

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

- understand the peripheral devices(L2)
- explain the modes of data transfer(L2)
- understand I/O interface(L2)

UNIT V **8 L**

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memories, Cache Memory, Virtual Memories, Memory Management Hardware.

Learning Outcomes:

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

- understand the memory hierarchy(L2)
- analyze the organization of different types of memories(L4)
- learn the memory management hardware(L2)

Text Book(s):

1. M. Morris Mano, Computer System Architecture, 3/e, Pearson education, 2008.

References

1.Carl Hamacher, ZvonkoVranesic, SafwatZaky,Computer Organization,5/e, McGraw Hill,2001.

2. John P. Hayes, Computer Architecture and Organization, 3/e, McGraw Hill, 1998.

3. William Stallings, Computer Organization and Architecture, 6/e, Pearson PHI, 2012.

Course Outcomes:

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

- classify the machine's instruction set architecture (ISA) including basic instruction fetch and execute cycles, instruction formats, control flow, and operand addressing modes(L2)
- build the design and functioning of a machines central processing unit (CPU) including the data path components (ALU, register file) and the control unit(L3)
- understand the basic input/output functioning including program controlled I/O and interrupt I/O(L1)
- analyze the organization of different types of memories (L4)
- analyze the performance of processors and cache(L4)

19ECS204: OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Operating system is an essential part of any computer system. This course is designed to explain the basics and the applications of operating system, the working of operating system. This course also focuses on other concepts of operating system: scheduling Algorithms, process management and process synchronization. It also gives us a detailed idea about memory management and I/O systems.

Course Objectives

- To introduce students with basic concepts of operating system, its functions and services.
- To provide the basic concepts of process management and synchronization.
- To familiarize the dead lock issues.
- To understand the various memory management schemes.
- To give exposure over I/O systems and mass storage structures and Linux system.

UNIT I **8 L**

Introduction: What Operating Systems Do, Computer System Organization, Computer-System Architecture, Operating System Structure, Operating system operations, Process Management, Memory Management, Storage management, Protection and security, Kernel data structures

Operating system Structures: operating system services, User and operating system Interface, system calls, Types of System calls, system programs, operating system structure, system boot.

Learning Outcomes:

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

- explain the main responsibilities of an operating system (OS) and the history leading to their current form(L2)
- list the most fundamental subsystems and services of OS (L1)
- analyze and list out different system calls (L4)

UNIT II **8 L**

Process Management: Process concepts, process scheduling, Operations on processes, inter-process communication

CPU Scheduling: Scheduling-criteria, scheduling algorithms, Thread scheduling, Multiple processor scheduling, algorithm evaluation, Multithreaded programming, Multi-core Programming, Multi-threading Models, Thread Libraries.

Learning Outcomes:

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

- demonstrate the concepts of Process, thread and CPU scheduling(L2)
- list out different scheduling algorithms(L1)
- analyze scheduling algorithms with different examples (L4)

UNIT III **8 L**

Process Synchronization: Critical section problem, Peterson's solution, synchronization hardware, Mutex locks, semaphores, classic problems of synchronization, monitors.

Deadlock: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock.

Learning Outcomes:

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

- classify and compare hardware and software solutions to the critical section problem, demonstrate several classical process synchronization problems(L2)
- analyze deadlock prevention and avoidance policies(L4)
- apply different methods to recover from deadlock(L3)

UNIT IV **8 L**

Memory Management: Swapping, contiguous memory allocation, paging, segmentation, structure of page the table.

Virtual memory: Demand paging, Copy-on-Write, page-replacement, allocation of frames, thrashing.

File Concepts: File concept, access Methods, directory and disk structure, protection.

Learning Outcomes:

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

- list out detailed description of various ways of organizing memory hardware(L1)
- analyze various techniques of allocating memory to processes, analyze different file concepts and access methods. (L4)
- compare different page replacement algorithms(L2)

UNIT V **10 L**

I/O systems: Application interface, kernel I/O subsystem, transforming I/O to hardware operation.

Mass-storage structure: Disk management, disk scheduling, Swap space management

System Protection: Goals of protection, principles of protection, Domain of protection, Access matrix.

Linux System: Design principle, kernel modules, process management, scheduling, memory management, file systems, input and output, network structure, security.

Learning Outcomes:

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

- demonstrate the principles and complexities of I/O and hardware. (L2)
- analyze system protection techniques(L4)
- evaluate disk scheduling algorithms(L5)

Text Book(s):

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Concepts with Java, 9/e, John Wiley, 2016.

References

1. Andrew S Tanenbaum, Modern Operating Systems, 2/e, Pearson/PHI, 2014.

2. Crowley, Operating System- A Design Approach, McGraw-Hill, 2012.

3. Stallings, Operating Systems - Internal and Design Principles, 5/e, 2013.

4. Pal Chaudhary, Operating system principles & Design, 1/e, PHI Learning, 2013.

5. Deitel and Deitel, Operating System, Pearson Education, 2003.

6. D.M. Dhamdhere, Operating systems- A Concept based Approach,2/e, McGraw Hill, 2010.

Course Outcomes:

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

- illustrate the basic and overall view of operating system (L2)
- analyze the concept of a process, process life cycle, process states and state transitions (L4)
- implement and practice CPU scheduling strategies, process synchronization techniques and memory-management schemes (L3)
- simplify and resolve Deadlock handling situation (L4)
- evaluate Disk storage management, protection and security mechanisms (L5)

19ECS232: COMPUTER NETWORKS

L	T	P	C
3	0	2	4

The course is designed to impart a basic understanding of the working of computer networks, with the Internet as the case in point. Starting with the application layer with which the user interacts directly, it covers the important principles and protocols in the application, transport, network and link layers. Brief introductions to socket programming and wireless networks are introduced.

Course Objectives:

- Familiarize the student with the components of the Internet and the concept of layered protocol architecture.
- Expose the student to the important principles behind the working of various layers of a network.
- Enable the student to write simple network applications using socket programming.
- Demonstrate the working of the most important protocols used in the Internet.
- Acquaint the student with the basics of wireless networking.

UNIT I **6 L**

Computer networks and the Internet: Internet, The Network Edge, The Network Core: Delay, Loss and Throughput in Packet-Switched Networks, Protocol Layers and Their Service Models, History of Computer Networking and the Internet.

Learning Outcomes:

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

- identify the roles of the various components of the Internet(L3)
- explain network parameters such as delay, loss and throughput(L2)
- model the network using a layered architecture(L3)

UNIT II **8 L**

Application Layer: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS- The Internet's Directory Service, Socket Programming: Creating Network Applications

Learning Outcomes:

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

- summarize the principles governing the working of network applications(L2)
- outline the working of popular applications in the Internet(L2)
- develop simple network applications using socket programming(L6)

UNIT III **10 L**

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-oriented Transport: TCP, Principles of Congestion Control: TCP Congestion Control

Learning Outcomes:

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

- explain the need for multiplexing and demultiplexing at the transport layer(L2)
- compare connectionless service with connection-oriented service(L4)
- outline the working of TCP and UDP(L2)
- analyze the principles of congestion control(L4)

UNIT IV **10 L**

The Network Layer: Introduction, Virtual Circuit and Datagram Networks, Inside Router, The Internet Protocol (IP), Routing Algorithms

Learning Outcomes:

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

- distinguish between virtual circuit and datagram networks(L4)
- outline the working of the Internet Protocol(L2)
- explain and analyze the working of routing algorithms(L2)

UNIT V **10 L**

The Link Layer: Introduction to the Link Layer, Multiple Access Links and Protocols, Switched Local Area Networks

Wireless and Mobile Networks: Introduction, Wireless Links and Network Characteristics, Wi-Fi: 802.11 Wireless LANs (Architecture and MAC Protocol), Mobile IP

Learning Outcomes:

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

- summarize the protocols used for multiple access links(L2)
- compare the characteristics of wireless networks with those of wired networks(L4)
- outline the working of IEEE 802.11 standard and Mobile IP(L2)

COMPUTER NETWORKS LABORATORY

List of Practical Experiments:

1. Write a report that includes a diagram showing the topology, type of connection devices, and speed of the wired and wireless LAN in your organization. Also find out the MAC and IP addresses and the subnet mask of your computer.
2. Install and run a network diagnosis tool such as Tcp dump or Wireshark. Start capturing packets on an active interface, open a browser and type the address of your favorite search engine. Wait till the page loads and stop capture. List out the type and number of each type of packets captured.
3. Write a program to create a server that listens to port 5003 using stream sockets. Write a simple client program to connect to the server. Send a simple text message "Hello" from the client to the server and the server to the client and close the connection.
4. Write a program to create a chat server that listens to port 5004 using stream sockets. Write a simple client program to connect to the server. Send multiple text messages from the client to the server and vice versa. When either party types "Bye", close the connection.
5. Write a program to create a server that listens to port 5005 using stream sockets. Write a simple client program to connect to the server. The client should request for a text file and the server should return the file before terminating the connection.
6. Write a program to create a server that listens to port 5006 using stream sockets. Write a simple client program to connect to the server. Run multiple clients that request the server for binary files. The server should service each client one after the other before terminating the connection.
7. Write a program to create a server that listens to port 5007 using stream sockets. Write a simple client program to connect to the server. Run multiple clients that request the server for text files. The server should service all clients concurrently.
8. Write a program to create a server that listens to port 5009 using datagram sockets. Write a simple client program that requests the server for a binary file. The server should service multiple clients concurrently and send the requested files in response.

Text Book(s):

1. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, 6/e, Pearson, 2012.

References

1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, 5/e, Prentice Hall, 2011.

2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, 3/e, Morgan Kaufmann, 2011.

3. Richard Stevens, UNIX Network Programming – Volume 1, 3/e, Prentice Hall of India, 1997.

Course Outcomes:

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

- interpret the concept of modular network design using layered protocol architecture(L5)
- list the various components in the Internet and their functions(L1)
- analyze various types of services provided by each layer in the network architecture(L4)
- discuss the working of the important protocols used in the Internet(L6)
- develop simple network applications and test them(L6)

19ECS234: DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
3	0	2	4

This course enables the students to gain knowledge in various techniques of designing algorithms, estimating the efficiency of the developed algorithms in terms of time and space. The knowledge gained in this course can be applied to the latest developments in technology.

Course Objectives

- Explain the asymptotic performance of algorithms.
- Demonstrate the complexity of an algorithm in terms of time and space.
- Help to design and implement programs in various programming paradigms.
- Familiarize with efficient algorithms in software design and development.

UNIT I **9 L**

Introduction to Algorithms: Algorithm specification, Performance Analysis. Divide and Conquer: The general method: Binary search, finding maximum and minimum, Merge sort, Quick sort, Selection sort, Strassen's Matrix multiplication.

Learning Outcomes:

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

- define and specify the characteristics of an algorithm(L1)
- analyze the performance of an algorithm(L4)
- list different methods in analyzing time complexity(L1)
- interpret divide and conquer technology for designing algorithms(L2)
- illustrate the efficiency of algorithms designed(L2)

UNIT II **8 L**

The Greedy Method: The general method, Knapsack problem, Job sequencing with deadlines, optimal storage on tapes, minimum cost spanning trees, single source shortest paths.

Learning Outcomes:

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

- define control abstraction of Greedy method(L1)
- illustrate the significance of greedy method(L2)
- compare divide and conquer strategy with greedy method(L2)
- apply the method to implement various applications(L3)

UNIT III **8 L**

Dynamic Programming: The general method, multistage graphs, all pairs shortest paths, optimal binary search trees, reliability design, the travelling sales person problem.

Learning Outcomes:

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

- compare dynamic method with previous methods(L2)
- apply dynamic method for developing algorithms(L3)
- illustrate the merits of dynamic method(L2)
- analyze the performance of algorithms(L4)

UNIT IV **9 L**

Basic search and traversing techniques: Techniques for Binary trees, Techniques for Graphs, connected components and spanning trees, Bi-connected components and depth first search. Back Tracking*:* The General Method, Eight Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycle.

Learning Outcomes:

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

- illustrate techniques of searching(L2)
- make use of different methods of searching and traversing(L3)
- recall the concept of spanning trees(L1)
- apply principles of backtracking in solving problems related to graphs(L3)

UNIT V **8 L**

Branch and Bound: The method, traveling sales person problem, efficiency considerations.

Algebraic Problems: The general method, Evaluation and Interpolation.

Learning Outcomes:

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

- outline general method of branch and bound(L2)
- develop solution for travelling salesperson problem(L3)
- distinguish between performance of various methods(L4)
- compare different interpolation methods(L4)
- evaluate algebraic expressions(L5)

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

List of Practical Experiments:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Use divide and conquer method to recursively implement and to find the maximum and minimum in a given list of n elements.
4. Find Minimum Cost Spanning Tree of a given undirected graph using
   (i) Kruskal's algorithm.

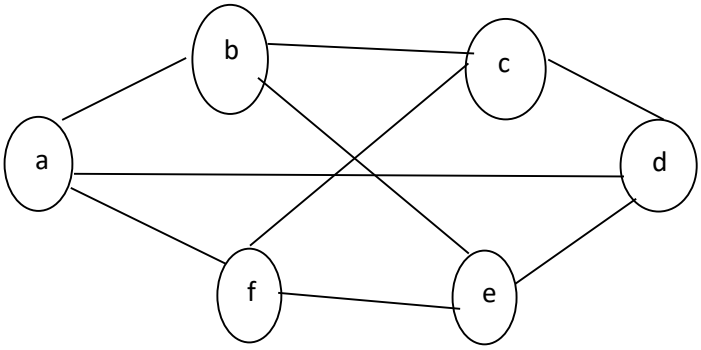
   (ii) Prim's algorithm.

5. Consider the following five jobs and their associated weights and deadlines, implement job sequencing algorithm to obtain optimal solution.

Index	1	2	3	4	5
Job	J1	J2	J3	J4	J5
Deadline	2	1	3	2	1
profit	60	100	20	40	20

6. (i) Print all the nodes reachable from a given starting node in a digraph using BFS method.
   (ii) Check whether a given graph is connected or not using DFS method.
7. Find a subset of a given set S = {s1,s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6} and {1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
8. Implement All Pairs Shortest Paths Problem using Floyd's algorithm.
9. From a given vertex in a weighted connected graph, find shortest paths to other vertices u sing Dijkstra's algorithm.

10. Implement backtracking method to color all the vertices of a graph such that no two adjacent vertices have the same color (Graph Coloring Problem).



Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

11. Develop an algorithm to evaluate an algebraic expression.

Text Book(s):

1. Ellis Horowitz, S. Sahni, Fundamentals of Computer Algorithms, 2/e, University Press, 1984.

2. Thomas H. Cormen, Charles E. Leiserson, Introduction to Algorithms, et.al., 3/e, MIT Press, 2012.

References

1. Aho, Hopecraft, Ullman, The Design and Analysis of Computer Algorithms, 1/e, 2002.

2.Michel T. Goodrich & Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, 1/e, John Weily and Sons, 2001.

3. Sara Baase, Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, 3/e, Pearson Education, 1999.

4. Mark Allen Weiss, Data Structures and Algorithm Analysis in JAVA, 3/e, Pearson Education, 2011.

5. Jon Kleinberg, Eva Tardos, Algorithm Design, 1/e, Pearson, 2013.

Course Outcomes:

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

- define algorithm(L1)
- compare various methods of designing algorithms(L2)
- illustrate the merits and demerits of different designing techniques(L2)
- identify best method to develop an algorithm(L3)
- evaluate the algorithms in terms of efficiency(L5)

19ECS292 : COMPREHENSIVE SKILL DEVELOPMENT III

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

Stream	Course Code	Course Title	Category	L	T	P	C
Comprehensive Skill Development	19ECS292	Soft Skills And Quant itative Aptitude	PW	1	2		1
		Coding	PW			3	
Total number of hrs per week						6	

Part-1

A. Verbal and Soft Skills:

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

B. Quantitative Aptitude and Reasoning

Puzzles, Arithmetic, Geometry, Mensuration.

Part-2

Coding: -Medium Level problem solving techniques:

Permutations and Combination, Probability, Hash Tables, Heap, Greedy Method, Backtracking

Course Outcomes:

On completion of the course, student will be able to

- effectively communicate through verbal/oral communication and improve the listening skills. (L3)
- 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. (L6)
- understand the problems and develop his competitive coding skills. (L2)
- apply the skills in various domains and will be able to solve complex problems faced by the industry(L3).
- function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality(L4).