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

Vision and Mission of university

Vision

To become a global leader in higher education.

Mission

To impart futuristic and comprehensive
education of global standards
with high sense of discipline and
social relevance in a serene and
invigorating environment.

Vision and Mission of the department

Vision

Excel in computer science and engineering education with international standards for global employment and research.

Mission

- *Create an excellent academic ambience that promotes innovation and research.*

- *Impart quality education through well designed curriculum experiential learning in tune with the changing needs of the industry.*

- *Collaborate with world class academic institutions and software industries for mutual benefit.*

- *Produce competent and socially committed graduates having creative skills and ethical values.*

Program Educational Objectives:

The Program Educational Objectives of the B.Tech. (Computer Science and Engineering) program are:

1. The graduates will demonstrate competence in Computer Science and Engineering to become successful engineering professionals.
2. The graduates will exhibit commitment to developing sustainable solutions that satisfy the current societal needs.
3. The graduates will adapt to and aid in technological advances by life-long learning and innovation.

Program Outcomes (POs)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

Upon successful completion of B.Tech.(CSE) Program, student will be able to:

PSO1: identify, formulate and solve engineering problems to provide efficient solutions.

PSO2: design and develop computer-based applications of varying complexities in emerging areas of Computer Science and Engineering.

PSO3: possess the subject knowledge and scientific temper necessary to engage in research with professional and ethical responsibility towards societal needs.

B.Tech. Computer Science and Engineering
REGULATIONS
(w.e.f. 2019-20 admitted batches)

1. ADMISSION

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

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

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 rulesof reservation of statutory bodies, wherever applicable, will be followed.

3. CHOICE BASED CREDIT SYSTEM

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 to promote:

- Activity-based learning
- Student-centered learning
- Cafeteria approach
- Learning at their own pace
- Interdisciplinary learning

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

4. STRUCTURE OF THE PROGRAM

The Program consists of courses based on humanities and social sciences, basic sciences, introductory 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 another department courses
		Open Electives	Common to all disciplines that nurturethe 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.

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

In general, assign credits to the courses based on the following contact hours per week.

- One credit assign for each Lecture / Tutorial hour per week.
- One credit assigns for two hours of Practicals per week.

5. MEDIUM OF INSTRUCTION

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

6. REGISTRATION

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

7. ATTENDANCE REQUIREMENTS

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 register for a subsequent semester of study. They have to repeat the same semester along with their juniors.

However, on the recommendation of the Principal / Director of the Institute/School, the Vice-Chancellor may condone the shortage of attendance of the students whose attendance is between 75% and 84% on medical grounds and payment of a prescribed fee.

8. EVALUATION

Assessment of a student's performance in theory courses includes two components: Continuous Evaluation (40 marks) and Semester-end Examination (60 marks).

A candidate must secure a minimum of 40 out of 100 marks (40%) in all theory courses (continuous evaluation and semester-end examination). However, he must ensure a minimum of 24 marks out of 60 (40%) at the semester-end examinations.

Practical courses assess under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to obtain a ‘pass’ grade.

For theory courses that include a laboratory component, the final grade is evaluated based on 70% of theory and 30% of the laboratory. However, the student must acquire 40% in the semester-end theory examination and secure 40% (Theory + Practical) overall to secure a ‘pass’ grade.

Project Work/ Industrial internship courses assess under continuous evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure ‘pass’ grade.

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. However, a student has to undergo two hours of training per week in any one of the above in both I and II semesters and should obtain a satisfactory grade to be eligible for a degree.

The details of the Assessment Procedure 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 (20) marks for mid examinations. Three quizs/tests will be conducted for 30 marks and out of which an average of 20 marks will be considered. (ii) Remaining 20 marks are evaluated based on quizzes/ assignments/ Coursera certifications
		Semester End Examinations	60	Sixty (60) marks for semester-end Examinations.
		Total	100	
2	Practicalcourses	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. 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 combinedcourses	(a) Theory component: continuous evaluation and a semester end examination.	100	70% of the weightage will be given for theory component. Evaluation for theory component shall be same as S. No 1 as above.

		(b)Practical component: continuous evaluation	100	30% weightage for practical components. Evaluation for practical component shall be same as S. No 2 as above
		Total	200	
4	Project work (VII & VIII Semesters)	Continuous Evaluation	100	i) Forty (40) marks for periodic evaluation on originality, innovation, sincerity and progress of the work assessed by the project supervisor. ii) Thirty (30) marks for mid-term evaluation by a panel of examiners. 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 Seminarpresentation on the training, assessed by the Teacher Coordinator. 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

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.

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.

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.

A student who has secured ‘F’ grade in a practical course shall have to attend special instruction classes held during summer.

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.

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

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.

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 valuationfee will be refunded, if the student is successful in the appeal by securing a better grade.

11. SUPPLEMENTARYAND SPECIAL EXAMINATIONS

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

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

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

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

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 courseswill be decided by the respective Board of Studies (BoS).

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

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.

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.

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

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 DCof respective campuses.

16 GRADING SYSTEM

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	-

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

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.

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.

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	$\geq$8.0*
First Class	$\geq$ 6.5
Second Class	$\geq$ 5.5
Pass Class	$\geq$ 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 OFGRADES

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.

Betterment of Grades is permitted ‘only once’, immediately after completion of the program of study.

19. DISCRETIONARY POWER

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

Department of Computer Science and Engineering
B. Techin 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 (Calculusand 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 andProgramming**	ES	3	1	3	0	5.5	Common to all
5.	19EME121/ 19EME131	Workshop / Engineerin gGraphics	ES/ES	0/ 1	0	3	0	1.5/ 2.5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/ National Cadet Corps/NationalSports Organization/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	0	3	0	3.5	Branch Specific
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/ National Cadet Corps/National Sports Organization/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.	19EMA210	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	Cours e Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECS331	Software Engineering	PC	3	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	1	0	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	3	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	3	0	0	0	0	Mandatory Course
9.	19ECS392	Comprehensive Skill Development V	PW	0	0	0	6	1	Departmen tSpecific
10	HSMCH102	Universal Human Values: Understanding Harmony	HS	2	1	0	0	3	
							Total	**26**	

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	1	0	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 Behavior)	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	1	0	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	Online Course
						Total	**13**		

Total Credits 165

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	26	18	13	**165**

Category and Credits

Category	Code	Courses	Credits GITAM	Credits suggested by AICTE
Humanities & Social Sciences	HS	Communicative English	**15**	**12**
		HS1 and HS2 (elective)		
		Gandhi for the 21st Century		
		ComprehensiveSkill Development I		
		ComprehensiveSkill Development II		
		Universal Human Values: Understanding Harmony		
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		
		ComprehensiveSkill Development III	**14**	**15**
		ComprehensiveSkill Development IV		
		ComprehensiveSkill Development V		
		ComprehensiveSkill Development VI		
		Internship		
		Project Phase I		
		Project Phase II		
Mandatory	MC	Environmental Science, Constitution of India, Engineering Ethics	**-**	**-**
Total			**165**	**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,MEand 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/ 19EMA210/ 19EMA212	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.	19EMA214/ 19EMA216	Engineering Mathematics IV (Descriptive Statistics/ Applied Statistics)	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
15	19EID234	Life Sciences for Engineers (Only for admitted batch 2019-20)	OE	2	0	2	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	Workplace Communication - Basic	OE	3	0	0	3
13	GEL347	Workplace 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 must 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 must 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 must 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 must 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 must 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 must 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	1	0	3
2		19EEI371	Sensors and Signal Conditioning	ID	2	1	0	3
3		19EME371	Quantitative Techniques for Management	ID	2	1	0	3
4	Basic Science Courses	19ECY371	Applications of Chemistry in Electronics	ID	2	1	0	3
5	Managem ent courses	19EHS405	Operations Research	ID	2	1	0	3
6		19ECE371	Disaster Management	ID	2	1	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	1	0	3
2		19EEI471	Robotics & Automation	ID	2	1	0	3
3		19EEC473	Fundamentals of Digital Signal Processing	ID	2	1	0	3
4		19EBT473	Introduction To Bioinformatics	ID	2	1	0	3
5	Basic Science Courses	19EPH471	Quantum Computing	ID	2	1	0	3
6	Managem ent Courses	19EME456	Optimization Techniques	ID	2	1	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	1	0	3
2		19ECE354	Remote Sensing and Geographic Information Systems	ID	2	1	0	3
3		19EEI477	Industrial Automation	ID	2	1	0	3
4	Management Courses	19EME349	Total Quality Management	ID	2	1	0	3
5		19EME357	Supply Chain Management	ID	2	1	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	National Service Scheme/ National Cadet Corps/NationalSports Organization/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:

- Tofamiliarizethestudentswiththetheoryofmatricesandquadratic forms.
- To explain the series expansions using mean valuetheorems.
- To teach basic concepts of partialderivatives.
- To explain the evaluation of double integrals and itsapplications.
- To demonstrate the evaluation and applications of tripleintegrals.

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: MeanValueTheorems **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

- demonstratethegivenfunctionasseriesofTaylor'sandMaclaurin's with remainders (L2)
- illustrate series expansions of functions using mean valuetheorems (L2)

UNIT III:MultivariableCalculus **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)
- applyJacobianconcepttodealwiththeproblemsinchangeof
- variables (L3)
- evaluate maxima and minima of functions(L3)

UNIT IV:MultipleIntegrals-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:MultipleIntegrals-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 andspherical geometries (L3)
- evaluate volumes using triple integrals(L3)

Text Book(s):

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

References:

1. R.K.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics, 3/e, 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

- utilizethetechniquesofmatrixalgebraforpracticalapplications(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 propertiesofmaterialsforadvancedcoursesintheirrespectiveengineering branches.Itintroduceselectromagnetictheorywithrelevantmathematical tools, optical fibers and their propagation characteristics, propertiesof 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, fieldsand waves.
- To familiarize students with electromagnetics inmodern communication systems.
- Toimpartknowledgeconcerningtheelectricalbehaviourof dielectric materials.
- To demonstrate the properties ofmagnets.
- To introduce semiconductor physics anddevices.

UNIT I: BasicsofElectromagnetics **9 L**

Electrostaticfield: Coulomb'slawandGauss'law,derivationofCoulombs lawfromGauss'law,applicationsofGauss'law(linecharge,thinsheetof chargeandsolidchargedsphere),Gauss'lawofelectrostaticsindielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson's and Laplaceequations.

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

- applyCoulomb'sandGauss'lawstoelectricfieldconfigurations from charge distributions (L3)
- applytheBiot-Savarts'lawtoderivemagneto staticfield distributions (L3)
- use vector calculus to describe electromagnetic phenomena(L2)
- relatethelawofconservationofchargetocontinuityequation(L3)
- illustrate the Maxwell's equations, Maxwell's displacement current and correction of Ampere's law(L2)

UNIT II:FiberOptics **7 L**

Introduction, advantages of optical fibers, principle and structure, acceptanceangle,numericalaperture,modesofpropagation,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)

- analyzepropagationoflightthroughopticalfibersbasedonthe concept of modes (L4)
- summarizeapplicationsofopticalfibersinmedical,communication and other fields(L2)

UNIT III: Dielectric andMagneticMaterials **10 L**

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

Magnetic materials: Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theoryofferromagnetism(qualitative),domaintheory,hysteresis,softand hard magnetic materials.

Learning Outcomes:

After completing this unit, the students will be able to

- explaintheconceptofdielectricconstantandpolarizationin dielectric materials (L2)
- interpretdielectricloss,LorentzfieldandClaussius-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:Semiconductorphysics **8 L**

Introduction,originofenergyband,intrinsicandextrinsicsemiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination,carrierconcentrationinintrinsicsemiconductors,variation of intrinsic carrierconcentration with temperature, n-type and p-type semiconductors,carrierconcentrationinn-typeandp-typesemiconductors.

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)
- assessthevariationofcarrierconcentrationinsemiconductorswith
- temperature (L5)

UNIT V:Semiconductordevices **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

- explainthedriftanddiffusioncurrentsandformationofjunction layer (L2)
- state Einstein’s relations(L1)

- explain Hall effect and its applications(L3)
- illustrateandinterprettheV-Icharacteristicsofap-njunctiondiode(L2)
- describe applications of p-n junction diodes in photodiodes,LEDs and solar cells (L3).

Text Book(s)

1. David J.Griffiths,"IntroductiontoElectrodynamics",4/e, Pearson Education, 2014.
2. Charles Kittel, "Introduction to Solid State Physics", 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. Todeterminethemagneticfieldalongtheaxisofacircularcoil carrying current.
2. To determine the numerical aperture of a given optical fiber and hence to find its acceptanceangle
3. To determine magnetic susceptibility by Gouy'smethod
4. To determine the Hall coefficient using Hall effectexperiment
5. To determine the resistivity of semiconductor by Fourprobe method
6. To determine the energy gap of asemiconductor.
7. To study the characteristics of PN Junctiondiode.
8. To study magnetic hysteresis loop (B-Hcurve).
9. Todeterminethedielectricconstantofasubstancebyresonance method.
10. To determine hysteresis loss byCRO.
11. To study the characteristics ofPhotodiode
12. To study the characteristics of SolarCell

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 thecharacteristicsofphotodiode,p-njunctiondiodeand 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 usingHall 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 renewableenergyresources,electrochemicalenergysystems,construction of batteries, technological importance machining and etching, polymers, nano-materials,molecularmachinesandswitches.Theknowledgegained in this course can be applied to the latest problems in the aboveareas.

Course Objectives

- To acquaint with electrochemical energy systems andtheir applications.
- To impart knowledge on the basic concepts of batterytechnology.
- To familiarize the students with various sources ofrenewable energy and their harnessing.
- To demonstrate the construction of photovoltaiccells.
- To introduce different types ofnano-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 electrodepotentials. (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, Modernbatteries-zincair,lithiumcells-$LiMnO_2$cell-challengesofbattery technology.FuelcellsIntroduction-classificationoffuelcells–hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuelcell.

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)
- applytheredoxprinciplesforconstructionofbatteriesandfuel cell. (L3

UNIT III **8L**

Renewable Sources of Energy Introduction- sources of renewableenergy

Solarenergy–Introduction-PhysicalandChemicalpropertiesofSilicon-ProductionofSolarGradeSiliconfromQuartz-DopingofSilicon-pandn 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, Electroplatingofchromium,goldetc.Electrolessplatingofcopper,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)
- applythemethodsofmetalfinishinginthemanufactureof 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 asartificialmolecularmachines;Molecularswitches–cyclodextrin-based switches

Learning outcomes:

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

- explaintheconceptsofartificialmolecularmachinesandmolecular 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,EngineeringChemistry,KrishnaPrakashan,Meerut.
3. G Palanna, Engineering Chemistry, Tata McGraw Hill2009.

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

Thecourseenablesthestudentstogainknowledgeonvarious,instrumental methods of analysis, measurements of physical parameters, volumetric analysis,preparationofpolymers,analysisofwater,andchromatographic separationtechniques.

CourseObjectives

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

List of Experiments

1. Determination of Mohr's salt by potentiometricmethod
2. Determination of strength of an acid by pH metricmethod
3. Determination of conductance by conductometricmethod
4. Determination of viscosity of aliquid
5. Determination of surface tension of aliquid
6. Determination of sulphuric acid in lead-acid storagecell
7. Determination of chromium (VI) in potassiumdichromate
8. Determination of copper in a copperore
9. Determination of Zinc by EDTAmethod.
10. Estimation of active chlorine content in Bleachingpowder
11. Preparation of Phenol-Formaldehyderesin
12. Preparation of Urea-Formaldehyderesin
13. Thin layerchromatography
14. Preparation of TiO_2/ZnO nanoparticles
15. SEM analysis of nanomaterials

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

- explainthefunctioningoftheinstrumentssuchaspH,Conductometric and Potentiometric methods. (L2)
- identify different ores (Cr & Cu) and their usage in differentfields (industry, software devices, electronic goods). (L3)
- experimentwiththephysicalparameteroforganiccompounds. (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 presentconcepts 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

Thecourseisdesignedtoenablethestudenttowriteprogramsforproblem

solving.Afteranintroductiontoprogramlogicdesignusingalgorithmsand flowcharts, converting the logic into programs is taught. The features of structured programming are explained with the C programminglanguage 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 andrunning 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 andfiles.
- Demonstratethehandlingofvariablesandinput-outputoperationsin C.
- Train the student to convert program logic into C language codeusinga top-down approach.

UNIT I **9L**

IntroductiontoComputerProblem-Solving–Introduction,TheProblem- SolvingAspect,Top-DownDesign,ImplementationofAlgorithms.

Fundamental Algorithms – Exchanging the values of two variables, Counting, Summation of a Set of Numbers, Factorial Computation, Sine FunctionComputation,GenerationoftheFibonacciSeries.BasicsofFlow Charts.

Introduction to C Language – Structure of a C Program, Keywords, Identifiers,DataTypesandVariabledeclaration,Constants,Input/Output function.

Learning Outcomes:

After completion of this unit the student will be able to

- understandaproblemandbuildanalgorithm/flowcharttosolveit(L2).
- list the steps involved in writing and running a program(L1).
- interpretthestructureofCprogramandvariouskeyfeaturesofC(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–Pointervariable,pointerdeclaration,Initializationofpointer, accessingvariablesthroughpointers,pointerstopointers,pointerstovoid.

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–DeclarationandDefinitionofArray,accessingelementsinarray, Storing values in array, linear search, binary search, bubble sort, Two – dimensionalarrays,multidimensionalarrays.ArraysandPointers,Pointer Arithmetic and arrays, array ofpointers.

Strings–DeclarationandDefinitionofString,StringInitialization,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 itemsusing 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-DesigningStructuredPrograms,userdefinedfunction-function definition,functionprototype,functioncall,Typesoffunctions.Parameter Passingbyvalue,parameterpassingbyaddress,Passingarraytofunction, 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).
- applythein-builtfunctionstodevelopcustomfunctionsforsolving 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, nestedstructures,self-referentialstructures,arraysofstructures,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-casecharacter.
3. Print sizes and ranges of different datatypes.
4. Find Roots of a Quadratic Equation using‘if’.
5. Find minimum among threenumbers.
6. Check whether the given number isperfect
7. Print Twin Primes up to a Specifiedlimit.
8. Find GCD of twonumbers.
9. Swap two numbers usingpointers.
10. Performs all the five arithmetic operations usingPointers.
11. Implement linearsearch.
12. Sort an array in descendingorder.
13. Reverse the given string without using String handlingfunctions.
14. Sort strings in dictionary order.
15. Use a function to perform addition and multiplication of twomatrices.
16. Use a function to perform transpose of a givenMatrix
17. Read an array of elements of size ‘n’ and find the largest andsmallest number using functions
18. Findthesumofdigitsofanumber.Numbermustbepassedtoa function using pointers.
19. Print the first n Fibonaccinumbers.
20. Reverse astring.
21. Calculatethepercentageofmarksofthreedifferentsubjectsofeach student using array of structures.
22. Demonstrates the memory allocation done by a structure and a union (declare Structure and Union in the sameprogram).
23. Demonstratememberaccessinaunion(declarethreedifferenttypesof variables in union, assign values and print them).
24. Acceptsthenamesoftwofilesandcopiesthefirstfileintothesecond, line by line using fgets() and fputs() functions.
25. Storethedataof‘n’employeesinafile,where‘n’isgivenbythe user.
26. Count number of characters, words and lines in a givenfile.

TextBook(s):

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

References:

1. JeriRHanly,ElliotBKoffman,ProblemSolvingandProgramDesign in C, 7/e, Pearson Education,2012.
2. P.DeyandMGhosh,ProgramminginC,2/e,OxfordUniversityPress, 2011.
3. B.W.KernighanandDennisM.Ritchie,TheCProgrammingLanguage,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.Thiscourseenablesthestudentstogainhandsonexperience 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 incarpentry.
- Impart the skills to do some carpentryoperations.
- Demonstrate different types of tools used in fitting, soldering and brazing.
- Train fitting, soldering and brazingjobs.
- Familiarize different types of basic electric circuitconnections.

Wood Working:

Familiaritywithdifferenttypesofwoodsandtoolsusedinwoodworking and make following joints

a) Half – Lapjoint.

b) Mortise and Tenonjoint.

c) Corner Dovetail joint or Bridlejoint.

Sheet Metal Working:

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

Fitting:

Familiaritywithdifferenttypesoftoolsusedinfittinganddothefollowing fittingexercises

a)V-fit b)Dovetailfit c) Semi-circularfit
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) Parallelandseries b) Two-wayswitch

c)Godownlighting d) Tubelight
e) Threephase motor f) Soldering ofwires

Course Outcomes:

After completion of this lab the student will be able to

- summarizevariouscarpentryoperationrequiredtocreateaproduct in real time applications. (L2)
- developdifferentpartswithmetalsheetinrealtimeapplications. (L3)
- demonstrate fitting operations in various applications.(L3)
- preform soldering and brazing operations.(L3)
- select different types of electric circuits in practicalapplications (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.

CourseObjectives

- Createawarenessoftheengineeringdrawingasthelanguageof engineers.
- Familiarize how industry communicates, practices for accuracyin presenting the technical information.
- Developtheengineeringimaginationessentialforsuccessful design.
- Demonstrate utility of drafting and modeling packagesin orthographic and isometric drawings.
- Train the usage of 2D and 3D modelingsoftwares.
- Impart graphical representation of simplecomponents.

ManualDrawing: **7 L**

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

a) Conic sections - general methodonly,

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

Course Outcomes:

After completion of this unit the student will be able to

- utilize Engineering Graphics as Language of Engineers.(L3)
- prepare drawings as per standards(BIS). (L3)
- identify various engineeringcurves. (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)
- drawisometricandorthographicdrawingsusingCADpackages. (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 opportUNIT Ies, 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, effectsof 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, fireservice 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.

COURSEOBJECTIVES

- 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 givenbelow 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

	COURSEOutcome	**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	0	3	0	3.5	Branch Specific
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/ National Cadet Corps/National Sports Organization/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,testingofhypothesisforsmallandlargesamplesinengineeringapplications.

Course Objectives:

- Tofamiliarizethestudentswiththefoundationsof DataScience, probability and statistical methods.
- Toexplaintheconceptsinrandomvariablesandseveraldistributions in engineering applications.
- Toteachtheconceptsofcorrelation,regressionandestimationsand their properties.
- To explain the concept of testing of hypothesis for largesamples.
- To impart knowledge on small sampletests.

UNIT I: Data ScienceandProbability **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 importancein engineering (L2)
- analyze thedata quantitatively or categorically, measureof averages, variability (L4)
- definethetermstrial,events,samplespace,probabilityandlawsof 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 andProbabilityDistributions **8 L**

Random variables (discrete and continuous), probability mass anddensity functions, probability distribution Binomial, Poisson, normaldistribution- 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 computeprobabilities, theoretical frequencies (L3)

- explainthepropertiesofnormaldistributionanditsapplications (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, parabolaand 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

- identifydifferenttrendsinscatterplots,strengthsofassociation between two numerical variables (L3)
- makeuseofthelineofbestfitasatoolforsummarizingalinear relationship and predicting future observed values (L3)
- estimate the value of a population parameter, computation ofpoint and interval estimation (L3)

UNIT IV: Testing of Hypothesis and LargeSample Tests **8 L**

Formulationofnullhypothesis,alternativehypothesis,criticalregion,two types of errors, level of significance and power of the test. **Large Sample Tests**: Test for single proportion, difference of proportions, test forsingle 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

- identifythedifferencebetweenone-tailedandtwo-tailedhypothesis tests (L3)
- analyze the testing of hypothesis for large samples(L4)

UNIT V: SmallSampleTests **6 L**

Studentt-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)
- testfortheχ2squaregoodnessoffitandindependenceofattributes (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)
- explaintheassociationofcharacteristicsthroughcorrelationand regression tools (L3)
- identify the components of a classical hypothesis test(L3)
- usethestatisticalinferentialmethodsbasedonsmallandlarge sampling tests (L4)

19EID134: AI TOOLS

(Common to all)

Effective for admitted batch 2019-20

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 "ArtificialIntelligence (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 thedomain. The global market for artificial intelligence is going to face a phenomenal growth over the coming yearswith organizations across the world capitalizing on the disruptive technologies that AI is offering. This courseintroduces the recent applications of AI namely, Virtual Assistants, Computer Vision, along with trending topicssuchasDeepLearningandReinforcementLearning.TheideaofthecourseistointroducethebasicconceptsofAI as well as latest trends in the domain. This course is envisaged to provide a basic understanding on latestdevelopments ofAItoall disciplinesengineeringundergraduates.

CourseObjectives:

- ToprovideabasicfoundationondifferentconceptsofArtificialIntelligence.
- ToinvestigatevariousapplicationsofAIsuchasVirtualAssistants,ComputerVision,aswellasotherSmart Applications.
- Explorethescope,advantagesaswellaslimitationsofintelligentsystems.
- ExperimentwithdifferentmachinelearningconceptssuchasDeepLearningandReinforcementLearning
- ToexposestudentstotheAI-intensivecomputingandinformationsystemframeworks.

UNIT I **10L**

IntroductiontoArtificialIntelligence: BasicsofAI.ApplicationsofAI.Advancedsearch,Constraintsatisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilisticreasoning.

Conceptual introduction to **Machine Learning:** Introduction to Neural Networks, Supervised, Unsupervised, andSemi-SupervisedLearning,DeepLearning,ReinforcementLearning,LinearRegression.

Conceptualintroductionto**NaturalLanguageProcessing:**NaturallanguageUnderstanding,SentimentAnalysis,Segmentation andrecognition.

Conceptual introduction to **Speech Recognition & Synthesis:** Speech Fundamentals, Speech Analysis, SpeechModelling,SpeechRecognition,SpeechSynthesis**,** Text-to-Speech.

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

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- recognizevariousdomainsinwhichAIcanbeapplied(L2)
- definemachinelearningandformsoflearning(L1)
- describenaturallanguageprocessingandconceptsforconvertingspeechtodifferentforms(L2)
  - identifytheconceptsofimageprocessing(L3)

UNIT II **12L**

BOTTechnologiesandVirtualAssistants:Catboats: IntroductiontoaChabot,ArchitectureofaChabot.NLPinthecloud,NLInterface,howtoBuildaChabot,Transformativeuserexperienceofcatboats,DesigningelementsofaChabot,BestpracticesforChabotdevelopment.NLPcomponents.NLPwrappertocatboats.AudiobotsandMusicbots.

VirtualAssistants: ArchitectureofaVirtualAssistant.

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- analyzethearchitectureofaChabot(L4)
- illustratehowtoconstructaChabot(L2)
- differentiatevariouscatboats(L4)
- interpretthearchitectureofavirtualassistant(L3)

UNIT III **12L**

Image Processing&Computer Vision: Image-Definition andTagging.Classification ofimages. Tagging.Imageformation,DeepLearningalgorithmsforObjectdetection& Recognition.Face recognition,Instancerecognition, Feature detection and matching, Segmentation, Recognition Databases and test sets Applications --Feature extraction,Shapeidentification. Fanedetection.

Applications: Automation, Agriculture [Crop and Soil Monitoring, grading farm produce, Predictive Analytics],RetailandRetailSecurity[Amazon Go],Autonomousvehicles.

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- classify thepropertiesofimages(L3)
- interprettheconceptsofimageprocessing(L2)
- implementthemethodsinprocessinganimage(L3)
- analyzeandapplytheconceptsofimageprocessinginautomationandagriculture(L4)

UNIT IV **12L**

Reinforcement Learning: Introduction to Reinforcement Learning, Game Playing [Deep Blue in Chess, IBMWatson in Jeopardy, Google’s Deep Mind in AlphaGo], Agents and Environment, Action-Value

Function, DeepReinforced Learning

Applications:Robotics,Gaming,Diagnosticsystems,VirtualAssistants.

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- illustratereinforcementlearning(L2)
- employthereinforcementlearningingameplaying(L3)
- usereinforcementlearninginagentbasedenvironment(L3)
- practicelearningprocessindiagnosticandvirtualassistantsystems(L3)

UNIT V **10L**

SmartApplications: SmartManufacturing,SmartAgriculture,SmartHealthcare,SmartEducation,SmartGrids,Smart TransportationandAutonomousVehicles,SmartHomes,SmartCities.

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- understandtheapplicationofintelligenceinvariousdomains(L2)
- applytheartificialintelligenceinvariousapplications(L3)
- correlatetheintelligencetoadvancedapplications(L4)

TextBook(s)

1. TomMarkiewicz&JoshZheng,Getting startedwithArtificialIntelligence,O'ReillyMedia,2017.
2. StuartJ.RussellandPeterNorvig,ArtificialIntelligenceAModernApproach.PrenticeHall

References

1. AurélienGéron,HandsonMachineLearningwithScikit-LearnandTensorFlow[Concepts,Tools,andTechniquestoBuildIntelligentSystems],Published byO'Reilly Media,2017.
2. BuildanAIAssistantwithWolframAlphaandWikipediainPython.**https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe**
3. JosephHowse,PrateekJoshi,MichaelBeyeler-Opencv_ComputerVisionProjectswithPython-PacktPublishing(2016).
4. CuratedDatasetsonKagglehttps://www.kaggle.com/datasets.

AITOOLSLABORATORY

ListofPracticalExperiments:

1. Supervisely-PerformDataLabellingforvariousimagesusingobjectrecognition
2. Lobe.ai-BuildcustommodelsusingthevisualtoolforObjectrecognitionandsentimentanalysisthatcan convertfacialexpressionsinto emoticons
3. TeachableMachine-InBrowserObjectRecognitionthroughBrain.JS
4. Liv.ai-AppforSpeechrecognitionandSynthesisthroughAPIs
5. BuildingaChabotusingAWSLex,Pandorabots
6. ConfigureanexistingNeuralNetworkbymanipulatingvariousparametersinvolved
7. BuildavirtualassistantforWikipediausingWolframAlphaandPython
8. BuildaConvolutionalNeuralNetworkforCatvs.DogImageClassification

OnlineResources:

Pytorch:

https://pytorch.org/https://git

hub.com/pytorch

Keras:

https://keras.io/https://github

.com/keras-team

Theano:

http://deeplearning.net/software/theano/https://github.com/T

heano/Theano

Cafee2:

https://caffe2.ai/https://githu

b.com/caffe2

Deeplearning4j:

https://deeplearning4j.org/

Scikit-learn:

https://scikit-

learn.org/stable/https://github.com/scikit

-learn/scikit-learn

DeepLearning.Ai:

https://www.deeplearning.ai/

OpenCv:

https://opencv.org/https://github.com/q

qwweee/keras-yolo3

YOLO:

https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-

opencv/nVIDIA:CUDA:

https://developer.nvidia.com/cuda-math-library

CourseOutcomes

Aftercompletionofthiscourse,thestudentwillbeableto

- distinguishtheconceptsofartificialintelligence,machinelearning,naturallanguageprocessing,imageprocessing. (L4)
- illustratethearchitecturesofChabotandvirtualassistant(L2)
- analyzeimagebasedapplicationsbyusingimageprocessingconcepts(L4)
- employreinforcementlearningindifferentapplications(L3)
- identifysmartapplications(L3)

19EID134: **AI TOOLS**

(Common to all)

Effective from admitted batch 2020-21 onwards

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 "ArtificialIntelligence (AI)" has become ubiquitous in everyday applications from virtual assistants to self-driving cars. Severalapplications 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 latesttrends in the domain. This course is envisaged to provide a basic understanding on latest developments of AI to all disciplines engineering undergraduates.

Pre-Requisites:

Courser code: 19EID131

Course Name: Problem Solving and Programming

Course Objectives:

- Provide introduction to basic concepts of Artificial Intelligence.
- Explore applications of AI
- Explore the scope, advantages of intelligent systems
- Experiment with different machine learning concepts
- Exposure to AI-intensive computing and information system frameworks

UNIT I **6 L+6 P**

Introduction to Artificial Intelligence: : Basics of AI. Agents and Environment, The Nature of Environment, Applications of AI:Game Playing [Deep Blue in Chess, IBM Watson in Jeopardy, Google's Deep Mind in AlphaGo]

Learning Outcomes:

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

- recognize various domains in which AI can be applied (L2)

UNIT II **6 L+6 P**

Conceptual introduction to Machine Learning:

Supervised, Unsupervised, and Semi-Supervised Learning, Reinforcement Learning, Introduction to Neural Networks, Deep Learning.

Learning Outcomes:

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

- define machine learning and forms of learning (L1)
- identify types of machine learning(L1)

UNIT III **7 L+6 P**

Image Processing & Computer Vision:

Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Edge Detection, Segmentation, Feature Detection & Recognition. Classification of images. Face recognition, Deep Learning algorithms for Object detection & Recognition.

Learning Outcomes:

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

- identify the concepts of image processing (L2)
- implement the methods in processing an image (L3)

UNIT IV **6 L+4 P**

Conceptual introduction to Natural Language Processing: Speech Recognition & Synthesis: Speech Fundamentals, Speech Analysis, Speech Modelling, Speech Recognition, Speech Synthesis, Text-to-Speech, Sentiment Analysis, Segmentation and recognition.

Learning Outcomes:

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

- illustrate how to construct a Chabot (L4)
- describe natural language processing and concepts for converting speech to different forms (L2)

UNIT V **7 L+6 P**

BOT Technologies: Chatbots: Introduction to a Chatbot, Architecture of a Chatbot. NLP in the cloud, NL Interface, how to Build a Chatbot, Transformative user experience of chatbots, Designing elements of a chatbot, Bestpractices for chatbot development. NLP components. NLP wrapper to chatbots. Audiobots and Musicbots.

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)
- correlate Artificial Intelligence to advanced applications(L4)

Text Book(s)

1. Tom Markiewicz& Josh Zheng, Getting started with Artificial Intelligence, Published by O’Reilly Media,2017

2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach.

References

1. AurélienGéron, Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017

1. 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**

2. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv_ Computer Vision Projects with Python-Packt Publishing (2016).

3. 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. Teachable Machine - In Browser Object Recognition through Brain.JS
3. Lobe.ai - Build custom models using the visual tool for Object recognition and sentiment analysis that can convert facial expressions into emoticons
4. Haar Cascade Object detection for Eye and Face in Python using OpenCV
5. Text to Speech recognition and Synthesis through APIs
6. Sentiment Analysis and Polarity detection
7. Building a Chatbot using IBM Watson visual studio
8. Building a Chatbot using Pandora bots
9. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python

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

- able to grasp the concepts of artificial intelligence, machine learning, natural language processing, image processing.(L1)
- recognize various domains in which AI can be applied.(L2)
- implement the methods in processing an image.(L3)
- implement simple of chatbots.(L4) .
- identify smart applications.(L4)

19EID234: LIFE SCIENCES FOR ENGINEERS

(for admitted batch 2019-20)

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.
- Introducethetechniquesused for modification of living organisms.
- Describethe 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).
- IdentifyDNA 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 ELECTRICALAND 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 familiarizethebasicDCandACnetworksusedinelectricaland electronic circuits.
- Toexplaintheconceptsofelectricalmachinesandtheir characteristics.
- To introduce the importance of transformers in transmission and distribution of electricpower.
- To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors(MOSFETs).
- ToexposebasicconceptsandapplicationsofOperationalAmplifier andconfigurations.

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)
- identifyandanalyzeseriesandparallelconnectionsinacircuit (L4)
- predict the behavior of an electrical circuit(L2)
- determinethecurrent,voltageandpowerinthegivenelectrical circuit(L3)
- apply various techniques to analyze an electriccircuit(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 DCmachines(L1)
- analyze EMF and torque expressions of DCmachine(L4)
- demonstratetheperformancecharacteristicsofdifferenttypesofdc machines (L3)
- explain types of starters used for starting of dc motors(L2)

- estimate losses and efficiency of electricalmachine(L2)

UNIT III **12L**

Transformers: Constructional details, EMF equation, voltageregulation, 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 oftransformer(L2)
- explain the working principle of three phase inductionmotor(L5)
- describe torque and torque slip characteristics(L1)
- estimatelossesandefficiencyofthreePhaseInductionMotors(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

- describethedevicestructureandphysicaloperationofadiode(L1)
- discuss V-I characteristics of diodes(L2)
- explain the use of diode as switch and in electroniccircuits(L2)
- describetheconstructionandoperationofn-channelandp-channel MOSFETs(L1)
- explaintheuseofMOSFETasanamplifierandbidirectionalswitch(L2)

UNIT V **10L**

OperationalAmplifiers: TheIdealOpAmp,TheInvertingConfiguration, 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, ASingle 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 ofOp-Amp(L2)

- construct a single Op-amp difference amplifier(L3)

Basic Electrical and Electronics Engineering Laboratory

1. Verification of Kirchhoff's Laws KVL andKCL.
2. Verification of DC SuperpositionTheorem.
3. Verification of Thevenin's Theorem and Norton'sTheorem.
4. OCC and External characteristics of separately excitedDC generators.
5. Swinburne's test on a DC shuntmotor.
6. OC and SC Tests on single phasetransformer.
7. Brake Test on DC shuntmotor.
8. Current Voltage Characteristics of a p-n JunctionDiode/LED.
9. Diode RectifierCircuits.
10. Voltage Regulation with ZenerDiodes.
11. DesignofaMOSTFETamplifierandMOSFETinverter/NORgate
12. Inverting and Non-Inverting Amplifier Design withOp-amps.
13. Simulation experiments usingPSPICE
    a. Diode and Transistor CircuitAnalysis.
    b. MOSFET Amplifierdesign.
    c. Inverting and Noninverting Amplifier Design withOp-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)
- analyzetheperformancequantitiessuchaslosses,efficiencyand identify applications of DC machines(L4)
- explain the use of transformers in transmission and distributionof electric power and other applications (L2)
- demonstratetheoperationandapplicationsofvariouselectronic devices (L2)

- constructInvertingandNoninvertingconfigurationsofOp-Amp (L3)

19ECS134: DATA STRUCTURES WITH PYTHON

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

L T P C : 2 0 2 3.5

The study of data structures, a fundamental component of a computer science education, serves as the foundationuponwhichmanyothercomputerscienceapplicationsarebuilt.Knowledgeofdatastructures isamustforstudentswhowishtoworkindesign,implementation,testingormaintenanceofanysoftware system.Organizationofdatainanefficientwayforapplication,isthemajorfocusofthecourse.

Course Objectives

- Introduce object-oriented concepts.
- Introduction to sort and searchmethods.
- Familiarize with linear data structures and operations onthem.
- Demonstrate the organization of data as trees and various operations ontrees.
- Teach various graphrepresentations.
- Enabletoperformgraphtraversalandfindshortestpathandminimalspanningtreeforagraph.
- Expose common sorting techniques and theircomplexities.

UNIT I **10L**

Object-oriented concepts in Python: Creating a class, objects, methods, constructor, encapsulation, inheritance, polymorphism, operator overloading.

Learning Outcomes:

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

- explain the advantages of object-oriented approach (L2)
- explain the concept of abstraction and encapsulation(L2)
- summarize the benefits of inheritance and polymorphism(L2)

UNIT II **10L**

Searching: SequentialSearch,binarysearch.

Sorting:Insertionsort,selectionsort,bubble sort.

Linked lists: Single linked list, double linked list, circular linked list.

Learning Outcomes:

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

- summarize various ways of representing data(L2)
- explain the working of searching and sorting algorithms(L2)
- compare different types of linked lists (L5)

UNIT III **10L**

Stacks: Definition, operations: array implementation, linked list implementation.**Queues:**Definition,operations:arrayimplementation,linkedlistimplementationand applications, Priority Queue, Double-EndedQueues.

Learning Outcomes:

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

- discusshowstacksandqueues areimplementedusingarraysandlinkedlists(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, binary search tree and operations

Learning Outcomes:

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

- discuss the properties of trees, binary trees , binary search trees(L2)
- explaindifferent tree traversals and applications(L2)
- analyze the complexity of operations on binary search trees(L4)

UNIT V **10 L**

Graphs:ADT,datastructureforgraphs, properties of graphs, types of graphs, graph representations, graphtraversals,directedacyclicgraph, shortestpath algorithms, spanning trees and min spanning tree.

Learning Outcomes:

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

- demonstrate different graph representations and operations(L2)
- illustrate the working of shortest path algorithms and min spanning tree(L2)

Text Book(s):

1. MichelT.Goodrich,RobertoTamassia,MichelH.Goldwasser, **DataStructures&Algorithms in Python,** Willey March, 2013. ISBN:978-1-118-29027-9.
2. RanceD.Necaise,Data**Structures&Algorithmsusing**Python,JohnWilley&Sons,India. 2011, ISBN 9788126562169.

References:

1. Wesly J.Chun, Core Python Programming, 2/e, Prenctice Hall, 2006

DATA STRUCTURES WITH PYTHON LABORATORY

This Lab provides hands-on experience in designing, implementing, and using the most – commonly used concepts like Object-oriented concepts, searching, sorting algorithms, and linked list. Followed by data structure concepts like arrays, stacks, queues, linked lists, trees and graphs.

List of Practical Experiments:

1. Write a program to create
   - Student class with data members student rollno, name,address, course. Include a constructor to initialize data members. Add a method to print the student details.
   - Book class with data members book_id,name,cost and publisher. Include constructor and a method to display the book details. Create 3 objects and display their details.
   - Account class with data members acc_no,name,balance. Include a constructor and methods to perform deposit and withdraw operations on account. Create account object perform some operations and display the account details.
   - Product class with data members product_id, product_name, price, expiry_date. Include constructor to initialize data members and a method to print products details.
   - Complex_Number with data members real_part and imaginary_part. Include constructor to initialize complex number. Add a method which adds two complex numbers.
   - Employee class with data members eno,ename,sal,designation. Include constructor to initialize employee details and count the number of employee objects created.
2. Create a class called Distance. A person has to travel a certain distace and he used two cars. Now create two objects “cardist1” and “cardist2” for the class Distance. Add the two objects distances and put the total distance in the third object of class Distance “totaldist”. Take one data member, which will accept the distance input in km. Take two functions, for accepting the distance and the other for displaying. Display the total distance in meters.
3. Develop a program to Perform Python Multi-Level and multiple inheritances.
4. Design a program to overload “+” operator for
   - Concatenating two strings
   - Adding two complex numbers
5. Develop a program to overload “area” method to calculate area of different polygon shapes.

Write a program to

6. implement Method Overriding
7. Perform Linear Search on an array.
8. Perform Binary Search on a list stored in an array.
9. Develop a program to implement various sorting techniques
   - Insertion sort
   - Selection Sort
   - Bubble Sort
10. Design 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
11. Design 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
12. Create a Circular singly linked list for adding and deleting a Node.
13. Create a stack and perform various operations on it.
14. Convert the infix expression into postfix form.
15. Perform String reversal using stack
16. Create a queue and perform various operations on it.
17. Construct a binary tree and perform various traversals.
18. Construct a binary search tree and perform search operation.
19. Implement Depth First Search, Breadth First Search traversals on a graph.
20. Implement Dijkstra's Shortest Path Algorithm

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)

19ECS134:DATASTRUCTURESWITHPYTHON

(for admitted batch of 2019-2020)

L,T,P,C: 2, 0, 3, 3.5

The study of data structures, a fundamental component of a computer science education, serves as the foundationupon which many other computer science applications are built. Knowledge of data structures is a must forstudentswhowishtoworkindesign,implementation,testingormaintenanceofanysoftwaresystem.Organizationof datainanefficientwayforapplication,isthemajorfocusofthecourse.

CourseObjectives

- Introducevariousdatarepresentationmethodsandsearchingmethods.
- Familiarizewithlineardatastructuresandoperationsonthem.
- Demonstratetheorganizationofdataastreesandvariousoperationsontrees.
- Teachvariousgraphrepresentations.
- Enabletoperformgraphtraversalandfindshortestpathandminimalspanningtreeforagraph
- Exposecommonsortingtechniquesandtheircomplexities.

UNIT I **10L**

Python primitives: Pythonoverview,ObjectsinPython,Expressions,OperatorsandPrecedence,ControlFlow,Functions, Simple Input and Output, Exception handling, Iterators and Generators, Collections [Strings, Lists,Tuples,Dictionaries].

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- summarizevariouswaysofrepresentingdata(L2)
- explaintheworkingoflinearandbinarysearchalgorithms(L2)
- comparevariousdatarepresentationsandsearchalgorithms(L2)

UNIT II **10L**

AlgorithmAnalysis: AsymptoticAnalysisandBigONotation**Recursion**:Whatisrecursion,examples[Factorialfunctions,Fibonacciseries].**ArrayBasedSequences**:PythonSequencetypes,low-levelarrays,dynamic arrays, efficiency of python's sequences, using array-based sequences. **Searching:** Sequential Search,binarysearchandalgorithmicanalysis.**Sorting:**Insertionsort,selectionsort,bubble sort

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- summarizevariouswaysofrepresentingdata(L2)
- explaintheworkingoflinearandbinarysearchalgorithms(L2)
- comparedatarepresentationsandsortingalgorithms(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:arrayimplementation,linkedlistimplementationandapplications,PriorityQueue.Double-Ended Queues.

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- discusshowstacksandqueuesareimplementedusing arraysandlinkedlists(L2)
- explaintheimplementationofpriorityqueues(L2)
- listtheapplicationsofstacks,queuesandpriorityqueues(L1)
- comparedifferenttypesoflinkedlists(L5)

UNIT IV **10L**

Trees: Definition,Treeproperties, **Binary trees**: properties,implementation, tree traversals, Heaptree, Heapsort**Search Trees**:binarysearch tree,AVLtreesandoperationsonAVLtrees,and(2,3)-Trees

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- discuss thepropertiesoftrees,binary,binarysearchandAVLtrees(L2)

- explainhowoperationssuchasinsertion,deletionandtraversalareperformedondifferenttypesoftrees(L2)
- analyzethecomplexity ofoperationsondifferenttreetypes(L4)

UNIT V **10L**

Graphs:ADT**,**datastructureforgraphs,graphtraversal,Transitiveclosure,directedacyclicgraph,shortestpaths[weightedgraphs,dijkstra'salgorithm],minimumspanningtrees[Prim's,Kruskal's,disjointpartitions,union-find structures].

LearningOutcomes:

Aftercompletionofthisunit,thestudentwillbeableto

- demonstratedifferentgraphrepresentationsandoperations(L2)
- illustratetheworkingofcommonsortingalgorithms(L2)
- analyzethecomputationalefficiencyofalgorithmsforsorting(L4)

TextBook(s):

1. MichelT.Goodrich,RobertoTamassia,MichelH.Goldwasser,**DataStructures&AlgorithmsinPython**,Willey March,2013.ISBN:978-1-118-29027-9.
2. RanceD.Necaise,**DataStructures&AlgorithmsusingPython**,JohnWilley&Sons,India.ISBN9788126562169.

References

1. WeslyJ.Chun,CorePythonProgramming,2/e,PrencticeHall.
2. ManoharSwmynathan,MasteringMachineLearningwithSixSteps,Apress,ISBN-13:978-1-4842-2866-1
3. JoséUnpingco,PythonforProbability,Statistics,andMachineLearning,SpringerISBN978-3-319-30717-6(eBook)
4. ReemaThareja,PythonProgrammingusingproblemsolvingApproach,OxfordUniversity,HigherEducationOxfordUniversityPress,Firstedition,ISBN-10:0199480173,10June2017.
5. JohnVGuttag,IntroductiontoComputationandProgrammingUsingPython,RevisedandexpandedEdition, MITPress, 2013.
6. KennethALambert,FundamentalsofPythonfirstProgrammes,Copyrightedmaterial,1/e,CourseTechnologyInc., 6thFebruary2009.
7. JohnB.SchneiderShiraLynnBroschatJessDahmen,AlgorithmicProblemSolvingwithPython.

CourseOutcomes:

AfterCompletionofthiscourse,thestudentwillbeableto:

- explainvariouswaysofrepresentingdatainacomputer(L2)
- demonstrateoperationsonlineardatastructures(L2)
- illustratethemechanismsforcreating,alteringandtraversingvarioustypesoftrees(L2)
- explaintherepresentations,traversalsandapplicationsofgraphs(L2)
- analyzecommonsortingalgorithms(L4)
- chooseadatastructurethatgivesthebestperformanceforagivenapplication(L6)

DATASTRUCTURESWITHPYTHONLABORATORY

ThisLabprovideshands-onexperienceindesigning,implementing,andusingthemost–commonlyuseddatastructureincludingarrays,stacks,queues,linkedlists,trees,hashtablesandgraphs.Implementationofdifferentsearching andsorting algorithmsisalsodone.

<u>ListofPracticalExperiments:</u>

1. Pythonsampleprogramsforpractice
   - Findminimumamongthreenumbers.
   - FindtheGCDandLCMoftwo/threenumbers
   - Checkwhetherthegivennumberisperfect
   - PrintTwinPrimesuptoaSpecifiedlimit.
   - Printtheprimenumbersuptoaspecifiedlimit.
   - Findthesumofdigitsofanumber.CheckwhethergivennumberisArmstrongnumberornot.
   - Swappingoftwonumbers
   - Performsallthefivearithmeticoperations.
2. Writeaprogramtoreadalinearlistofitemsandstoreitinanarray.
   - Copythecontentsfromonearraytoanotherarray
   - Copythecontentsfromonearraytoanotherarrayinreverseorder
   - Deletetheduplicateelementsfromanarray.
3. Writeprogramsfor:

- Representingsparsematrix
- Sparsematrixaddition
- Sparsematrixtranspose

4. WriteaprogramtoPerformLinearSearchandBinarySearchonaliststoredinanarray.

5. Writeaprogramtocreateasinglylinkedlistforthefollowingoperations

- InsertaNodeatBeginning,atEndingandatagivenPosition
- DeleteaNodeatBeginning,atEndingandatagivenPosition
- Search,CounttheNumberofNodesandDisplay

6. Writeaprogramtocreateadoublylinkedlistforthefollowingoperations

- InsertaNodeatBeginning,atEndingandatagivenPosition
- DeleteaNodeatBeginning,atEndingandatagivenPosition
- Search,CounttheNumberofNodesandDisplay

7. WriteaprogramtocreateaCircularsinglylinkedlistforaddinganddeletingaNode.

8. Writeaprogramtocreateastackandperformvariousoperationsonit.

9. Writeaprogramtoconverttheinfixexpressionintopostfixform.

10. Writeaprogramtocreateaqueueandperformvariousoperationsonit.

11. Writeaprogramtocreateabinarytreeandperformvarioustraversals.

12. Writeaprogramtocreateabinarysearchtreeandperformsearchoperation.

13. WriteaprogramtoimplementDepthFirstSearch,BreadthFirstSearchtraversalsonagraph.

14. WriteaprogramtoimplementDijkstra'sShortestPathAlgorithm

15. Writeaprogramtoimplementvarioussortingtechniques:[ComparewithPython'sBuilt-InSortingFunctions also]

- Insertionsort
- SelectionSort
- BubbleSort
- MergeSort
- QuickSort

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 — **3 Hours per week**

A. Verbal and Soft Skills

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

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

B. Quantitative Aptitude and Reasoning

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

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

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

Coding: **GitHub** – Accepting assignments pull and push the code or resource, GitHub configuration,
Visual Studio code – Configuring, integrating Git for assignment submission
Online competitive coding platforms – Introduction to online coding platforms to get prepared for competitive coding.
Problem Solving with Python: Collections, Techniques for manipulating Strings, Recursion, Searching, Sorting, Stacks and Queues.
Problem Solving with C: Memory, C Syntax, Conditions and Loops, Functions and Recursion, Arrays, Techniques for manipulating Strings, Searching, Sorting, Stacks and Queues, Structures. sentation of graphs, Breadth First Search, Depth First Search, Dynamic Programming.

Scheme of Evaluation

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

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

Late Work

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

References:-

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

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

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

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 ideaor 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 opportUNIT Ies, 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 opportUNIT Ies 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 etcSelect 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 ofsums (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
(w.e.f 2020-21 admitted batch)

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, and exceptions. 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 andBufferedReader 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 sentenceand 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 libraryare 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

19ECS132: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(For the admitted batch of 2019-20, 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 andtechniques.
- To illustrate classes and class libraries, developing classes forsimple
- applications.
- To demonstrate various types of Inheritancemechanisms.
- To introduce diverse software packages applicability and usage of Exceptions andGenerics.
- To train designing graphical effects throughApplets.

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).
- implementcontrolstructuresandextendedstructuresspecifictoJava (L3).

UNIT II **10L**

Introduction to Classes, Objects And Methods: Class Fundamentals, Objectscreation,ReferenceVariablesandAssignment,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(),obtainingcharacterswithinastring,Stringcomparison, picking indexes, modifying string, Command-Line Arguments, Scanner Class,Vectorclass,WrapperClasses,Parsing,AutoboxingandUnboxing.

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, MethodOverriding, 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.

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

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.

AppletProgramming: Introduction,howappletsdifferfromapplications, building applet code, applet life cycle, about HTML, designing a web page, passing parameters to applets, getting input from theuser.

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 ornot.
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 stringmethods.
   a) equals() b) compareTo() c) substring() d)indexOf() e) toLowerCase()
4. Develop a program to demonstrate constructoroverloading.
5. DesignavehicleclasshierarchyinJava,anddevelopaprogramto demonstrate Polymorphism.
6. Developaprogramtodemonstratemultipleinheritancethrough interface.
7. Writeaprogramtofindtherootsofaquadraticequationusinginterface and packages.
   - Declare an interface in packageQuad1
   - Declare another package Quad2 and implement theinterface
8. Develop a program to demonstrate exception handling by using FINALLY &MULTIPLE CATCHstatements.
9. Writeaprogramtothrowauserdefinedexceptionforemployee details
   - Ifanemployeeageisgreaterthan50,anageexceptionmustbe thrown
10. Developanappletthatreceivesthreenumericvaluesasinputfromthe 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. Createanappletprogramfordrawingcolourlines,rectangle,filled rectangle,roundedrectangle,filledroundedrectangle,oval,filledoval, arc, fill arc and polygon. Every drawing shape should be in different colour. Write a text “hello everyone” at thecenter.
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 identificationnumberandsimilarlythemembersofthelibraryarealso given a unique identification number. A book can be retained for 15 days with the member after issue. Implement codeto:
  - Findwhetheraparticularbookisavailableinthelibrary:searchby Title or by author.
  - Post a Reminder to the member when his book is due a daybefore. The remainder would state the name of the book and the duedate.

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

- identifyvarious 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 Quant itative Aptitude	HS	1	2		1
		Coding	HS			3	
Total number of hrs per week						6	

Part-1 **3 Hours per week**

A. Verbal and Soft Skills:

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

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

B. Quantitative Aptitude and Reasoning

Puzzles, Numbers, Arithmetic, Data Interpretation.

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

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

Part-2 **3 Hours per week**

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

Scheme of Evaluation

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

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

Late Work

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

References:-

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

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

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.	19EMA210	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**	

19EMA210: 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 engineeringpractice 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

(For 2020-21 Odd and Even Sems and 2021-22 Odd Sem only)

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)

19EID232: INTERNET OF THINGS
(with effect from 2021-22 Even Semester)

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 its characteristics
- Expose the student to sensors used for sensing different physical quantities
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with different application program interfaces for accessing Cloud services.
- Enable students to create simple IoT applications.

Unit I **5 Hours**
Introduction to Internet of Things (IoT): Introduction and Definition of Internet of Things, IoT Growth, Application Areas of IoT, Characteristics of IoT, Things in IoT, IoT Stack, Enabling Technologies, IoT Challenges, IoT Levels, IoT vs. Cyberphysical Systems, IoT vs WSN

Learning Outcomes:
After completion of this unit, the student will be able to
- describe IoT architecture and application areas (L2)
- interpret the design principles that govern connected devices(L2)
- summarize the different IoT levels and compare with different systems (L2)

Unit II **6 Hours**
Introduction to Sensors, Microcontrollers, and Their Interfacing: Introduction to Sensor Interfacing, Types of Sensors, Controlling Sensors through Webpages, Microcontrollers
Learning Outcomes:
After completion of this unit, the student will be able to
- list the different physical quantities and their sensing mechanisms (L1)
- describing the interfacing of sensors with embedded computing systems (like Arduino/Raspberry Pi and electrical signal relationships(L2)
- demonstrate the control of sensors using webpage interfaces (L4)

Unit III **6 Hours**
Protocols for IoT – Messaging and Transport Protocols: Messaging Protocols, Transport Protocols (Li-Fi, BLE), Protocols for IoT – Addressing and Identification: Internet Protocol Version 4 (IPv4), Internet Protocol Version 6 (IPv6), Uniform Resource Identifier (URI)
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 IV **5 Hours**
Cloud for IoT: IoT with Cloud – Challenges, Selection of Cloud Service Provider for IoT Applications, Introduction to Fog Computing, Cloud Computing: Security Aspects, Case Study: How to use Adafruit Cloud?

Learning Outcomes:
After completion of this unit, the student will be able to
- describe the cloud architecture for collecting data from different sensors and analyzing them (L2)
- choose a service provider for a specific IoT application(L3)
- analyze different case studies involving Cloud IoT and discuss the security aspects (L3)

Unit V **6 Hours**

Data Analytics – Visualizing the Power of Data from IoT, Data Analysis, Machine Learning, Types of Machine Learning Models, Model Building Process, Modelling Algorithms, Model Performance.

Application Building with IoT: Smart Perishable Tracking with IoT and Sensors, Smart Healthcare – Elderly Fall Detection with IoT and Sensors, IoT–Based Application to Monitor Water Quality
Smart Warehouse Monitoring, Smart Retail

Learning Outcomes:
After completion of this unit, the student will be able to
- describe the architecture of IoT involving data collection and analysis
- list the types of machine learning models used to analyze collected data (L2)
- discuss different applications of IoT illustrating the use of different data analyses and machine learning algorithms (L3)

Text Book:
1. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, Internet of Things, Wiley India, 2019

List of Experiments (2 Hours each)
1. Blinking led with Arduino using software delay, LED Control with switch
2. Temperature measurement using LM35 and display both on LCD and serial monitor
3. Control DC motor with H-bridge and as well as PWM
4. Raspberry pi installation and led control
5. DHT11 sensor interfacing to Raspberry pi and Transfer the data to Thingspeak server
6. Interfacing camera and raspberry pi
7. Accelerometer ADXL345 with i2c with raspberry pi
8. Nodemcu to control LED with thinger.io
9. With Nodemcu HTTP protocol get and post
10. With nodemcu Webserver control led
11. MQTT protocol using Nodemcu
12. Blinky app with led control

Text Book(s)
1. Simon Monk, Programming Arduino: Getting Started with Sketches, Mc Graw Hill Publications, 2011
2. Simon Monk, Programming the Raspberry Pi, Getting Started with Python, Mc Graw Hill Publications, 2015
3. Simon Monk, Hacking Electronics: Learning Electronics with Arduino and Raspberry Pi, Mc Graw Hill Publications, 2017
4. Manoj R. Thakur, NodeMCU ESP8266 Communication Methods and Protocols : Programming with Arduino IDE Amazon Media, 2018.

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 andI/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

<u>List of Practical Experiments:</u>

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, 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)
- analyzethe 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:

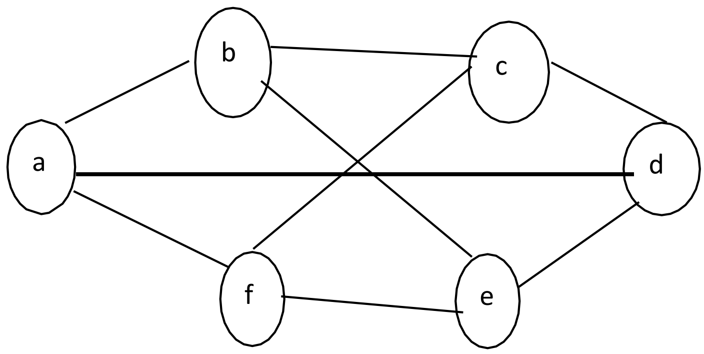
1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be 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).

11.11.



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.

12. 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 - 3 Hours per week

***A. Verbal and Soft Skills*:**

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

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

B. Quantitative Aptitude and Reasoning
Puzzles, Arithmetic, Geometry, Mensuration.

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

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

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

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

<u>Scheme of Evaluation</u>

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

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

Late Work

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

References:-

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

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

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).

19ECS331: SOFTWARE ENGINEERING

L	T	P	C
3	0	2	4

This course is aimed at helping students build up an understanding of how to develop a software system from scratch by guiding them through the development process and giving them the fundamental principles of system development with object-oriented technology using UML. The course will initiate students to the different software process models, software requirements engineering process, systems analysis and design as a problem-solving activity, key elements of analysis and design within the system development life cycle. Giving the student an insight into learning the quality methods, testing methodologies.

Course objectives:

- Understanding the software engineering concepts, process and various models of software engineering.
- Understanding the software requirements and their importance and having knowledge about analysis, modelling etc.
- Knowing and understanding software design, architecture design of software products.
- Understanding every aspect of software quality management, reviews and quality assurance methods
- Understanding the testing of software and having knowledge of strategies and tactics of software testing.

UNIT I: 8 L

Introduction to Software Engineering: The Nature of Software, The Software Process, Software Engineering Practice.

Process Models: A Generic Process Model, Prescriptive Process Models: The Waterfall Model,Prototyping Process Model, Evolutionary Process Model, Unified Process Model.

Agility and Process: Agility, Agility and the Cost of Change, Agile Process, Scrum.Learning Outcomes:

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

- define software and its evaluation nature (L1)
- how to use models in engineering projects (L1)
- demonstrate the working of agile methodology within the market (L2)
- explain the advantages and disadvantages of different types of process models (L2)
- relate process models are recommended to use (L2)

UNIT II: 10 L

Principles That Guide Practice: Core Principles, Principles that Guide Each Framework Activity. **Understanding Requirements:** Requirements Engineering, Establishing the Groundwork, Requirements Gathering, Building the Analysis Model, Negotiating Requirements, RequirementsMonitoring, Validating Requirements.

Requirements Modelling: Requirements Analysis, Scenario-Based Modeling, Class-BasedModeling, Functional Modelling, Behavioural Modelling.

Learning Outcomes:

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

- classify the principles to framework activities (L2)
- summarize the requirements engineering tasks (L2)
- construct the software requirements specification document for a software project (L3)
- build to analyze, design and develop the system models using an object-oriented methodology (UML) for software development (L3)

UNIT III: 8 L

Design Concepts: Design within the Context of Software Engineering,TheDesign Process, Design

Concepts, The Design Model.
Architectural Design: Software Architecture, Agility and Architecture, Architectural Styles,Architectural Considerations, Architectural Decisions, Architectural Design.
Learning Outcomes:
After completion of this unit, the student will be able to:

- build a design model from an analysis model (L3)
- develop the design model irrespective of every element (L3)
- examine the design concepts and design model(L4)
- list the different software architectural styles and patterns(L4)
- examine the architectural design (L4)

UNIT IV: 8 L

Quality Concepts: Quality, Software Quality, Achieving Software Quality.

Reviews - A Recommended Approach: Criteria for Types of Reviews, Formal Technical Reviews, Agile Reviews.

Software Quality Assurance: Elements ofSoftware Quality Assurance,SQA Process and Product Characteristics, SQA Tasks, Goals and Metrics, Statistical Software Quality Assurance, Software Reliability, The ISO 900 Quality Standards, The SQA Plan.
Learning Outcomes:
After completion of this unit, the student will be able to:

- explain quality concepts (L5)
- importance of approaches to conducting the reviews (L5)
- decide which metrics are used to improve the quality (L5)
- explain different quality standards (L5)

UNIT V: 8 L

Software Testing: Component Level: A Strategic Approach to Software Testing, Planning and Recordkeeping, Test Case Design, White-Box Testing, Black-Box Testing.

Integration Level: Software Testing Fundamentals, Integration Testing, Artificial Intelligence andRegression Testing, Validation Testing.
Learning Outcomes:
After completion of this unit, the student will be able to:

- list the different testing techniques (L4)
- examine different approaches to software testing strategies (L4)
- choose a suitable testing technique to find the errors of a software functionalities(L5)
- select proper testing strategy and tactic for a specified project (L5)

Text Books(s)
1. Roger S. Pressman, Bruce R. Maxim, Software Engineering: A Practitioner's Approach, 9thEdition, McGraw Hill, International Edition, 2020.

Reference Book(s)
1. K.K. Agarwal &Yogesh Singh, Software Engineering, New Age International Publishers, 2007.
2. Waman S Jawadekar, Software Engineering Principles and Practice, McGraw-Hill, 2004.
3. Rajib Mall, Fundamentals of Software Engineering, 4/e, PHI, 2009.
4. Ian Somerville, Software Engineering, 9th Edition, Pearson, 2011

Course Outcomes:

- How to use models in engineering projects (L1)
- Summarize the requirements engineering tasks (L2)
- Develop the design model irrespective of every element (L3)
- Decide which metrics are used to improve the quality (L5)
- Choose a suitable testing technique to find the errors of a software functionalities(L5)

For Laboratory courses: List of Experiments:

1. **Mini-Project I**
   A Point-of-Sale (POS) System

   A retail POS system typically includes a computer, monitor, keyboard, barcode scanners, weight scale, receipt printer, credit card processing system, etc. and POS terminal software. It interfaces to various service applications, such as a third-party tax calculator and inventory control. These systems must be relatively faulted tolerant; that is, even if remote services are temporarily unavailable they must still be capturing sales and handling at least cash payments. A POS system must support multiple and varied client-side terminals and interfaces such as browser, PDAs, touch-screens.
2. **Mini-Project II**
   Online Shopping
   The customer uses some web site to make purchases online. Follow the various websites like snapdeal, Flipkart, Amazon. in so as to design online shopping.
3. **Mini-Project III**
   E-Library OPAC
   An Online Public Access Catalog (OPAC) is an e-Library website that is part of the Integrated Library System (ILS), also known as a Library Management System (LMS), and managed by a library or group of libraries. Members of the library can search the library catalogue online to locate various resources - books, periodicals, audio and visual materials, or other items under the control of the library. Members may reserve or renew the resources.
4. **Mini-Project IV**
   A Multi-Threaded Airport Simulation

   Simulate the operations in an airport. Your application should support multiple aircraft using several runways and gates avoiding collisions/ conflicts. Landing: an aircraft uses the runway, lands, and then taxis over to the terminal. Take-Off: an aircraft taxis to the runway and then take off.
5. **Mini-Project V**
   Bank ATM
   An automated teller machine (ATM) or the automatic banking machine (ABM) is a banking subsystem that provides bank customers with access to financial transactions in a public space without the need for a cashier, clerk or bank teller. A customer uses a bank ATM to check balances of his/ her bank accounts, deposit funds, withdraw cash and/or transfer funds.ATM technician provides maintenance and repairs.
6. **Mini-Project VI**
   Hospital Management System

   The hospital management system is a large system including several subsystems or modules providing a variety of functions. Hospital subsystems or modules support some of the many job duties of hospital receptionists. The receptionist scheduled the patient's appointments and admission to the hospital to collect information from the patient upon the patient's arrival and or phone. For the patient that will stay in the hospital ("inpatient"), she or he should have a bed allotted in a ward. Receptionists might also receive patient's payments, record them in a database and provide receipts, file insurance claims and medical reports.
7. **Mini-Project VII**
   An Auction Application

   Several commerce models exist and are the basis for a number of companies like eBay.com, pricellne.com etc. Design and implement an auction application that provides auction services. It should clearly model the various auctioneers, the bidding process, auctioning etc.
8. **Mini-Project VIII**
   A Notes and File Management System

   In the course of one student’s years and professional career, one produces a lot of personal notes and documents. All these documents are usually kept on papers or individual files on the computer. Either way, the bulk of the information is often erased, corrupted and eventually lost. The goal of this project is to build a distributed software application that addresses the problem. The system will provide an interface to create, organize and manage personal notes through the Internet for multiple users. The system will also allow users to collaborate by assigning permissions for multiple users to view and edit notes.

9. **Mini-Project IX**
   Credit Card Processing System

   A credit card processing system (Credit card payment gateway) is a system under consideration. The main part of the system is the Merchant's Credit Card Processing System. The merchant submits a credit card transaction request to the credit card payment gateway on behalf of a customer. Bank which issued the customer's credit card which could approve or reject the transaction. If the transaction is approved, funds will be transferred to the merchant's bank account.

10. **Mini-Project X**
    Airport Check-In and Security Screening

    Passenger, tour guide, minor (child), the passenger with special needs (e.g. with disabilities), involved in relation to airport business. Individual check-in, group check-in (for groups of tourists), security screening, etc. Representing the process taking place in the airport and serving the needs of passengers.

19ECS305: CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

The aim of this course is to introduce information security concepts to the students. This course develops a basic understanding of goals, threats, attacks and mechanisms, algorithms and their design choices. The course also familiarizes students with a few mathematical concepts used in cryptology. The course emphasizes to give a basic understanding of attacks in cryptosystems and how to shield information from attacks. It also deals with message authentication, Digital signatures and Network security.

Course objectives:

- Understand basics of security concepts and comprehend Classical Encryption Techniques (L3)
- Impart various symmetric cryptographic techniques (L2)
- Learn number theory related to RSA and Diffie-Hellman algorithms (L3)
- Study different hash functions and message authentication techniques (L3)
- Impart knowledge on application and transport layers security concepts (L2)

UNIT I: 9 L

Introduction: Computer Security Concepts, The OSI Security Architecture, Cryptography, cryptanalysis, attacks, services, security mechanisms.
Classical Encryption Techniques: Substitution Techniques**,** Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher Polyalphabetic Ciphers.Transposition Techniques.

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

- illustrate different security attacks (L2)
- apply classical substitution methods (L3)
- explain Transposition techniques (L2)

UNIT II: 9 L

Details of UNIT I
Symmetric Key Cryptography: Block Ciphers and the Data Encryption Standard (DES) algorithm. Differential and linear cryptanalysis, triple DES. Block cipher design principles, Block cipher modes of operation, Advanced Encryption Standard (AES), Stream Ciphers: RC4.

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

- distinguish block and stream ciphers (L2)
- explain working of block cipher DES and AES algorithm (L2)
- discuss working of stream cipher RC4 (L2)

UNIT II: 9 L

Number theory: Divisibility and The Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem. Public Key **Cryptography:** Principles of public key cryptosystem, RSA algorithm, security of RSA. Diffie Hellman key exchange.

Learning Outcomes:

After completion of this unit, the student will be able to:
- illustrate the concepts of divisibility, modularity and primality (L2)
- RSA algorithm using a suitable programming language (L4)
- explain Diffie Hellman key exchange method (L2)

UNIT IV: 9 L

Cryptographic Hash Functions: Applications of hash Functions, Secure Hash Algorithm (SHA) SHA-512, SHA 3. MAC and Digital Signatures: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, HMAC, DAA and CMAC. Digital signatures, Digital Signature Standard (DSS). Authenticated Encryption: CCM, GCM.

Learning Outcomes:
After completion of this unit, the student will be able to:
- explain and implement simple hash functions (L2)
- discuss message authentication techniques (L2)
- explain Digital Signature Standard (DSS) (L2)

UNIT V: 9 L

Key management and distribution: Distribution of Public Keys, X.509 Certificates

Internet Security: Introduction to SSL and TLS. Email Security: Pretty Good Privacy (PGP), S/MIME. IP Security: IP security overview, IP security Policy, Encapsulating Security Payload**.**

Learning Outcomes:
After completion of this unit, the student will be able to:
- explain transport-level security techniques (L2)
- discuss application-level security techniques (L2)
- list network-level security techniques (L2)

Text Books(s)
1. William Stallings, Cryptography and Network Security – Principles and Practice, 7/e. Pearson Education, 2017.

Reference Book(s)
1. Behrouz A Fourozen and DebdeepMukhopadhyaya, Cryptography and Network Security, 3/e, McGraw Hill, 2015.
2. Atul Kahate, Cryptography and Network Security, 4/e, McGraw Hill, 2019.
3. Buchmann, Introduction to Cryptography, Springer, 2004
4. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C (cloth), 2/e, Publisher: John Wiley & Sons, Inc., 1996.
5. Chwan-Hwa(John) Wu, Introduction to Computer Networks and Cybersecurity, CRC Press, 2013

Course Outcomes:
- illustrate working of classical encryption techniques (L3)
- describe the working of symmetric encryption techniques (L2)
- experiment the working of public key cryptography algorithms such as RSA, Diffie-Hellman (L3)
- apply Hash functions and message authentication techniques (L3)
- summarize Application and transport layers security mechanisms. (L2)

19ECS333: DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	2	4

This course provides fundamental and practical knowledge on database management system concepts through Data Modeling, Normalization, Structured Query Language. Concurrency control, Transaction management and crash recovery are introduced. This course is structured to enable students to gain experience in creation of data models, design of database and Database Application Development.

Course Objectives

- Focus the role of a database management system in an organization
- Demonstrate basic database concepts, including the structure and operation of the relational data model
- Introduce simple and moderately advanced database queries using Structured Query Language (SQL)
- Explain and successfully apply logical database design principles, including E-R diagrams and database normalization
- Demonstrate the concept of a database transaction and related database facilities, including concurrency control, and data object locking and protocols

UNIT I: Introduction to DBMS and ER-Model 8 L

Introduction to DBMS: Overview, File system vs DBMS, advantages of DBMS, storage data, queries, transaction management, DBMS structure, people who work with Databases.

Data base Design: data models, the importance of data models.

E-R model: Entities, attributes and entity sets, relationship and relationship sets, mapping cardinalities, keys, features of ER model, conceptual database design with ER model.

Learning Outcomes:

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

- interpret the basic terminology of DBMS like data, database, database management systems(L2)
- compare DBMS over File Systems(L2)
- define levels of abstraction with three tier architecture(L1)
- define the role of DBA and other users of DBMS(L1)
- model a given application using ER diagram(L3)

UNIT II: Relational Model 8 L

Relational model: Integrity constraints over relations and enforcement, querying relation data, logical database design, views, destroying/altering tables and views.

Relational Algebra and Relational Calculus

Learning Outcomes:

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

- translate an ER Model to Relational Model and vice versa(L2)
- match the integrity constraints from ER model to relational model(L1)
- compare the difference between views and physical tables and working with views(L2)
- construct the given Query in Relational Algebra and Relational Calculus(L3)

UNIT III: Structured Query Language (SQL) and Database Application Development 8 L

Structured Query Language (SQL): Introduction to SQL, Basic SQL Queries: DML, DDL, DCL, TCL commands, The set oriented commands like Union, Intersection, Except and Nested Queries, Aggregate Operators, Null values, Relational set operators, SQL join operators

Database Application Development: SQL functions, procedural SQL, embedded SQL, cursors, ODBC and JDBC, triggers and active database, designing active databases.

Learning Outcomes:

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

- create and modify database using SQL query(L5)
- illustrate different types of query forms (simple queries, nested queries, and aggregated queries) in SQL(L2)
- build Embedded SQL, cursors, triggers and active database using PL/SQL programs(L3)
- develop knowledge about ODBC and JDBC connectivity to connect database(L3)

UNIT IV: Schema Refinement and Normal Forms 8 L

Schema Refinement and Normal Forms: Schema Refinement, Functional Dependencies,Reasoning about Functional Dependencies.Normal Forms, Properties of Decomposition, Normalization, Different types of normal forms, different types of dependencies.

Learning Outcomes:

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

- make use of about schema refinement process(L3)
- extend the concept of functional dependencies (FDs) and knows about anomalies(L2)
- illustrate knowledge about different types of normal forms and the importance of normalization(L2)

UNIT V: Transaction Management and Concurrency Control 10 L

Transaction Management and Concurrency Control: Introduction to Transaction Management, ACID properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency control without locking,

Crash Recovery: Aries, Recovering from a System Crash, Media recovery.

Learning Outcomes:

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

- interpret the overview of transaction management in DBMS(L2)
- explain the importance of concurrency and concurrency control mechanisms(L2)
- develop knowledge about concurrency control with and without locks(L3)
- identify different types of crashes in DBMS(L3)
- apply crash recovery techniques to recover from DBMS crashes (L3)

Text Books(s)

Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill, 3e, 2014.

Reference Book(s)

1. H.F.Korth and A.silberschatz, Database System Concepts, McGraw-Hill, 6e, 2011.
2. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education,7e, 2016.

Course Outcomes:

- understand and evaluate the role of database management system in an organization(L2)
- explain and apply logical database design principles, including E-R diagrams and database normalization(L3)
- understand and use of database queries using Structured Query Language (SQL)n(L2)

- demonstrate the concept of a database transaction and related database facilities, including concurrency control, and data object locking and protocols(L2)
- design and develop a small database project using database software (L6)

For Laboratory courses: List of Experiments:
Software used: MySql / Oracle 19c

1. (a) Develop a sample ER model for the specified database.
   (b) Implementation of DDL, DML, TCL and DRL commands
   (a) Create (b) alter (c)drop (d) rename (e) truncate (f) Insert
   (g) Select (h) Update (i)Delete (j) commit (k) rollback
   (l)save point (m) Like'%' (n)grant (o) revoke (p)relational operators.

2. Create an Employee database to set various constraints. (The Employee relation is having EID, Ename, DoB, Dept., Joining date, Salary)
   (a) Primary key (e) Null, (i) Disable Constraints
   (b)Foreign Key (f) Not null (j) Drop Constraints
   (c) Check (g) Default
   (d) Unique (h) Enable Constraints

3. Write PL/SQL statements for the following queries on EMPLOYEE table with following schema.*(Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id, Designation , Salary)*

a) List the E_no, E_name, Salary of all employees working for MANAGER.
b) Display all the details of the employee whose salary is more than the Sal of any IT PROFF.
c) List the employees in the ascending order of Designations of those joined after 1981.
d) List the employees along with their Experience and Daily Salary.
e) List the employees who are either 'CLERK' or 'ANALYST'.
f) List the employees who joined on 1-MAY-81, 3-DEC-81, 17-DEC-81,19-JAN-80.
g) List the employees who are working for the Dept no 10 or 20.
h) List the Enames those are starting with 'S'.
i) Display the name as well as the first five characters of name(s) starting with 'H'
j) List all the employees except 'PRESIDENT' & 'MGR" in as order of Salaries.

4. Creating Views, grouping functions and performing joins.

5. Lab Practice Assignment:
   a. Create user and implement the following commands on relation (Emp and Dept).
   b. Develop a query to grant all privileges of employees table into departments table.
   c. Develop a query to grant some privileges of employees table into departments table.
   d. Develop a query to revoke all privileges of employees table from departments table.
   e. Develop a query to revoke some privileges of employees table from departments table.4. Use of different of operators for nested sub-queries.

6. Trigger:
   a. To write a Trigger to pop-up the DML operations.
   b. To write a Trigger to check the age valid or not Using Message Alert.
   c. Create a Trigger for Raise appropriate error code and error message.
   d. Create a Trigger for a table it will update another table while inserting values.

7. Checking normalization for database tables and use of cursors.

8. **Mini Projects**.

The students are given the following use cases as mini project for a group of 3-4 as a batch, to model the data and create UI with Databse connectivity.

a) Inventory Control System.
b) Material Requirement Processing System.
c) Hospital Management System.
d) Railway Reservation System.
e) Personal Information System.
f) Web Based User Identification System.
g) Timetable Management System.
h) Hotel Management System.

19ECS303: FORMAL LANGUAGES AND AUTOMATA THEORY

L	T	P	C
3	0	0	3

Automata Theory comprised of theoretical computer science and discrete mathematics, is the study of abstract machines for solving computation problems. This course is intended to help the students to gain knowledge in fundamentals of theory of computation that can recognize formal languages typically illustrated by the Chomsky hierarchy. This knowledge can further be applied widely in compiler construction, artificial intelligence.

Course objectives:

- Impart the mathematical concepts of theoretical computer science from the perspective of formal languages in the design of solving computational machines.
- Familiarize various formal languages, grammar and their relationships.
- Demonstrate various finite state machines and recognize formal languages.

UNIT I: Finite Automata **8 L**

Central concepts of strings, languages and automata theory, Deterministic Finite Automata, Non-Deterministic Finite Automata, Finite Automata with Epsilon Transitions, Finite Automata with Output.

Learning Outcomes:

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

- illustrate the central concepts of automata theory (L2)
- construct Non-Deterministic Finite Automata and Deterministic Finite Automata (L3)
- list out various finite state machines (L1)

UNIT II: Regular Expressions and Languages **8 L**

Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Closure Properties of Regular Sets, Pumping Lemma for Regular Languages, Equivalence and Minimization of Finite Automata by partitioning.

Learning Outcomes:

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

- interpret various operations and properties of regular expressions (L2)
- construct a Non-Deterministic Finite Automaton for a regular expression (L3)
- decide whether a language is a regular language or not using pumping lemma theorem (L5)
- construct the equivalent minimized Deterministic Finite Automata (L3)

UNIT III: Grammars **10 L**

Context–free grammars; Parse trees; Applications; Ambiguity in grammars and Languages, Simplification of Context Free Grammars, Normal Forms, Pumping Lemma for Context Free Languages, Closure Properties of Context Free Languages.

Learning Outcomes:

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

- classify the grammars of the formal languages (L2)
- construct an unambiguous grammar from ambiguous grammar(L3)
- decide whether a language is context free language or not using pumping lemma theorem (L5)

- illustrate the process of string acceptance of Context Free Languages (L2)

UNIT IV: Pushdown Automata **9 L**

Definition of the Pushdown Automaton, The Language of Push Down Automaton, Equivalence between Acceptance by Empty Stack and Acceptance by Final State, Equivalence of CFG and PDA, Deterministic Pushdown Automaton, Membership Algorithm (CYK).

Learning Outcomes:

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

- illustrate the design of Pushdown Automata for Context Free Languages (L2)
- analyze the equivalence of Pushdown Automata with empty store to final state (L4)
- analyze the equivalence of Pushdown Automata with Context Free Languages (L4)

UNIT V: Turing Machines **8 L**

Turing Machine as Acceptor, Turing Machine as a Computing Device, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine, Linear-Bounded Automata, Universal Turing Machines (UTM).

Learning Outcomes:

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

- illustrate the design of Turing machine for unrestricted grammars (L2)
- identify various programming techniques in the design of Turing machines (L3)
- distinguish between Turning Machines and Linear-Bounded Automata (L4)

Text Books(s)

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, 3/e, Pearson, 2008.
2. Kamala Krithivasan and Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson Education, 2009.

Reference Book(s)

1. Peter Linz, An Introduction to Formal Language and Automata, NarosaPub. House, Reprint 2000.
2. John C.Martin, Introduction to Languages and the Theory of Computation,3/e, Tata McGrawHill, 2003.
3. Michael Sipser, Introduction to Theory of Computation, 3/e, Wadsworth Publishing Co Inc, 2012.

Course Outcomes:

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

- identify different finite state machines for modelling and solving computational problems (L1)
- illustrate the concepts in the design of Finite State Machines to recognize Regular Languages (L2)
- analyze the relation between grammar and language, and design Context Free Grammars for formal languages (L4)
- construct Pushdown Automata for the Context Free Languages and analyze the equivalence between them (L3)
- design and analyze Turing Machine for Unrestricted Grammar (L6)

19ECS341: PROGRAMMING WITH R

L	T	P	C
2	0	2	3

The course is designed to enable the student to write programs for problem solving. After an introduction to R, R Studio, Exploratory Data Analysis, Using R for Data Visualization and Graphics for Communication are designed to work together to make data science fast, fluent. This course lays for developing program logic and for writing programs in R according to the developed logic.

Course objectives:

- Impart usage of functions in R in an efficient way.
- Familiarize R for computation, graphics, and modelling.
- Focus R in their own research.
- Facilitate knowledge of R on their own.

UNIT I: Introduction –Importance of R and R Studio (IDE) 8 L**R Language Constructs** – Variables, Data types, Program Structure in R, Arithmetic and Boolean operators.

Control Statements: if, If-else, default values for argument, return values, for loop, while conditions and repeat loop.

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

- show and use R for simple programming tasks(L1)
- interpret the structure of R program and various key features of R(L5)
- construct R programs using various conditional statements(L3)

UNIT II: R data structures 10 L

Introduction to Data Structure in R, Vectors, Lists, Scalars, Data Frames, Matrices, Arrays, Strings, Factors, Use of data structures in different conditions, Advantage of using a particular approach.
Functions in R: Mathematical Functions, Summary Functions, String Functions, data frame functions, vector functions, user defined functions and Built - in functions in R.

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

- translate mathematical expressions to R notation using operators (L2)
- develop R programs using loops and nested loops(L3)
- solve problems related to arrays, strings and vectors(L6)
- apply the in-built functions to develop custom functions for solving problems(L3)

UNIT III: File Handling in R 8 L

File operations in R, reading file, writing to a file, Importing and exporting a file.
Using R for Data Visualization: Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot () Function –Customizing Graphs, Saving Graphs to Files.

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

- make use of files and file operations to store and retrieve data(L3)
- utilize data from files and other sources and perform various data manipulation tasks on them(L3)
- evaluate the functions and methods of effective visualization of quantitative information(L5)
  apply data visualization techniques offered by R base like dot plot, box plot, scatter plot, line chart(L3)

UNIT IV: Data Transformation 10 L

Data Transformation using dplyr package.

Exploratory Data Analysis: variation, missing values, co variation, patterns and models.

Learning Outcomes:

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

- learn how to transform your data using the dplyr package(L4)
- dscover any existing patterns and identify mistakes(L4)
- propose hypothesis that can be tested and check assumptions(L6)

UNIT V: Graphics for Communication 6 L

Graphics for Communication: Introduction, label, Annotations, scales, zooming, themes, saving your plots.

Model building, **RMarkdown basics**

Learning Outcomes:

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

- utilize R graphics and tables to visualize results of various statistical operations on data(L3)
- Learn to fit data into models and better understand how the model works (L5)
- Learn to communicate with markdown files (L4)

Text Books(s)

1. Jared P. Lander, R for Everyone, 2/e, Pearson Publications, 2017.
2. Garrett Grolemund and Hadley Wickham, R for Data Science, O'Reilly Media, 1/e, 2017.

Reference Book(s)

1. Norman Matloff, The Art of R Programming, Cengage Learning, 1/e, 2011.

Course Outcomes:

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

- build motivation for learning a programming language(L1)
- show how to transform the datasets into a form convenient for analysis(L2)
- show how to learn powerful R tools for solving data problems with greater clarity and ease(L2)
- determine how to examine the data, generate hypotheses, and quickly test them(L5)
  choose R Markdown for integrating prose, code, and results(L5)

19ECS343: ADVANCED DATA STRUCTURES FOR MACHINE LEARNING

L	T	P	C
2	0	2	3

After the students have gone through a course on data structures using python, where they learn the formal and abstract representations of data and its manipulation. Studying course on advanced data structures should teach the students concrete implementations and manipulation of such basic data structures and their use in design and analysis of non-trivial algorithms for a given computational task. On completion of such a course, students should be able to analyse the asymptotic performance of algorithms demonstrate their familiarity with major data structures, rule to manipulate those, and their canonical applications such as graphs and pattern recognition.

Course objectives:

- CO1: Analyze algorithms and data structures applying methods for amortized analysis
- CO2: Evaluate methods for performance improvement of dictionaries and hashing techniques.
- CO3: Analyze and assess various time and space efficient searching tree data structures
- CO4: Analyze and assess the applicability of fundamental graph algorithms to applications and external sorting schemes.
- CO5: Define and apply data structures for Pattern Matching and tries

UNIT I: Review of basic data structures 9 L

Recursion: illustrative examples; Array based sequences: low level arrays, Dynamic Arrays, amortized analysis; Stacks, Queues, Double Ended Queues; **Priority Queues**: Priority Queue as ADT, Implementing Heap using Priority Queue, Sorting with Priority Queue;

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

- analyse the fundamental concepts of linear data structures (L3)
- apply priority queue for implementation of heaps (L3)
- demonstrate sorting using priority queues (L2)

UNIT II: Maps and Hash Tables 9 L

Maps, and Hash Tables: Maps and Dictionaries; Hash Tables; **Hashtablerepresentation:**hashfunctions,collisionresolution-separatechaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison ofhashingandskiplists.

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

- describethefundamental conceptsofmapsandhashingtechniques(L2)
- applyhashingtechniquesfor indexing(L4)

UNIT III: Trees 9 L

General Trees, Binary Trees, Implementing Trees, Binary search trees; Balanced search trees, AVL trees, Splay Trees, Red –Black Trees, Multiway search Trees, B-Trees, B-Tree of order m, height of a B-Tree, insertion, deletion and searching, Comparison of Search Trees.

Learning Outcomes:
After completion of this unit, the student will be able to:
illustrate the representation and use of non linear data structures (L2)

• illustrate different variants of search trees (L5)
• construct B-Trees of higher order (L3)

UNIT IV: Graphs 9 L

The graph ADT, Representation in memory; Directed Acyclic Graph; Shortest path using Prim-Jarnik Algorithm and Kruskal's Algorithm; Disjoint Partitions and Union Find Structures.
External Sorting: Model for external sorting, Multi-way merge, Polyphase merge.

Learning Outcomes:
After completion of this unit, the student will be able to:
demonstrate the applications of graph for finding shortest paths (L2)
• analyze sets through disjoint partition and union (L2)
• apply model for external sorting techniques for datasets (L2)
• apply merging schemes to datasets (L2)

UNIT V: Pattern Matching and Tries 9 L

Pattern Matching: Pattern matching algorithms -Brute force, the Boyer –Moore algorithm, the Knuth-Morris- Pratt algorithm;
Tries: Standard Tries, Compressed Tries, Suffix Tries, Search Engine Indexing.

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

- comparedifferentpatternmatchingalgorithms(L4)
- demonstratethefundamentalconceptsof*trie*datastructure(L2)
- createapplicationsforsearchengineindexing(L2)

Text Books(s)

1. MichaelT.Goodrich, R.TamassiaandMichael H. Goldwasser,DatastructuresandAlgorithmsin Python,Wileystudentedition,JohnWileyandSons,2013.

2. S.Sahni,Datastructures,AlgorithmsandApplicationsinjava,UniversitiesPressOrient LongmanPvt. Ltd,2011.

3. Bradley N Miller, David Ranum, Problem Solving with Algorithms and Data Structures using Python, Franklin, Beedle& Associates publishing, 2013.

Reference Book(s)

1. MarkAllenWeiss,DatastructuresandAlgorithm Analysis inJava,3/ePearsonEducation. Ltd., 2011.

2. Datastructuresusingjava, Langsam,Augensteinand Tanenbaum,PHI, 2003.

19ECS345: ADVANCED COMPUTER NETWORKS

L	T	P	C
2	0	2	3

This course aims to provide understanding of advanced computer network concepts, building on the basic functions of various layers, protocols and standards used in practice to have a comprehensive and deep knowledge in computer networks.

Course objectives:

- Introduce the concepts of network architecture and application programming interface concepts
- Enable the students to understand various Internetworking protocols
- Familiarize the students with advanced internetworking concepts such as Interdomain routing and multicast communication
- Introduce the concepts of end-to-end protocols, congestion control, and resource allocation techniques
- Expose the student to the latest trends in traditional, multimedia applications and content distribution networks

UNIT I Introduction 8 L

Introduction: Applications, Requirements – Perspectives, Scalable Connectivity, Cost-Effective Resource Sharing, Support for Common Services. Network Architecture- Layering and Protocols, OSI Architecture, Internet Architecture. Implementing Network Software- Application Programming Interface (Sockets). Performance- Bandwidth and Latency, Delay×Bandwidth Product, Application Performance Needs.

Learning Outcomes:

After completion of this unit, the student shall be able to:

- Differentiate connectivity and scalable connectivity (L2)
- Describe network architectures (L2)
- Explain cost effective resource sharing (L2)
- Program simple network software using socket programming (L3)
- Summarize the performance of a network in terms of bandwidth, latency and their product (L2)

UNIT II Internetworking 8 L

Internetworking (Part - I): Switching and Bridging-Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN switches. **Basic Internetworking (IP)-**What is an internetwork, service model, global addresses, Datagram Forwarding in IP, Subnetting and classless addressing, address translation (ARP), DHCP, ICMP, Virtual Networks and Tunnels.

Learning Outcomes:

After completion of this unit, the student shall be able to:

- Compare datagram networks with virtual circuit networks (L2)
- Describe various data link layer switching techniques (L2)
- Sketch datagram forwarding approach in Internet Protocol (L2)
- Present the process of subnetting and classless addressing (L2)
- Explain the concept of tunnelling (L2)

UNIT III Internetworking and Advanced Internetworking 8 L

Inter-networking (Part - II): Routing - Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics. **Implementation and Performance-** Switch Basics, Ports, Fabrics, Router Implementation. **Advanced Internetworking:** The Global Internet – Routing Areas, Interdomain Routing (BGP), IP Version 6 (IPv6). **Multicast:** Multicast addresses, Multicast routing (DVMRP, PIM)

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

- Illustrate with an example working of distance vector and link state routing protocols (L3)
- Describe performance of network devices such as a switch, router and a bridge (L2)
- Explain the concepts of autonomous system and Interdomain routing (L2)
- Sketch the header of Internet Protocol version 6 (L2)
- List different multicast communication techniques (L2)

UNIT IV Advanced Internetworking and End-to-End Protocols 8 L

Multiprotocol Label Switching (MPLS): Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels, **Routing among Mobile Devices:** Challenges for Mobile Networking, Routing to Mobile Hosts (Mobile IP), **End-to-End Protocols**: Simple Demultiplexer (UDP), Reliable Byte Stream (TCP) - End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Performance, Alternative Design Choices. **Congestion Control and Resource Allocation:** Issues in Resource Allocation - Network Model, Taxonomy, Evaluation Criteria. Queuing Disciplines - FIFO, Fair Queuing

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

- Describe the concept of virtual private networks and tunnels (L2)
- Summarize routing process in mobile hosts (L2)
- Sketch TCP's connection establishment and termination (L3)
- Explain the process congestion control in TCP (L2)
- List and describe different queuing mechanisms (L2)

UNIT V Applications 8 L

Traditional Applications - Email, world wide web, HTTP, web services. Multimedia Applications, Session Control and Call Control (SDP, SIP, H.323), Resource Allocation for Multimedia Applications. Infrastructure services - DNS, SNMP. Overlay Networks - Routing Overlays, Peer-to-Peer Networks, Content Distribution Networks.

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

- Illustrate working of electronic mail and world wide web (L3)
- Enumerate various protocols used for multimedia communication (L2)
- Describe various resource allocation techniques for multimedia applications (L2)
- Explain the working of DNS and SNMP (L2)
- Summarize working of different overlay networks (L2)

Text Books(s)

1. Larry L. Peterson, Bruce S. Davie. Computer Networks, A Systems Approach, Morgan Kaufmann Publishers, Fifth Edition, 2012

Reference Book(s)

1. W. R. Stevens. Unix Network Programming, Vol.1, Pearson Education, 1990
2. Andrew S Tanenbaum and David J Wetherall, Computer Networks, 5/e, Pearson Education, 2010
3. Darren Spohn, Data Network Design, 3/e TMH, 2002
4. D.Bertsekas, R.Gallager, Data Networks, 2/e, PHI, 1992

Course Outcomes: After successful completion of the course, the student shall be able to:

- Describe network architecture and application programming interface concepts (L2)
- Explain working of internetworking protocols (L2)
- Illustrate different routing protocols and end-to-end transmission (L3)
- Distinguish the various protocols used at the transport layer (L2)
- Summarize working of traditional, multimedia applications and overlay networks (L2)

For Laboratory courses: List of Experiments:

1. Configuration and logging to a router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Write client server programs using socket programming to exchange messages between the client and the server.
4. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address
5. Configure, implement and debug the following: Use open source tools for debugging and diagnostics.
    a. ARP/RARP protocols
    b. RIP routing protocols
    c. BGP routing
    d. OSPF routing protocols
    e. Static routes (check using netstat)
6. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down
7. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
8. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive emails.
9. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a linux PC.

19ECS347: DISTRIBUTED SYSTEMS

L	T	P	C
2	0	2	3

The course is designed to provide an understanding of the principles on which the Internet and other distributed systems are based, their architecture, algorithms and how they meet the demands of contemporary distributed applications.

Course objectives:

1. Understand foundations of Distributed Systems.
2. Introduce inter process communication in Distributed Systems.
3. Introduce the idea of peer-to-peer services and file system.
4. Understand in detail about Distributed Transaction management
5. Design and develop large scale distributed systems.

UNIT I: Characterization of Distributed Systems 6 L

Characterization of Distributed Systems: Examples of Distributed Systems, Trends in Distributed Systems, Focus on resource sharing, Challenges.

System models: Physical models, Architectural models, Fundamental models
Case study: World Wide Web.

Learning Outcomes:

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

- demonstrate knowledge of the basic elements and concepts related to distributed system technologies(L2)
- analyze the challenges of distributed systems. (L4)

UNIT II: Inter process Communication& Remote Invocation 6 L

Inter process Communication: The API for internet protocols, External data representation and marshalling, Multicast communication, Network virtualization: Overlay networks. Case study: MPI
Remote Invocation: Request-reply protocols, Remote procedure call, Remote method invocation.
Case study: Java RMI,

Learning Outcomes:

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

- outline the communication aspects of middleware. (L2)
- examine how RPC and RMI takes place in distributed system. (L4)

UNIT III: Peer-to-peer Systems, Distribute File Systems & Name Services 7 L

Peer-to-peer Systems: Introduction, Napster and its legacy, Peer-to-peer middleware, Routing overlays. Overlay case studies: Pastry, Tapestry

Distributed File Systems: Introduction, File service architecture, Case study: Sun Network File System
Name Services: Introduction, Name services and the Domain Name System, Directory services

Learning Outcomes:

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

- identify the need of peer-peer systems and its applications. (L3)
- demonstrate knowledge of details the main underlying components of distributed file systems.(L2)
- explain the issues related to name services and name spacing. (L2)

UNIT IV: Time and Global states 7 L

Time and Global states: Introduction, Clocks, events and process state, synchronizing physical clocks, Logical time and logical clocks, Global states, Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections, Coordination and agreement in group communication.

Learning Outcomes:

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

- classify the physical clocks and logical clocks(L4)
- analyze the need of mutual exclusion. (L4)
- outline the election algorithms. (L2)

UNIT V: Transactions and Concurrency Control 6 L

Transactions and Concurrency Control: Introduction, Transactions, Nested transactions, Locks, Optimistic concurrency control, Timestamp ordering,

DistributedTransactions: Introduction, Flat and nested distributed transaction, Atomic Commit protocols, Concurrency control in distributed transactions. Distributed deadlocks, Transaction recovery

Learning Outcomes:

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

- analyze the atomic commit protocols and deadlocks. (L4)
- make use and apply important methods in distributed systems to support deadlocks and transaction recovery (L3)

Text Books(s)

1. George Coulouris, Jean Dollimore and Tim Kindberg, Gordon Blair, "Distributed Systems Concepts and Design", 5/e, Pearson Education, 2012.

Reference Book(s)

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
3. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.

Course Outcomes:

- discuss trends in Distributed Systems. (L6)
- apply remote method invocation and objects. (L3)
- design Distributed Transaction management. (L6).
- demonstrate experience in building large-scale distributed applications(L2)

For Laboratory courses: List of Experiments:

1. TostudyClientServerbasedprogram usingRPC and RMI
2. Implement process strategies: creation of child, zombie, orphan process
3. Simulate file allocation strategies for Sequential(In this file organization, the records of the file are stored one after another both physically and logically. That is, record with sequence number 16 is located just after the 15^{th} record. A record of a sequential file can only be accessed by reading all the previous records.)
4. Simulate file allocation strategies for Indexed (Indexed file allocation strategy brings all the pointers together into one location: an index block. Each file has its own index block, which is an array of disk-block Addresses. The ith entry in the index block points to the ith block of the file. The directory contains the address of the index block. To find and read the ith block, the pointer in the ith index-block entry is used.)
5. Simulate file allocation strategy for Linked(With linked allocation, each file is a linked list of disk blocks; the disk blocks may be scattered anywhere on the disk. The directory contains a

pointer to the first and last blocks of the file. Each block contains a pointer to the next block.)

6. Implement file organization strategy for single level
7. Implement file organization strategy for Two level
8. Implement file organization strategy for Hierarchical level
9. TostudyImplementationofMutualExclusionalgorithms
10. TowriteProgram formulti-threaded client/serverprocesses.
11. Simulate Bankers Algorithm for Dead Lock Avoidance
12. Simulate Bankers Algorithm for Dead Lock Prevention
13. WriteadistributedapplicationusingEJB
14. WriteaprogramusingCORBAtodemonstrateobjectbrokering.
15. Use.Net frameworkto deployadistributedapplication.

19ECS349: COMPUTER GRAPHICS

L	T	P	C
2	0	2	3

This course provides a comprehensive introduction to computer graphics. Focuses on fundamental concepts and techniques, and their cross-cutting relationship to multiple problem domains in graphics (rendering, animation, geometry, imaging). Lab sessions on developing basic primitives to core algorithms for Graphics enables the learner to grasp the complexities of computer graphics.

Course objectives:

- Provide Introduction to basic concepts and principles of Computer Graphics.
- Enable understanding of design of various algorithms related to computer graphics
- Facilitate Analysis of 2D geometrical transformation and 2D viewing
- Outline 3D geometrical transformations and viewing
- Exposure to Hardware devices and Applications of Computer Graphics

UNIT I: Introduction to Graphics Systems L 6 P 4

Applications domains of Computer Graphics. Overview of Graphics systems: concepts of scan conversion, rasterization and rendering. Overview of coordinate systems, Video Display Devices-Raster Scan systems-random scan Systems-Graphics monitors and Workstations-Input devices.

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

- Understand usage of graphics systems in various applications (L2)
- Illustrate different concepts in graphics systems (L2)
- Explore input, display devices used in graphics systems (L2)

UNIT II: Graphics primitives L 7 P 6 Display and Drawing of Graphics Primitives: Point, Line, Circle, ellipse, Polygon and Text. line drawing algorithms- DDA, Bresenham, Circle generating mid-point Algorithm, Ellipse generating mid-point algorithm.
Filled Area Primitives: Polynomial, Spline Curves. Scan line polygon fill algorithm, boundary-fill and flood fill algorithms. Inside outside tests.

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

- Apply algorithms to draw Graphics primitives (L3)
- Explore Filled Area Primitive algorithms (L2)
- Illustrate Drawing and Filling Area Primitives (L2)

UNIT III: 2D Graphics: Geometrical transforms, 2D Viewing L 7 P 6

Two dimensional Transformations: Translation, scaling, rotation, reflection and shear. Matrix representations and homogeneous coordinate systems, composite transformations. Transformations between coordinate systems.

Two Dimensional Viewing:The viewing pipeline, viewing coordinate reference frame, window to viewport coordinate transformation. Clipping: Point clipping, Cohen-Sutherland Line Clipping, Sutherland –Hodgeman polygon clipping, Text Clipping.
Learning Outcomes:
After completion of this unit, the student will be able to:

- Learn two dimensional transformations in Graphics (L2)

- Analyse two dimensional viewing (L4)
- Understand Clipping (L2)

UNIT IV: 3D Graphics **L 6 P 6**

Three Dimensional Object representation: Three Dimensional Concepts and Object representations: Polygon Surfaces, Curved Lines and Surfaces.

Three DimensionalGeometric Transformations: Translation- Rotation-Scaling-Reflection Transformations-Composite Transformations, Three Dimensional Transformation Functions.

Three Dimensional Viewing: Viewing Pipeline, Viewing Coordinates,Projection Transformations: Parallel Projections Perspective Projections, Three Dimensional Clipping

Learning Outcomes:

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

- Illustrate three dimensional object representations in Graphics (L2)
- Explore three dimensional transformations in Computer Graphics (L2)
- Analyse three dimensional viewing (L4)

UNIT V: Illumination and Colour Models, Aliasing, Data Structures for Graphics **L 6** P 6

Light and Colour – Light sources, Colour Models.

Aliasing: Antialiasing techniques like Pre and post-filtering, super sampling, and pixel phasing.

Data Structures for Graphics: Introduction toQuad Trees, K-d Trees, Boundary Volume Hierarchies, Triangular Meshes.

Learning Outcomes:

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

- Illustrate illuminating light sources and colour models (L2)
- Select suitable Aliasing techniques required for said application (L3)
- Summarize various data structures used for Graphics (L2)

Text Books(s)

1. Donald Hearn & M. Pauline Baker, "Computer Graphics C Version", Pearson Education,New Delhi, 2014
2. Peter Shirley, Steve Marschiner, etc. ," Fundamentals of Computer Graphics" 3rd Edition,Taylor & Francis Group, CRC Press, 2009

Reference Book(s)

1. David F. Rogers, Procedural Elements for Computer Graphics, Tata McGraw Hill BookCompany, New Delhi, 2003
2. J. D. Foley, S. K Feiner, A Van Dam F. H John, Computer Graphics: Principles & Practicein C, Pearson Education, 2004
3. Edward Angel, Dave Shreiner, "Interactive Computer Graphics" 6th Edition, Addison-Wesley

Course Outcomes:

- Summarize basics of Computer graphics: L2
- Differentiate graphics data handling from non-graphics data handling: L4
- Analyse 2D graphics representations: L4
- Implement basic 2-D, 3-D graphics algorithms: L3
- Grasp 3D graphics representations: L1

For Laboratory courses: List of Experiments:

1. Implementation of line generation using DDA, Bresenham algorithms.
2. Implementation of Circle generation using Mid-point method and Bresenham's method.
3. Implementation of Ellipse generation using Mid-point Method.
4. Implementation of Polygon filling using flood fill, boundary fill, and scan line algorithms.
5. Implementation of 2D transformations: Translation, Scaling, Rotation, Mirror reflection and Shearing
6. Implementation of Line Clipping using Cohen- Sutherland Algorithm
7. Implementation ofPolygon Clipping using Sutherland- Hodgeman Algorithm
8. Implement Representation of a 3D object using polygon surfaces and then perform 3D transformation.
9. Implementation of projection of a 3D object on Projection Plane : Parallel and Perspective.
10. Implement colour transformation
11. Implement Quad Trees
12. Model a polygon with Triangle mesh

19ECS351: SOFTWARE REQUIREMENTS MANAGEMENT

L	T	P	C
2	0	2	3

The purpose of requirements management is to ensure that the organization validates and meets the needs of its customers, external and internal stakeholders. Requirements management provides a way to avoid errors by keeping track of changes in requirements and fostering communication with stakeholders from the start of a project throughout the engineering lifecycle. Student will be able to identify requirements of the software problem/application and prepare estimation in terms of cost and effort

Course objectives:

- Understand the various types of requirements of the software applications.
- Study the various aspects of Requirements engineering such as s/w constraints, assess requirements risk, andfeasibility etc.
- How to prepare an SRS document and manage the requirements?
- Acquaint with various software size estimation techniques.
- Demonstrate different approaches for software cost and effort estimation.

UNIT I: Introduction 8 L

Introduction, requirements, requirement engineering, requirements document, best way to write requirements, detailed requirements, difference between functional and non-functional requirements, system stakeholders, requirements engineering process, recognizing requirements engineering process problems, suggesting a good requirements engineering process. Practical process improvement: Process maturity, process assessment, process improvement, top ten guidelines.

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

- understand the functional requirements of the software applications. (L2)
- understand the non-functional requirements of the software applications.(L2)
- identify the stake holders(L3)

UNIT II: Requirements Elicitation 8 L

Assess system feasibility, identify and consult system stakeholders, record requirement sources, system's operating environment, using business concerns to drive requirements elicitation, domain constraints, collect requirements from multiple view points, use scenarios to elicit requirements, operational process. Requirements Analysis and Negotiation: System boundaries prioritize requirements, assess requirements risk.

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

- To assess the system feasibility. (L2)
- understand the challenges of Requirements Elicitation. (L2)
- introduce various s/w constraints(L1)
- describe the various risks associated with requirements(L3)

UNIT III: Describing Requirements&Requirements Management 8 L

Describing Requirements: Standard templates use language, use diagrams, supplement natural language requirements, specifying requirements quantitatively.

Requirements Management: Uniquely identify each requirement, policies for requirements management, traceability policies, maintaining a traceability manual, change management policies,

identify global system requirements, identify volatile requirements, record rejected requirements.
Learning Outcomes:
After completion of this unit, the student will be able to:

- study various policies for requirement management. (L2)
- demonstrate s/w change management policies. (L3)
- understand about SRS(L2)

UNIT IV: Software Size Estimation 8 L

Software estimation, size based estimation, two views of sizing, function point analysis, Mark-II FPA, full function points, LoC estimation, and conversion between size measures.

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

- understand various s/w size estimation methods. (L2)
- study different LoC estimation techniques. (L2)
- understand function point analysis. (L2)

UNIT V: Effort, Schedule & Cost Estimation 10 L

What is productivity, estimation factors, approaches for effort and schedule estimation, COCOMO II, Putnam estimation model, algorithmic models, cost estimation tools: Desirable features of requirements management tools, some requirements management tools available, Rational Pro, desirable features in software estimation tools, some software estimation tools.

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

- estimate software effort for applications or products(L5)
- estimate software cost by various methods (L5)
- schedule a software application development(L3)
- acquaint with various software estimation tools (L2)

Text Books(s)

1. Ian Sommerville and Pete Sawyer, Requirements Engineering: A good practice guide, John Wiley, 1997.
2. Rajesh Naik, Swapna Kishore, Software Requirements and Estimation, TMH, 2001.

Reference Book(s)

1. DeanLeffingwell , Don Widrig,Managing Software Requirements, A Use Case Approach, 2/e, Addision- Wesley,2003.
2. Ian Graham, Requirements Engineering and Rapid Development, AddisionWesley, 1998
3. S.Robertson, J.Robertson, Mastering the Requirements Process, 2/e, Pearson, 2006.

Course Outcomes:

- identify the functional and non-functional requirements of s/w application /problem/product. (L3)
- prepare feasible study report for a small s/w application(L2)
- develop an SRS for specific case study. (L3)
- apply various s/w size estimation techniques to specific application or case study. (L3)
- apply cost and effort estimation methods to specific application or case study (L3)

For Laboratory courses: List of Experiments:

1. Develop requirements specification for a given problem (The requirements specification should include both functional and non-functional requirements)
2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required).
3. Develop Structured design for the DFD model developed.
4. Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)
5. Develop Sequence Diagrams(using case study)
6. Develop Class diagrams(using case study)
7. Develop Activity Diagram(using case study)
8. Develop State chart diagram (using case study)

19EEC371: FUNDAMENTALS OF COMMUNICATION SYSTEMS

L	T	P	C
2	1	0	3

This course covers fundamental concepts of communication systems, which are essential for the understanding of advanced communication systems. Beginning with the basic communication system, the need for modulation,various analog and digital modulation techniques are covered. Further, this course will also focus on the basic concepts of various antenna and Radar systems, their working principles and applications.

Course Objectives:

- To familiarizewith the need of modulation, AM, DSBSC and its applications.
- To explain the concept of angle modulation techniques and its practical applications.
- To demonstrate various pulse coding and the generation of digital modulation techniques.
- To explain the basics of antenna and its applications in HF/UHF/MW frequencies.
- To describe the working principles and applications of various RADAR Systems.

UNIT I **9L**

Introduction to Communication Systems: Introduction to communication, elements of communication system, need of modulation, electromagnetic spectrum and typical applications. amplitude modulation techniques: elements of analog communication, theory of amplitude modulation (AM) technique, double sideband suppressed carrier (DSBSC) technique, generation of amplitude modulated Signal: generation of AM Signal, generation of DSBSC Signal.

Learning Outcomes:

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

- describe the elements of communication system (L1).
- explain the need of modulation, electromagnetic spectrum and applications (L2).
- analyze the generation of amplitude modulated signal and DSBSC signals (L5).

UNIT II **8L**

Angle Modulation Techniques: Theory of angle modulation technique: frequency modulation, phase modulation, frequency spectrum of the FM wave, narrow band and wide band FM, stereophonic FM multiplex system, comparison of FM and AM.

Learning Outcomes:

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

- describe the theory of angle modulation technique (L1).
- compare frequency modulation, amplitude modulation and phase modulation (L2).
- differentiate narrow band and wide band FM (L4).
- analyze the stereophonic FM multiplex system (L4).

UNIT III **8L**

Digital Pulse Modulation Techniques: pulse code modulation, delta modulation,digital modulation techniques: introduction, basic digital modulation schemes: amplitude shift keying (ASK), frequency shift keying (FSK) and phase shift keying (PSK).

Learning Outcomes:

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

- explain the digital pulse modulation techniques like pulse code modulation and delta modulation (L2).
- classify the basic digital modulation schemes (L3).
- demonstrate the generation of ASK, PSK, FSK signals (L3).

UNIT IV **9L**

Antennas: Basic considerations, wire radiator in space, terms and definitions, directional high-frequency antennas: dipole arrays, folded dipole and applications UHF and microwave antennas: parabolic reflector antenna, horn antenna.

Learning Outcomes:

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

- explain the basic concepts of antenna fundamentals (L1).
- define the terms and definitions of antenna parameters (L1).
- illustrate the characteristics and applications of directional high-frequency antennas (L3).
- demonstrate the characteristics and applications of UHF and microwave antennas (L3).

UNIT V **8L**

Radar Systems: Fundamentals, radar performance factors, basic pulsed radar systems, moving- target indication (MTI), CW doppler radar, frequency modulated CW radar.

Learning Outcomes:

After completion of this unit the student will be able to

- explain the fundamentals and performance factors of radar (L1).
- describe the principles of pulsedradar systems and moving- target indication (MTI) (L1).
- distinguish between CW Doppler radar and frequency modulated CW radar (L4).

Text Book:

1. George Kennedy, BernardDavis and S R M Prasanna, Electronic Communication Systems, 5 Ed Mc Graw Hill Education (India) Private Limited, 2014.

References:

1. Taub H. and Schilling D., Principles of Communication Systems, Tata McGraw Hill, 2010.
2. Simon Haykins, Michel Mohar, Introduction to Analog and Digital Modulation, second edition, Wiley India, 2014.
3. P. Rama Krishna Rao, Analog Communications 1 Ed, Tata McGraw Hill, 2011.
4. GottapuSasibhushana Rao, Microwave and Radar Engineering, 1 Ed, Pearson Education, 2014.

Course Outcomes:

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

- summarize the need of modulation, AM, DSBSC and its applications (L2).
- describe the concept of angle modulation techniques and its practical applications(L1).
- demonstratevarious pulse coding and the generation digital modulation techniques(L3).
- explain the basics of antenna and its applications in HF/UHF/MW frequencies(L2).
- describe the working principles and applications of various RADAR Systems(L2).

19EME371: QUANTITATIVE TECHNIQUES FOR MANAGEMENT

L	T	P	C
2	1	0	3

Course Objectives:

- To study the fundamentals of linear programming and its application to special cases like transportation and assignment models.
- To understand the complex nature of operations research, problem, define the problem, formulate and solve the model and to perform the follow-up procedures.
- Demonstrate how analytical techniques and statistical models can help enhance decision making by converting data to information and insights for decision-making.
- Categorize and construct multistage decision analysis problems using decision trees.
- Categorize and construct multifactor problems with multiple objectives and uncertainty.
- Critically evaluate decisions of others and develop ways they could have improved their decision making

UNIT I **10 L**

Introduction, Measures of Central Tendency Mean, Median, Mode,Concept of Testing of Hypothesis, Types of Errors, Confidence intervals, Z- test for Means, Standard deviations and Proportions; T-test; F-test for two variances.

Learning outcomes:

After completing this unit, the student will be able to

- memorize how statistical data can be read for analysis and give valid inferences.(L1)
- describe and discuss the key terminology, concepts tools and techniques used in business statistical analysis.(L2)
- analyze the data and give valid inferences.(L4)
- design, conduct and analyze the experiments more efficiently and effectively.(L6)

UNIT II **8 L**

Chi- Square test for goodness of fit and independent of Attributes and their Applications, Correlation and Types, Scatter Diagram Method, Karl Pearson's Coefficient of Correlation and its properties, Spearman's Rank Correlation Coefficient,Regression & Multivariate Analysis.

Learning outcomes:

After completing this unit, the student will be able to

- explain and critically discuss the issues surrounding sampling and significance(L2)
- apply Regression analysis based on the experimental data and give valid inference.(L3)
- determine the influential factors and also the interaction effects on the response function(L5)

UNIT III **8 L**

Decision analysis, Decisions under risk, Decision trees- Decision analysis with experimentation, Utility theory, Decisions under uncertainty.

Learning outcomes:

After completing this unit, the student will be able to

- understand the need of decision analysis apply mathematical techniques in engineering decision making(L2)
- understand the need of decision analysis(L3)
- correlate the applications of decision making principles to different environments like uncertain and risky(L4)

UNIT IV **10 L**

Introduction to multi-objective decision making, Concept of Pareto optimality, Goal programming formulation, the weighting method of solution, Analytic hierarchy process

Learning outcomes:

After completing this unit, the student will be able to

- To correlate the applications of decision making principles to different environments like uncertain and risky.(L2)
- To apply the multi-objective solving concepts like utility and analytic hierarchy process.(L3)
- To apply the multi-objective solving concepts like utility and analytic hierarchy process.(L5)

UNIT V **12 L**

Linear Programming: Introduction, Formulation, Graphical solution, Simplex method Transportation Problem-Formulation, Initial Feasible Solution Assignment Models- Formulation, Optimal solution-Hungarian method

Learning outcomes:

After completing this unit, the student will be able to

- define, contrast between the different terminologies of real time field.(L1)
- outline the wide applicability of operations research technology from agriculture to defense, covering almost all domains of science, arts, commerce and technology.(L2)
- develop optimum solution for numerous problems of operations research by systematic defining, formulating, analyzing, developing an optimum solution and further refining the solution.(L3)
- anticipate a high level of mathematical, analytical and problem solving skills for problems that are of spontaneous nature, whose solution will be individualistic in application.(L6)

Text Book:

1. Anderson, Sweeney, Williams, 2005, An introduction to management science Thomson South Western
2. Barry Render, RalphMStairJr, Michael E Hanna, 2005, Quantitative analysis for management, Pearson Education

Reference Book:

1. Charles A. Gallagher Hugh. J.Watson , 1985, Quantitative Methods for Business Decisions, McGraw Hill international Book Company
2. Frederic S.Hillier, Gerald J.Liberman,2005 Introduction to Operations Research, A Tata McGraw-Hill
3. Gupta M.P. and R.B. Khanna, 2004, Quantitative Techniques for Decision Making, Prentice Hall of India
4. Sharma J.K, 2006, Operations Research Theory and Practice, Macmillan India Ltd.

Course Outcomes:

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

- formulate the real life problems as mathematical programming problems(L6)
- use appropriate mathematical techniques in engineering decision making. (L3)
- use Operations Research Techniques/ Models like Linear Programming, Transportation Model, Project management, for optimal allocation of resources. (L3)
- understand and apply the characteristics of different types of decisions making capabilities. (L3)
- identify real-life problems and choose appropriate tool/technique to model them, being aware of the assumptions underlying the tools.(L3)

19EEI371: SENSORS AND SIGNAL CONDITIONING

L	T	P	C
2	1	0	3

Measurements pervade our life. Industry, commerce, medicine, and science rely on measurements. Sensors enable measurements because they yield electric signals with embedded information about the measurand. Electronic circuits process those signals in order to extract that information. Hence, sensors are the basis of measurement systems. The emphasis of this course is on the design of a sensor and its signal conditioning circuits.

Course Objectives:

- To understand the basic fundamentals of sensors and their characteristics.
- To implement the principles of Resistive sensors and its signal conditioning circuit
- To apply the concepts of Reactance variation and Electromagnetic sensors
- To realize the Self-Generating sensors and its signal conditioning circuits
- To interpret the concepts of Intelligent Sensors & other sensing methods

UNIT I **8L**

Introduction to sensor-based measurement systems: General concepts and terminology, sensor classification, static characteristics & dynamic characteristics of measurement systems **Primary Sensors:** Temperature, pressure, flow velocity and flow-rate, level, force and torque, acceleration and inclination, velocity sensors, microsensor technology.

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

- Understand the basic sensor classification (L1)
- Analyze the Sensor Performance Characteristics(L4)
- Limitations of sensor. (L3)
- Understand about the Different primary sensors. (L1)
- Analyze Purpose of microsensor technology(L4)

UNIT II **8L**

Resistive Sensors: Potentiometers, strain gauges, resistive temperature detectors (rtds), thermistors, magnetoresistors, light-dependent resistors (LDRs), resistive hygrometers, resistive gas sensors, liquid conductivity sensors, **Signal conditioning for resistive sensors:** Measurement of resistance, voltage dividers, Wheatstone bridge: balance measurements, Wheatstone bridge: deflection measurements, differential and instrumentation amplifiers, interference.

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

- Understand the basics resistive sensors
- Describe the signal conditioning for the measurement of resistance
- Explain the basic circuits for Wheatstone Bridge.
- Analyze the Amplifiers circuits.
- Outline the concepts of interference circuits

UNIT III **8L**

Reactance variation and electromagnetic sensors: capacitive sensors, inductive sensors, electromagnetic sensors, **Signal conditioning for reactance variation sensors:** problems and alternatives, ac bridges, carrier amplifiers and coherent detection, specific signal conditioners for capacitive sensors, resolver-to-digital and digital-to-resolver converters.

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

- Working principle of electromagnetic, capacitive, inductive sensors
- Analyze the problems related to AC Bridges.

- Understand the signal conditioning circuits reactance variation sensors
- Illustrate converters of sensors
- Amplify and detect signal conditioning

UNIT IV **8L**

Self-generating sensors: thermoelectric sensors: thermocouples, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors, **Signal conditioning for self-generating sensors:** chopper and low-drift amplifiers, electrometer and transimpedance amplifiers, charge amplifiers, noise in amplifiers, noise and drift in resistors

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

- Understand the basic principles related to temperature sensors.
- Working principle of photodiodes and its types.
- Illustrate the self generating sensors
- Amplify the signal conditioning circuits
- Detect noise and drift in amplifiers & Resistors

UNIT V **8L**

Digital and intelligent sensors: position encoders, resonant sensors, variable oscillators, conversionto frequency, period, or time duration, direct sensor-microcontroller interfacing, communication systems for sensors, intelligent sensors, **Other sensing methods:** Sensors based on semiconductor junctions, sensors based on MOSFET transistors, charge-coupled and CMOS image sensors, fiber- optic sensors, ultrasonic-based sensors, biosensors

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

- Understand the Interfacing circuits
- Working principle related to intelligent sensors
- Outline the concepts of sensors based on semiconductors
- Apply the principle related o Fiber optic sensors
- Illustrate the various Biosensors

TEXTBOOK:

1. Sensors and Signal Conditioning, 2nd Edition,Ramon Pallas-Areny, John G. Webster,John Wiley & Sons, 2000.

REFERENCES:

1. A. K. Sawhney, PuneetSawhney, A Course in Mechanical Measurements and Instrumentation, 1/e, Dhanpat Rai and Company, 2001.
2. D. V. S. Murthy, Transducers and Instrumentation, 1/e, Prentice Hall of India, 1995.
3. D. Patranabis, Sensors and Transducers, 1/e, Prentice Hall of India, 2004.
4. D. Patranabis, Principles of Industrial Instrumentation, 1/e, Tata McGraw Hill Education, 2010.

Course Outcomes:

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

- Classify different types of sensors and their characteristics (L2)
- Build the signal conditioning circuits for different resistive sensors (L3)
- Develop the signal conditioning for reactance variation and electromagnetic sensors (L4)
- Implement the signal conditioning for self-generating sensors (L2)
- 5. Identify the differences between conventional sensors and Intelligent sensors (L1)

19ECY371: APPLICATION OF CHEMISTRY IN ELECTRONICS

L	T	P	C
2	1	0	3

This course enables the students to gain knowledge on various aspects of advanced electrochemical energy systems, solid state chemistry, superconductors and insulators, e-waste, Molecular machines and Molecular switches. The knowledge gained in this course can be applied to the latest developments in technology.

COURSE OBJECTIVES

- To impartknowledge on e-waste, its composition and hazardous material reduction.
- To familiarize the students on fundamentals of electrochemical energy systems and their applications.
- To createawareness on solids.
- To acquaint with the important characteristics of super conductors and insulators.
- To study the characteristics of molecular motors and machines, energy supply.

UNIT I

ADVANCED ELECTROCHEMICAL ENERGY SYSTEMS 9L

Electrodes – concepts, reference electrodes (Ag/AgCl electrode and glass electrode) electrochemical cell, cell potential calculations, numerical problems, Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.
Primary cells –alkali metal sulphide batteries, Fuel cells, methanol fuel cells, Propane oxygen fuel cell – working of the cells.
Secondary cells – nickel-metal hydride - working of the battery including cell reactions, button cells.

Learning outcomes:

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

- explain the significance of electrode potentials (L2)
- compare Ag/AgCl electrode, glass electrode. (L2)
- explain electrochemical sensors. (L2)
- distingushprimary cells and secondary cells. (L4)

UNIT II

Solid State Chemistry 8L

Introduction, classification and properties of solids. Crystallographic systems, types of lattices, Brag's equation, Born-Haber cycle and cohesive energy. Ionic and liquid crystals - properties and applications.

Learning outcomes:

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

- classify solids. (L2)
- compare the properties of solids. (L2)
- explain the Born Haber cycle and cohesive energy. (L2)
- distinguish the different types of liquid crystals. (L4)

UNIT III

SUPERCONDUCTORS & INSULATORS **8L**

Superconductors

Characteristics and applications- Green synthesis:- Principles – 3 or 4 methods of synthesis with examples – R4M4 principles

Insulators –

Definition and Classification with Examples; Characteristics of Insulating Materials; Thermal Insulators, Electrical Insulators - Their Characteristics and Engineering Applications.

Learning outcomes:

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

- define characteristics of insulating materials. (L1)
- illustrate the characteristics and applications of green synthesis. (L2)
- explain R4M4 principles. (L2)
- apply the concepts of superconductors (L3)

UNIT IV

ANALYSIS OF e-WASTE **8L**

Definition of electronic waste, Composition of e-waste (Material composition and metal content of typical end –of life e-waste, Hazardous materials in e-waste), Hazardous materials reduction,Analysis of waste electrical and electronic equipment (WEEE) using laser induced breakdown spectroscopy (LIBS) .

Learning outcomes:

After completion of Unit-IV, the student will be able to

- define e-waste. (L1)
- explain material composition and metal content. (L2)
- explain WEEE and LIBS. (L2)
- demonstrate hazardous materials reduction. (L3)

UNIT V

MOLECULAR MACHINES AND MOLECULAR SWITCHES **9L**

Introduction to supramolecular chemistry, self assembly with suitable examples (self assembly on gold surface), characteristics of molecular motors and machines, energy supply, natural molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor.

Molecular switches – Introduction, cyclodextrin-based switches, in and out switching, back and forth switching, displacement switching,

Learning outcomes:

After completion of Unit-V, the student will be able to

- explain the concept of supramolecular chemistry. (L2)
- illustrate molecular motors and machines (L2)
- identify artificial molecular machines (L3)
- compare Rotaxanes and Catenanes as artificial molecular machines. (L4)
- classify different types of switching. (L4)

Text Books:

1. P.C. Jain and M. Jain, Engineering Chemistry, 15th Dhanapat Rai & Sons, Delhi (2014).
2. Electronic wastes by Hugo Marce;oveit and Andrea Moura , Bernardes,Springer,2015,(ISBN978-319-15713-9)
3. O G Palanna, Engineering Chemistry, Tata McGraw Hill Education Private Limited, New Delhi, 2009.

References:

1. Sashi chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, Delhi.
2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press.
3. Ben L. Feringa and Wesley R. Browne, Molecular Switches, 2/e, Wiley-VCH, 2011.
4. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
5. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
6. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

COURSE OUTCOMES:

After completion of course, the student will be able to

- define electrochemical sensors. (L1)
- classify the different types of liquid crystals. (L2)
- apply the concepts of superconductors (L3)
- apply hazardous materials reduction. (L3)
- explain artificial molecular machines (L5)

19EHS405: OPERATIONS RESEARCH

L	T	P	C
2	1	0	3

This course is to aid decision making and improving efficiency of the system by applying advanced analytical methods. This course addresses a number of quantitative tools and techniques, and provides students with knowledge and skills needed to apply these tools and techniques for decision making in organizations.

Course Objectives:

- To Introduce the basics of Operations research, formulation and solution of Linear Programming Problems using different methods
- To Learn Formulation and solve problems of optimization problems in transportation and assignment of jobs.
- To explore different queuing models and sequencing techniques for optimal schedule of jobs on machines
- To impart knowledge on replacement policies for estimation of economic life of equipment and the concept of game theory to arrive at the optimal business strategy for a given situation.
- To introduce basic inventory models to optimize inventory costs and Project scheduling techniques – CPM & PERT for optimum time and costs

UNIT I **10L**

Basics of Operations Research: History, definition, operations research models, phases of implementing operations research in practice.

Linear Programming: Introduction, formulation, graphical solution, simplex method, artificial variable techniques – Big M and Two Phase methods, concept of duality, dual simplex method.

Learning Outcome:

After completion of Module-I, the students will be able to:

- recognize the significance of Operations Research and mathematical modelling while analysing the practical problems in industry (L1)
- formulate the various linear Programming Models (L6)
- evaluate the optimal solution to simple linear programming problems (L4)

UNIT II **8L**

Transportation Model: Formulation, methods for initial feasible solution, optimal solution – MODI method, unbalanced transportation problems, degeneracy in transportation problems.

Assignment Model: Formulation, optimal solution, Hungarian method, travelling salesman problem.

Learning Outcome:

After completion of Module-II, the students will be able to:

- formulate the linear programming problem as a Transportation model (L6)
- formulate the linear programming problem as an Assignment model (L6)
- evaluate the optimal solution to Transportation Problems (L4)
- evaluate the optimal solution to Assignment Problems (L4)

UNIT III **8L**

Queuing Models: Introduction, Kendall's notation, classification of queuing models, single server and multi-server models, Poisson arrival, exponential service, infinite population

Sequencing Models: Introduction, assumptions, processing n-jobs through two machines, n-jobs through three machines, n-jobs through m-machines, graphic solution for processing 2 jobs through n machines with different order of sequence

Learning Outcome:

After completion of Module-III, the students will be able to:

- define the various queuing models(L1)
- calculate Queue length & waiting time of a given queue system(L3)
- evaluate the optimal sequence of the jobs on machines for minimum cycle time(L4)

UNIT IV **9L**

Replacement Models: Introduction, replacement of items that deteriorate with time - value of money unchanging and changing, simple probabilistic model for replacement of items that fail completely.

Game Theory: Introduction, game with pure strategies, game with mixed strategies, dominance principle, graphical method for 2xn and mx2 games, linear programming approach for game theory.

Learning Outcome:

After completion of Module-IV, the students will be able to:

- analyze the replacement and maintenance costs of items under various replacement policies (L4)
- evaluate the optimal replacement policy of items (L4)
- analyze the players' strategies and thereby Evaluate optimal business strategies for the players (L4)

UNIT V **9L**

Inventory Models: Introduction, inventory costs, Economic Order Quantity (EOQ) and Economic Batch Quantity (EBQ) models with and without shortages, inventory models with quantity discounts

Project Management: Introduction, phases of project management, network construction, numbering the events-Fulkerson's rule, Critical Path Method (CPM), Programme Evaluation and Review Technique (PERT)

Learning Outcome:

After completion of Module-V, the students will be able to:

- recognize the significance of Inventory models & Project Management in real world industrial scenarios (L1)
- differentiate between the critical and non-critical activities of a given project (L4)

- propose the optimal schedule of the activities involved in a project (L6)
- evaluate the optimal order/batch quantity for minimum inventory cost (L4)

Text Book(s):

1. Gupta P K. & Hira D.S., Operation Research, 6/e, S Chand Publishers, 2006.
2. Paneerselvam R., Operations Research, 2/e, Prentice Hall of India, 2010.

Course Outcomes:

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

- develop the mathematical models and Propose the optimal resource allocation (L3&L6)
- formulate and solve transportation & assignment models for optimum resources (L6&L3)
- analyze the queue system and to propose the optimal sequence of jobs on machines (L4 & L6)
- evaluate the optimal replacement policy of the equipment and to analyze the strategic interaction between rational decision-makers (L6&L4)
- design the inventory systems and to plan the project activities (L6)

19ECE371: DISASTER MANAGEMNET

L	T	P	C
2	1	0	3

Most of the hazards turn into disasters due to unsustainable activities of human beings and cannot be completely avoided.However,the impact can be mitigated by proper planning, preparedness and organizing at various levels. Civil Engineers may have to work in varied locations where in they have to encounter a variety of disaster scenarios. Hence, they need to have adequate knowledge to deal with these disasters. This subject is aimed at providing a detailed understanding of various phases of disaster management, vulnerability profile and organizational structure of disaster management in India, and applications of science & technology for better disaster management.

Course objectives

- Familiarize Disaster management activities and phases
- Demonstrate the Vulnerability profile of India towards various disasters
- Explain the Components of disaster relief, disaster management policies
- Enable latest trends in disaster management
- Expose outcomes from various disasters in India

UNIT I **9 L**

Introduction to disaster management: Basic terminology (hazard, vulnerability, disaster, risk, exposure, resilience, capacity), classification of disasters, disaster mitigating agencies and their organizational structure at different levels (NDMA, NDRF, SDMA, DDMA), disaster management cycle.

Learning outcomes

After completion of Unit-I, students will be able to

- list various terms related to disaster management (L-1).
- classify various types of disasters (L-2).
- illustrate the organizational structures of disaster mitigating agencies (L-2).
- outline the significance of Disaster Management Cycle (L-2).
- explain the disaster management cycle (L-3).

UNIT II **8 L**

Vulnerability of profile of India: Vulnerability towards wind and cyclone, floods, earthquakes, heat waves, cold waves, dust storms, droughts, tsunamis, landslides, forest fires.

Learning outcomes

After completion of Unit -II, students will be able to

- explain the vulnerability scenario of India with respect to various disasters (L-2).
- select the vulnerable zones with respect to various disasters in India (L-3).

UNIT III **8 L**

Components of disaster relief: Water, food, shelter, protection and security, sanitation, health, waste management, financial assistance.

Institutional arrangements: Disaster management act 2005 and national policy on disaster management 2009.

Learning outcomes

After completion of Unit -III, students will be able to

- state the components of disaster relief (L-1).
- illustrate the significance of disaster relief components (L-2).
- explain the significance of institutional arrangements (L-2).

UNIT IV **9 L**

Applications of science and technology for disaster management: Geo-informatics in disaster management (RS, GIS, GPS), disaster communication system (early warning and its dissemination), land use planning and development regulations, disaster safe designs and constructions, structural and non-structural mitigation of disasters.

Learning outcomes

After completion of Unit -III, students will be able to

- explain the significance of Geo-informatics in disaster management**,** disaster safe designs and constructions (L-2).
- demonstrate the functioning of disaster communication system (L-2).
- outline the land use planning and development regulations (L-2).

UNIT V **8 L**

Case studies: Related to various recent disasters of earthquake, tsunami, cyclone, flood, drought, landslides, volcanic eruption, forest fire, heat wave, cold wave.

Learning outcomes

After completion of Unit -III, students will be able to

- name various disasters occurred in India and worldwide (L-1).
- identify major disasters in each category (L-3).
- analyze various disaster management case studies (L-4).

Text BooK

1. **R.B.Singh, Disaster Management, Rawat Publications, 2000.**

Reference Book

1. Iyengar, Natural Hazards in the Urban Habitat, C.B.R.I., Tata McGraw Hill, 1997.
2. Jon Ingleton, Natural Disaster Management, Tulor Rose Holdings Pvt. Ltd., 1999.

Course outcomes:

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

- classify various types of disasters and explain disaster management cycle (L-2).
- explain the vulnerability scenario of India with respect to various disasters (L-2).

- demonstrate the significance of disaster relief components, institutional arrangements (L2).
- apply the knowledge of geo-informatics, communication system in disaster Management (L-3).
- analyse various disaster management case studies (L-4).

19ECS391- COMPREHENSIVE SKILL DEVELOPMENT -IV

Soft Skills and Quantitative Aptitude	**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

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

19EOE301: JAPANESE FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Introduction to Japanese language, simple explanation of writing and pronunciation systems, characteristics of Japanese, grammar, meeting people, introductions, exchanging business cards, identifying people and things, useful daily expressions.

Unit II **8 hours**

Asking about business hours, shopping, time and numbers, large numbers, counters. Grammar: Pronouns and noun modifiers. Useful daily expressions.

Unit III **8 hours**

Getting around, confirming schedules (including going/coming), visiting another company (including month/week/day). Grammar: Motion verbs. Useful daily expressions.

Unit IV **8 hours**

Existence of people and things, asking/telling location, dining out, making plans for a weekend. Grammar: State of being/existence, basic verbs. Useful daily expressions.

Unit V **9 hours**

Giving and receiving, expressing gratitude, talking about plans (usage of Te-Form), Grammar: Adjectives, present form of i-adjective, present form of na-adjective, past forms of i-adjective and na- adjective, the Te-Form. Useful daily expressions.

References

1. Ajalt, Japanese for Busy People: Romanized Version Volume 1, 2006.

*Study through Romanized Textbook - No reading/writing in Japanese letters 188

19EOE303: FRENCH FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Asking for and giving personal information, asking for and giving directions, gender and number. Grammar: Verbs "avoir" and "etre", present tense, questions, vocabulary: countries and nationalities, professions, family, food

Unit II **8 hours**

Asking and giving the time, asking when something is open or someone is available, asking for prices and describing what one wants. Grammar: Alphabet and numbers, possessive adjectives, negative sentences. Vocabulary: Days of the week, months, money.

Unit III **8 hours**

Asking for information related to travel and accommodation, expressing one's wants/needs. Grammar: Present tense for verbs in -er, -ir and -re, present tense of irregular verbs. Verbs: to be able to, to want, to know. Vocabulary: Food, shops, packaging and measures.

Unit IV **8 hours**

Talking about daily routine and the working day, describing things, expressing oneself when buying things. Grammar: Possessive pronouns, reflexive verbs. Vocabulary: Clothes, colours and shapes, weather.

Unit V **9 hours**

Describing places; visiting the doctor, reading short advertisements, describing places, feelings and symptoms. Grammar: Using avoir aller, etre faire, vouloir pouvoir. Vocabulary: Parts of the body, rooms and features of interior spaces.

Textbook (s)

1. LE NOUVEAU SANS FRONTIÈRES - Workbook CD and selected passages/ exercises 189

References

1. LE NOUVEAU SANS FRONTIÈRES -

19EOE305: BIOTECHNOLOGY AND SOCIETY

L	T	P	C
3	0	0	3

Unit-I **9 hours**

History of Biotechnology, Genes (basic concepts) Genetic Engineering Inventions, Genetic engineering, Tools for manipulation of genes (introduction to recombinant DNA technology) Vectors and expression systems (introduction) Genomic engineering (concepts and potential applications)

Unit-II **9 hours**

Intellectual property rights (concepts related to drugs, genes and genomes) Recombinant DNA Debates, Biotechnology and Business, Patenting Life, Genetically Modified Foods: Risk, Regulation, and Our Food

Unit-III **8 hours**

Freezing, Banking, Crossing, Eugenics, The Human Genome Project, Genetic Testing, Disability, and Discrimination, Bioethics and Medicine, From the Pill to IVF, Cloning, Stem Cells.

Unit-IV **8 hours**

Drugs and Designer Bodies, Personal Genomics, Biotechnology and Race, Bioprospecting and Bio colonialism

Unit-V **8 hours**

Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Use of biofertilisers and biopesticides for organic forming

Text books:

1. Biotechnology and Society: An introduction. Hallam Stevens. University of Chicago Press. 2016. ISBN 022604615X, 9780226046150

References:

1. W. Godbey, An Introduction to Biotechnology, The Science, Technology and Medical Applications, 1/e, Woodhead Publishing, 2014.
2. J.M. Walker and R. Rapley, Molecular Biology and Biotechnology, 5/e, Royal
3. society of chemistry, 2009.
4. B.R.Glick, J.J.Pasternak, C.L.Patten. Molecular Biotechnology.ASM Press. 2009. ISBN-10: 1555814980, ISBN-13: 978-1555814984s

19EOE307: CONTEMPORARY RELEVANCE OF INDIAN EPICS

L	T	P	C
3	0	0	3

Unit I **8 hours**

Reading the Texts: Reading for gist, chapter summaries, plot, pair work and discussions in small groups.

Unit II **8 hours**

Understanding the Texts: Basic themes, characterization-major characters, watching short videos followed by discussion, analysis and writing short reviews.

Unit III **8 hours**

Story Retelling and Responsive Writing: Narrating short episodes, enacting select scenes, role play, writing short paragraphs and short essays based on basic themes, plot and major characters.

Unit IV **9 hours**

Exploring the Texts from Socio-cultural and Political Perspectives: Identifying examples of mutual co-existence, duties and responsibilities of individuals in the context of family and society, righteous action, conflict between good and evil, possibilities of redefining cultural and political systems, identifying spaces for reconciliation in conflict situations.

Unit V **9 hours**

Contemporary Relevance of the Epics: Human relations, team play, leadership lessons, resource management, core competencies and competitiveness.

References

1. C. Rajagopalachari, Ramayana, 44/e, Bharatiya Vidya Bhavan, Mumbai, India, 1951.
2. C. Rajagopalachari, Mahabharata, 57/e, Bharatiya Vidya Bhavan, Mumbai, India, 2012.
3. R. K. Narayan, The Mahabharata: A Shortened Modern Prose Version of the Indian Epic, Penguin Group, 2009.
4. R. K. Narayan, The Ramayana: A Shortened Modern Prose Version of the Indian Epic, Penguin Classic, 2006. 190

19EOE309: INDIAN NATIONAL MOVEMENT

L	T	P	C
3	0	0	3

Unit1
9 hours

Background: Early British colonialism in India, early rebellions-Pazhassi Raja (the cotiote war - Kerala, 18th century), Veerapandiyan Kattabomman (Tamilnadu/Madras Presidency - 18th century), Paik rebellion (Kalinga/ Odisha, early 19th century), Vellore mutiny (early 19th century); The Sepoy Mutiny of 1857 and its consequences.

Unit II **8 hours**
Contributory Factors: Socio-political consciousness, growth of Western education and its impact on socio-religious movement, British economic policies and their impact.

Unit III **8 hours**
Rise of Organized Movements: Emergence of Indian national congress, its policies and programmes, partition of Bengal, rise of radical nationalists, Bal-Lal-Pal, formation of the Muslim league; Minto- Morley reforms, the national movement during the first world war.

Unit IV **9 hours**
Gathering Momentum: Non-cooperation and civil disobedience, emergence of Gandhi, some prominent revolutionaries - Khudiram Bose, Prafulla Chaki, Bhupendra Nath Dutt, V.D. Savarkar, Sardar Ajit Singh, Lala Hardayal, Sardar Bhagat Singh, Raj Guru, Sukh Deo, Chandra Shekhar Azad, development ofsocialist ideas, communal divide.

Unit V **8 hours**
Towards Independence: Constitutional developments, provincial elections, quit India movement and after, participation of women, national movement during the second world war, Indian national army, naval mutiny of 1946, freedom and partition, impact on the world.

References

1. K. Majumdar, Advent of Independence, Bhartiya Vidya Bhavan, Mumbai, 1969.
2. R. Desai, Social Background of Indian Nationalism, 5/e, Popular Prakashan, Mumbai, 1976.
3. Bandyopadhyay, Sekhar, Nationalist Movement in India: A Reader, Oxford University Press,2008.
4. Chandra, Bipin, Nationalism and Colonialism in Modern India, Orient Longman Limited,New Delhi, 1979. 191

19EOE313: PERSONALITY DEVELOPMENT

L	T	P	C
3	0	0	3

Unit I **8 hours**

Self Awareness: Know yourself, have a snapshot of yourself, assess your personal traits, discovernatural potential. Activities and Tasks: Class discussion, questionnaires, Johari Window, SWOC analysis (strengths, weaknesses, opportUNIT Ies and challenges).

Unit II **8 hours**

Self Discipline: Importance of self discipline, characteristics of a self disciplined achiever, self discipline in personal life and career. Activities and Tasks: Viewing short videos followed by discussion and analysis, brainstorming in small groups, creating an action plan to realize academic and career goals.

Unit III **8 hours**

Motivating Oneself: Self motivation, confidence building, goal setting, decision making. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

Unit IV **9 hours**

Managing Oneself: Handling emotions, time management, stress management, change management. Activities and Tasks: Discussion and analysis of case studies, completing self- assessment questionnaires.

Unit V **9 hours**

Interpersonal Behaviour: Attitude towards persons and situations, team work, leadership skills, problem solving skills, interpersonal adaptability, cultural adaptability. Activities and Tasks: Team-building games and activities.

References

1. Hurlock Elizabeth B., Personality Development, McGraw Hill Education, India, 1979.
2. Covey, Stephen R., The 7 Habits of Highly Effective People: Powerful Lessons in PersonalChange, Free Press, 2004.
3. Carnegie, Dale, Levine, Stuart. R., The Leader In You: How to Win Friends, InfluencePeople and Succeed in a Changing World, Pocket Books, 1995.
4. Swami Vivekananda, Personality Development, Advaita Ashrama, 1993.

*This will be supplemented by materials and activities from internet-related sources.

19EOE224: VIRTUAL REALITY

L	T	P	C
1	0	4	3

Summary

Virtual Reality extends the boundaries of the physical environment by providing a never ending real estate on which an infinite number of worlds can be built to learn, explore and visualise. In order to empower interested students by providing them with an opportunity to learn a cutting-edge technology like VR and getting skilled for industry while in university, Facebook School of Innovation powered by SV.CO, has provided a VR skill pathway offering VR 201 (Beginner), VR 301 (Intermediate) and VR 401 (Advanced) level course.

Course Objectives

The objective of this course is to introduce the students to learn about Virtual Reality and the skills required to become a Unity VR developer.

Course Outcomes

By the end of the course, the student should be:

- well versed with the concepts of VR,
- able enough to understand, articulate and criticize VR experiences/applications in sufficient detail
- able to execute the concepts into demonstrable examples,
- able to understand the requirements and the skillset to be a VR developer in the current economy.

Skills required

None (But a basic understanding of VR, Unity, and C# will be helpful)

Skills acquired

- Basic VR Developer (Oculus Platform)
- Basic Unity Developer (Wireframing/Storyboarding, Level Designing, C# Programming)

Project

Build a basic Virtual Reality application that allows the student to exercise all the fundamental knowledge gained in the course

Course Syllabus

Level 1 : Introduction to VR and Unity3D

M1: Keep it Virtual (Introduction to VR)
M2: Platforms and Paradigms
M3: Unity, Diversity (Introduction to Unity 3D)
M4: Ready Player One (Getting Started in Unity)
M5: Oh Hello World (Deploying your First App to Oculus Quest or Go)

Level 2 : Components of Unity

M1: Materials and Meshes
M2: Lights, Camera, VR

M3: I like to Move it (Animation in Unity)

Level 3 : Scripting in Unity #1

M1: Basics of C# in Unity #1
M2: Basics of C# in Unity #2

Level 4 : Scripting in Unity #2

M1: Let's Code #1
M2: Let's Code #2

Level 5 : Oculus Quest (Go) and its basics

M1: Oculus Inputs and UI Fundamentals
M2: Events and Buttons

M3: Buttons and the Joystick

Level 6 : Fundamentals of Unity Physics and Visual Effects

M1: Action, but Reaction? (Physics, Colliders, Raycast)
M2: More Controller Interactions

M3: Visual Effects

Level 7 : Design and Debug

M1: Debug.Log("This is where it breaks")
M2: VR Design
M3: Documentation and Unity Collab

Level 8 : Performance in Unity and Easter Eggs (Optional Level)

M1: Device Performance
M2: Easter egg #1
M3: Easter egg #2

Capstone Project Targets

P1: Level Design and UI
P2: Mechanics, Navigation and Deploy

Continuous Evaluation Plan (100 marks)

Milestones Based Evaluation (50 marks):

- Each level has a graded target where the students demonstrate their understanding of the content and get feedback.
- Each target is evaluated for 5 marks.
- These targets from Level 1 to 8 will contribute to the internal marks. Level 8 is optional.
- Marks received out of 35 / 40 (if Level 8 is attempted) are scaled up to 50.

Project Evaluation (50 marks):

This will have two components:

1. Capstone Project linked Targets:
   a. Students will complete extra targets from which will contribute to a mini project /capstone work.

2. Viva Q&A
    a. Students are given a small task on the spot to complete based on the course, and/or asked a few questions to check their understanding of the course by an industry expert.

Annexure (Optional)

Checklist for students in VR201 to be eligible for the startup-aligned project

1. Interest was shown to build a startup in the pre-course interest form. (Likely teamed up)
2. The 4 highest scorers of the students (team of 2) that also show continuing interest in building a startup at the end of the 6 weeks in the program get to choose the problem statements (discussed and worked with coaches/TAs to structure into outcomes) that they get to work on.
3. In case the students choose not to go with their self-described problem statement then the next in the list in terms of scores top-down gets a chance. And if nobody later during the program wishes to go with their self-described problem statement, they'll go with the problem statement given out in the program anyway.

19EOE323: INDIAN HISTORY

L	T	P	C
3	0	0	3

Unit I **10 Hours**

Ancient Indian History and Culture (Earliest Times to 700 AD): Indusvalley civilisation, origin, significance. art and architecture, aryans and vedic period, expansions of Aryans in India, significance of the vedic age, evolution of monarchy and varna system, political conditions and admin-istration under Mauryas, Guptas, social and economic conditions in an-cient India, philosophy and religions in ancient India.

Unit II **8 Hours**

Medieval Indian History and Culture: Delhi sultanate, great mughals,bahumanis, rise of south supremacy and conflicts, Pallava, Chalukya, Chola and Rasthrakutas.

Unit III **8 Hours**

Modern Indian History and Culture: European penetration into India,the Portuguese and the Dutch, the English and the French east India com-panies, their struggle for supremacy, the battle of Plassey and its signifi-cance, consolidation of British rule in India.

Unit IV **8 Hours**

Impact of British Colonial Rule: Economic: Commercialization of ag-riculture, dislocation of traditional trade and commerce, de-industrialisation, decline of traditional crafts, drain of wealth, famine and poverty in the rural interior. Social and Cultural Developments: The state of indigenous education and its dislocation, orientalist, anglicist controversy, introduc-tion of western education in India, the rise of print media, literature and public opinion, the rise of modern vernacular literature, progress of sci-ence, rail and road connectivity.

Unit V **8 Hours**

The Rise of Indian National Movement: Indian response to British rule,the great revolt of 1857, the peasant movements of the 1920s and 1930s, the foundation of the Indian national congress, the moderatesand extrem-ists, the partition of Bengal (1905), the swadeshi movement in Bengal, the economic and political aspects of swadeshi movement. Gandhian nationalism: Gandhi's popular appeal, Rowlett Act, satyagraha, the Khilafat movement, the non-cooperation movement, civil disobedience movement, Simon commission, the peasant and working class movements, Cripps mission, the quit India movement, declaration of independence.

Text Book(s)

1. Romila Thapar, A History of India, Vol. I, Penguin Books, 2013.
2. R.C. Majumdar, The History and Culture of the Indian People: Volume 1, The Vedic Age, Bharatiya Vidya Bhavan, 2010.
3. B. L. Grover, Modern Indian History: From 1707 to the Modern Times, S. Chand, 1998.
4. R.C. Majumdar, History of the Freedom Movement in India, South Asia Books, 1988.

References

1. D. N. Jha, Ancient India in Historical Outline, Manohar Publishers and Distributors, 2001.
2. G. S. Chabra, Advanced Study in the History of Modern India, Lotus Press, 2007.
3. M.K. Gandhi, Hind Swaraj: Indian Home Rule, Sarva Seva Sangh Prakashan, Varanasi, 2014.
4. W. W. Hunter, History of British India, Read Books Design, India, 2010.
5. A. R. Desai, Social Background of Indian Nationalism, 6/e, Popular Prakashan, 2005

19EOE327: PROFESSIONAL COMMUNICATION

L	T	P	C
3	0	0	3

Unit I **8 hours**

Internal Communication: Memo-structure, layout and style, e-mail-structure, style, content and etiquette, notice-structure, content and layout, conducting a meeting, purpose and preparation, drafting agenda and minutes, conducting effective meetings, meeting etiquette.

Unit II **9 hours**

Making a Business Presentation: Planning-define the purpose, analyze audience and occasion, preparation-developing central idea, main ideas, gathering supporting materials, audio-visual aids, organization-introduction, body and conclusion, delivery-addressing the audience, body language, eye contact, use of appropriate language, style and tone.

Unit III **8 hours**

Business Letters: Form and structure, style and tone, letters of enquiry, letters placing orders/ giving instructions/urging action, letters of complaint and adjustment.

Unit IV **9 hours**

Proposals and Reports: Proposals, types, structure, prefatory parts, body of the proposal, supplementary parts, reports, types, informative, analytical, formal/informal, oral/written, individual/group, format and structure.

Unit V **8 hours**

Resume, Cover Letter, Interview and Telephone Etiquette: Resume, design and structure, cover letter, cover letters, accompanying resumes, opening, body, closing; Interview, planning, purpose, pre-interview preparation, conversation, two-way interaction, projecting a positive image, telephone etiquette- guidelines for telephone conversations in a professional context.

References

1. Seely, John, Oxford Guide to Effective Writing and Speaking, Oxford University Press, India, 2013.
2. Olsen Leslie, Huckin Thomas, Technical Writing and Professional Communication for Non-Native Speakers, McGraw Hill, 1991.
3. Rizvi, M. Ashraf, Effective Technical Communication, Tata McGraw Hill, 2005. 193

19EOE321: ENVIRONMENT AND ECOLOGY

L	T	P	C
3	0	0	3

Unit I **8 hours**

Basic Concepts: Environment types, features of environment, structureof atmosphere, earth's four spheres, ecology, ecological principles, pho-tosynthesis, components of ecosystem, carbon and oxygen cycles, nitrogen, hydrological, sedimentary, phosphorous and energy cycles.

Unit II **8 hours**

Biomes: Terrestrial biomes, Aphine Tundra biomes, extinction of species.Bio-diversity: Biodiversity in American contents, Europe, central Asia and Africa. Categorization of species, biogeographic zones of India, biodiversity conservation, strategies, biodiversity conservation in India.

Unit III **8 hours**

Environmental Degradation and Management: Greenhouse effect andglobal warming, acidification, world distribution of acid rain, impact of acid of precipitation, ozone depletion, Antarctic ozone hole, some basic facts about ozone depletion, salinisation, desertification or desertisation, soil erosion, types of soil erosion, soil conservation, deforestation, waste disposal, sustainable development.

Unit IV **8 hours**

Natural Hazards and Disaster Management: Disaster, natural hazards,earthquakes in India, seismic zones of India, earthquake prediction, tsu-nami, landslides, types of landslides, avalanches, cyclones, thunderstorms, tornadoes, surge, sea-surge or storm surge. Floods: floods in India, flood disaster management. Drought hazards: causes of droughts, consequences of droughts, biological hazards and disasters, famines, wildfire (forest fire), forest fires in India.

Unit V **8 hours**

Climate Change: Evidence of global warming, consequences of climaticchange, consequences of climate change in India. Biodiversity and Leg-islation: Earth summit, the five earth summit agreements, the Montréal protocol, Kyoto protocol on climatic change.

Text Book(s)

1. Majid Husain, Environment and Ecology, 2/e, Access Publishing, New Delhi, 2014.

References

1. S. V. S. Rana, Essentials of Ecology and Environmental Science, Prentice Hall India, New Delhi, 2011.

19LOE301: FUNDAMENTALS OF CYBER LAW

L	T	P	C
3	0	0	3

Objectives: *The objective of this course is to make students familiar with the developments that are taking place in different areas of study with the help of Computer and Information Technology. The students will acquire knowledge in national and international legal order on the Fundamentals of Cyber Laws. The abuse of computers has also given birth to a gamut of new age crimes that are addressed by the Information Technology Act, 2008 (as amended). The chief aim of this course is to encourage inter- disciplinary studies.*

UNIT-I **8 hours**

Conceptual and theoretical perspectives of Cyber Law - Computer and Web Technology –Evolution of Cyber Law – National &International Perspectivesof Cyber Law - Legal Issues &Challenges in India, USA and EU - Data Protection - Cyber Security, etc.

UNIT-II **8 hours**

International Perspectives - Budapest Convention on Cybercrimes - ICANN's core principles and the domain names disputes - Net neutrality - EU electronic communications regulatory framework - Web Content Accessibility Guidelines (WCAG).

UNIT-III **9 hours**

Information Technology Act, 2008 as amended - Overview of the Act - Jurisdiction -Electronic Governance - Electronic Evidence (Relevant portions of Indian Evidence Act) - Digital Signature Certificates (DSCs) - Duties of Subscribers of DSCs - Role of DSC Certifying Authorities - The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability – Powers of Police - Impact of the Act on other Laws - Social Networking Sites vis-à-vis Human Rights.

UNIT-IV **9 hours**

Cyber Laws vis-à-vis IPRs - Copyright in Information Technology - Software - Copyrights Vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Patents - European Position on Computer related Patents - Legal position of U.S and India on Computer related Patents - Trademarks in Internet - Domain name registration - Domain Name Disputes & World Intellectual Property Organization (WIPO) - Databases in Information Technology - Protection of database in USA, EU &India.

UNIT-V **8 hours**

Mobile Technology- SIM (Subscriber Identity Module) cloning–Mobile frauds - Usage of mobile software - Special reference to the relevant provisions of IT ACT 2008, India Penal Code and Evidence Act.

Textbooks:

1. Yatindra Singh : Cyber Laws
2. Vakul Sharma, Handbook of Cyber Laws

References:

1. Linda Brennan and Victoria Johnson: Social, ethical and policy implication of Information Technology.
2. Kamath Nandan : Law relating to Computer, Internet and E-Commerce.
3. Mike Godwin: Cyber Rights Defencing free speech in the Digital Age.

GEL244: ENGLISH FOR HIGHER EDUCATION

L	T	P	C
3	0	0	3

Introduction

The course aims to provide students with the knowledge and practical skills required to take globally-recognized tests of English language proficiency. This preparatory course will enable students to achieve the required band score by providing opportUNIT Ies to practise the strategies for effective use of the four language skills, in addition to application of the standard language rules. The integrated skills approach, exercises in various question/task types, and mock tests give the students ample exposure to the test conditions.

Course Objectives

- To provide comprehensive training to students for various English language proficiency tests that are prerequisite for admission into higher education programs
- To facilitate the required practice in each of the four skills, as well as language elements such as pronunciation, vocabulary and grammar
- To enable students to take the test/s with confidence by discussing, practicing, and analyzing each section/task type of the test
- To determine students to communicate opinions and information on everyday topics and common experiences effectively in English.
- To hone students writing skills through consistent guidance and practice of every subskill of writing.
- To offer a wide variety of reading topics/texts over the course, maintaining students' interest and giving a sense of meaningful progress in their reading comprehension ability.
- To enable the students to practice vocabulary and grammar in context integrating with four skills.

Unit 1: Listening **8 hours**

Listening for main ideas, gist and opinions; listening for specific information; understanding different accents

Task types: Form completion, table completion, pick from a list, matching, flow chart completion, note completion, multiple choice, labelling a diagram, labelling a plan, sentence completion and short answer questions.

Learning Outcomes

At the end of the unit, the learners will be able to

- comprehend the main ideas, specific information, and opinions presented in listening inputs that include short talks, conversations, transactional dialogues, and short discussions in general and academic contexts
- demonstrate ability to handle various listening comprehension tasks
- understand various native and non-native accents and respond correctly and appropriately to various questions

Unit 2: Speaking **8 hours**

Using appropriate vocabulary and correct grammar; demonstrate awareness of chunking while speaking; speaking about oneself; speculating and talking about the future; addressing abstract topics; paraphrasing; generalising and distancing; speculating and hypothesising; giving reasons and examples; discussing advantages and disadvantages; structuring a talk; speaking fluently for short duration on specific topics; making useful notes to respond effectively to questions asked; understanding questions and giving

appropriate answers
Task Types: Responding to questions on a range of personal topics in general and academic contexts; speaking based on specific verbal prompts: giving a structured coherent talk with adequate fluency, a clear introduction and effective conclusion; participating in a discussion of abstract concepts or general topics which are thematically linked
Learning Outcomes
At the end of the unit, the learners will be able to
- respond to general questions on personal, academic and professional information using appropriate and correct language
- demonstrate adequate fluency and speak coherently on a specific topic using the given prompts
- express and justify opinions, analyse, and speculate about issues in discussions
- present abstract concepts thematically using appropriate examples and reasons

Unit 3: Reading **9 hours**
Skimming for main ideas/themes/topics; scanning for details and locating specific information; understanding a process or the flow of information presented; distinguishing examples from main ideas; understanding factual, inferential, analytical and extrapolative texts; understanding gist and paraphrase; identifying authors' opinions/attitude
Task types: True/false/not given, sentence completion, note completion, summary completion, table completion, flow chart completion, pick from a list, multiple choice, short answer questions, matching headings, matching information, matching features, matching sentence endings
Learning Outcomes
At the end of the unit, the learners will be able to
- understand the gist, specific information, and opinions presented in a text, and distinguish examples from main ideas
- demonstrate understanding of the author's opinions as presented in a text
- use suitable strategies to answer various question types that test comprehension

Unit 4: Writing **9 hours**
Paragraph writing: interpretation of graphical data such as charts and tables; essay writing: argumentative and persuasive; organising ideas in writing to achieve coherence; grouping information/ideas in paragraphs and linking paragraphs; writing suitable introduction and conclusion to the given tasks; signalling, comparing and contrasting, presenting a balanced view; selecting and summarising main features; analysing the task requirements and planning an answer; summarising information/key features/trends in a diagram/chart/table; categorising data; brainstorming for ideas; introducing argumentsand maintaining a clear position using reasons and examples for support
Task types: Describing, summarising, and explaining data presented in a chart/table, describing the stages of a process or how something works; describing an object or an event; writing essays in response to a point of view, an argument, an issue, or a problem
Learning Outcomes
At the end of the unit, the learners will be able to
- demonstrate that they have had adequate practice in preparing drafts, revising, editing and rewriting in order to ensure task accomplishment
- produce descriptive/ narrative paragraphs based on their understanding of the data/information presented in various forms such as diagrams, charts, and tables
- write structured and coherent argumentative/ persuasive essays using use a range of vocabulary and correct grammar

Unit 5: Grammar and vocabulary in context **8 hours**

Tenses; phrasal verbs; idiomatic expressions; verb+noun collocations; collocations and phrases with *make*, *take, do* and *have;* negative affixes; adjectives+noun collocations; verbs and dependent prepositions; nouns and articles; discourse markers; punctuation; linking and pausing; intonation, word stress, speech rate and chunking; vocabulary to express amount extent or category, comparisons and contrasts, agreement and disagreement

Learning Outcomes

At the end of the unit, the learners will be able to

- apply knowledge of language for better comprehension of reading texts and listening inputs
- demonstrate knowledge of correct use of tense forms, prepositions, articles, adjective-noun collocations, and appropriate structures in speech and writing
- use idiomatic expressions, and phrasal verbs in suitable contexts, and draw upon a wide range of vocabulary for effective oral and written communication
- organising ideas in written and oral communication using appropriate discourse markers, and punctuation/pauses

References

1. Seely, John.*Oxford Guide to Effective Writing and Speaking.*Oxford University Press, (India), 2013
2. Rizvi, M Ashraf. *Effective Technical Communication*.Tata McGraw Hill. 2005.
3. Olsen, Leslie & Huckin, Thomas.*Technical Writing and Professional Communication for Non-native Speakers.*McGraw-Hill.1991

19EOE319: INTRODUCTION TO MUSIC

L	T	P	C
3	0	0	3

Unit I **8 hours**

Introduction to Indian Classical Music: Heritage-Contribution of vari-ous races and tribes to the evolution of music in India, technical aspects of Indian classical music, influences Persian music especially on hindustani music, significance of music in bringing about social change.

Unit II **9 hours**

History of Indian Music: Origin-Vedas, scriptures and bharata'snatyasastra, traditions- hindustani and carnatic, basic elements, shruthi, swara, raaga and taala, similarities and variations in hindustani, carnatic and western classical music, octave, semitones, introduction to shruthi, swara, raaga and taala, fundamental ragas, importance of taala in indian music, introduction to pallavi, anupallavi and charana.

Unit III **8 hours**

Hindustani Music: Brief history of hindustani music, concepts of raagaand taala, introduction to various gharanas, classification of music (folk, semi-classical, bhajans, light), appreciation of music.

Unit IV **8 hours**

Carnatic Music: History of carnatic music, traditions, the musical trinity,Syama Sastri, Thyagaraja, Muthuswami Dikshitar, introduction to tech-nical terms in carnatic music, compositional forms/strategies.

Unit V **9 hours**

Connections-Music, Art and Culture: Musical oral tradition as a trans-mitter of culture, music as an expression of societal change, music as a means of communication across cultures.

References

1. Rangaramanuja Iyengar R., History of South Indian Carnatic Music: From Vedic Times To The Present, Wilco Publishing House, 1972.
2. Beni Madhab Barua, Swami Prajnanananda, The Historical Development of Indian Music: A Critical Study, Buddh Gaya, India, 1973.
3. G.H. Ranade, Hindustani Music, Popular Prakashan, 1971.

19EID234: LIFE SCIENCES FOR ENGINEERS
(for admitted batch 2020-21)

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).

19ECS332: COMPILER DESIGN

L	T	P	C
3	**0**	**2**	**4**

Compilers play a significant role in fulfilling user's computing requirements, specified in terms of programs in a high-level language, which translate into machine-understandable form. The process involved in such a transformation of a program is quite complex. This course enables the students to gain knowledge on various phases involved in designing a compiler. Automata Theory and Formal Languages provides the basis for this course in which several automated tools help construct various phases. Advanced computer architecture, memory management, and operating systems help the compiler designer generate efficient code.

Course objectives:
- Explore the basic techniques that underlie the principles, algorithms and data structures involved in the Compiler Construction.
- Gain experience in using automated tools that helps in transforming various phases of the compiler.

UNIT I: Introduction & Lexical Analysis 8+4 T+P

Introduction: The Structure of Compiler, The Science of Building a Compiler in Bootstrapping and Cross compiler.

Lexical Analysis: The role of the Lexical analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical Analyzer Generator (LEX/FLEX).

Learning Outcomes:
After completion of this unit, the student will be able to
- summarizing various phases involved in the design of compiler construction(L2)
- comparing methods involved in constructing the compiler(L2)
- highlighting how regular expressions help to design the Lexical Analysis phase(L1)
- exploring how LEX Tool simplifies the design of the Lexical Analysis phase(L2)

UNIT II: Syntax Analysis (Part-I) 8+6 L+P

Introduction, Context-Free Grammars, Top-Down parsing: Brute force Parsing, Recursive Descent Parsing, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing, Bottom-Up parsing - Shift Reduce Parsing, Operator-Precedence Parsing, Error Recovery in Operator Precedence Parsing.

Learning Outcomes:
After completion of this unit, the student will be able to
- design the possible ways of constructing Syntax Analysis Phase (L3)
- identifying the issues involved in creating an efficient Top-Down (LL) parser(L1)
- implementing both bottom-up and top-down parsers (L3)
- illustrating the deficiencies in the design of basic Bottom-Up parsers(L4)

UNIT III: Syntax Analysis (Part-II) 8+3 L+P

Introduction to LR Parsing: Simple LR Parser, More Powerful LR Parsers, Using Ambiguous grammars, Error Recovery in LR Parsers, Parser Generator (YACC).

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

- identifying the issues involved in designing efficient Bottom-Up (LR) Parses(L1)
- predicting the role of look-ahead in LR parsers(L2)
- illustrating the significance of using ambiguous grammars in LR Parses(L4)
- assessing how YACC Tool simplifies the design of Parser(L5)

UNIT IV: Syntax Directed Translation & Intermediate Code Generation 8+2 L+P
Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation.

Intermediate Code Generation: Three Address codes, Types & Declarations, Translation of Arithmetic Expressions, Back patching for Boolean Expressions, and Flow of Control.

Learning Outcomes:
After completion of this unit, the student will be able to
- summarizing the notational framework of Syntax Directed Definitions(L2)
- designing Syntax Directed Definitions to generate intermediate code(L3)
- illustrating various techniques to store three address statements(L3)
- designing Syntax Directed Definitions for Boolean expressions using back patching (L3)

UNIT V: Code Optimization & Code Generation 8 L
Code Optimization: The Principal Sources of Optimization, Basic blocks and Flow Graphs, Optimization of Basic Blocks, Introduction to Data-Flow Analysis: Live Variable Analysis

Code Generation: Issues in designing a code Generator, The Target Language, A Simple Code Generator, Peephole Optimization, Register allocation, and Assignment.

Learning Outcomes:
After completion of this unit, the student will be able to
- identifying issues involved in the machine-independent code optimization(L1)
- illustrating with a suitable example on local and loop optimization(L4)
- determining the issues involved in global optimization techniques(L3)
- estimating the processes involved in obtaining the final code, register allocation, and assignment(L2)

Text Books(s)
1. Alfred.V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey. D. Ullman, Compilers Principles, Techniques and Tools, 2/e, Pearson Education, 2008.

References
1. Alfred.V. Aho, J.D.Ullman, Principles of compiler design, Narosa Publications, 2002
2. John R. Levine, Tony Mason, Doug Brown, Lex &yacc, O'reilly ,2/e, 1992
3. Keith Cooper, Linda Torczon, Engineering a compiler, Morgan Kaufmann, 2/e, 2011.

Course Outcomes:
After completion of this course, the student will be able to
- define and analyse various phases involved in designing a compiler(L1)
- compare and contrast between bottom-up and top-down parsing techniques(L2)
- illustrate the usage of Syntax Directed Definition in generating intermediate code(L3)
- identify various machine independent optimization techniques(L4)
- explore techniques involved in obtaining the final code(L4)

COMPILER DESIGN LABORATORY
For Laboratory courses: List of Experiments:

1. Implement transition diagram for identifying an identifier and classify whether it is either variable or array or function or structure.

2. Implement transition diagram for identifying constant and classify whether it is integer or real.

3. Write a LEX specification which takes input from a file (a C' program) and recognize valid identifiers, keywords contained in the program and store them in a file.

4. Write a LEX specification for lexical analyzer of C' language in which it recognizes all possible tokens in a given program taken as a file and output all the tokens into another file.

5. The production "A → α1 / α2 /α3 ..." of the CFG uses the following structure/class representation.
   struct/class production
   {
   char left, //Head of the production ie., left hand side
   char right(10)(10), //body of prod ie., all alternatives are represent as array of strings
   int noa, //noa means no of alternatives in the production
   },

   Similarly the Context Free Grammar can be represented as
   struct / class CFG
   {
   production p(10), // all productions of the grammar
   int nop, //nop means no of production.
   char t(10), nt(10), s, // string of t's , nt's and start symbol (optional)
   },
   The following programs are to be implementing using the above representation.
   a. Write a program which reads single productions of the form " A → α1 , A →α2, A → α3 ... " and make them into a single production "A → α1 / α2 /α3 ..." and display.
   b. Write a program which reads single productions of the form " A → α1 , B →α2, B → α3 ... " and build CFG and display.
   c. Write a program which reads a production and check for Left-Recursion (may contain in more than one alternatives) and if found eliminate it and store in another production and display the result.
   d. Write a program which reads a grammar and check for Left-Recursion (may contain in more than one productions) and if found eliminate it and store in another grammar and display the result.
   e. Write a program which reads a production, factor out the alternatives if required using left factoring and store the result in to another production and display it.
   f. Write a program which reads a grammar, factor out the alternatives of each production if required using left factoring and store the result in to another grammar and display it.
   g. Write a program which reads a grammar and find First symbols of all non-terminals.
   h. Write a program which reads a grammar and find Follow symbols of all non-

terminals.

6. Write a program to implement Recursive Descent Parser for any given grammar.

7. Write a program to implements Operator Precedence Parsing algorithm.

8. Consider the following Expression language that used to describe the Arithmetic expressions in a Calculator The syntax of the language is defined by following grammar
   <line><exp>\n
   <exp><exp>+ <term>| <exp>-<term>|<term>
   <term> <term>*<factor>|<term>/<factor>/<factor>
   <factor> (<exp>)|<value>
   <value> <letter>|<digit>

   A sample arithmetic expression written in this language is(a+b)*c\n or 2 + 4 * 5 -6 /2\n

   a. Design a LEX specification for the above language. (Ignore redundant spaces, tabs and newlines). Although the syntax specification states that value can be arbitrarily long, you may restrict the length to some reasonable value. (Implement the lexical analyser using JLex, flex or lex or any other tools)
   b. Write YACC Specification to validate any given arithmetic expression accepted by the above grammar.
   c. Write YACC specification to evaluate the given arithmetic expression accepted by the above grammar.
   d. Write YACC specification to generate three address code and quadruples for any given expression.
   e. Write YACC specification to convert an infix expression to a postfix expression.

9. Consider the following grammar which is used to describe the X language which might be used in next generation programmable calculators. It supports integer, real and complex numbers This language uses something called Hungarian notation the name of the variable itself tells you about the type of the data it contains if the starting letter is 'i' then integer , 'r' then real , 'c' then complex number
   <program> begin<stmts>end
   <stmts> <statement>,<stmts>| <statement>,
   <statement> <identifer>=<expr> | <conditional>
   <expr><expr> + <term> |<expr>-<term>|<term>
   <term> <term>*<fact>|<fact>
   <fact> <identifier><conditional>--->if <cexpr>thenbegin<stmts>end
   <cexpr> <identifier>==<identifier> |<identifier>!=<identifier>
   <identifier> i<letters>|r<letters>|c<letters>
   <letters> <letter><letters>|<letter>
   <letter> a|b|....|z|A|B| ..... |Z

a. Design a LEX specification for the above language. (Ignore the redundant spaces, tabs and newline Although the syntax specification states that value can be arbitrarily long, you may restrict the leng to some reasonable value. (Use JLex, flex or lex or any other lexical analyser generating tools).
b. Write YACC specification to generate three address code and quadruples for the given arithmetic statement.

c. Write YACC specification to validate the statements of the above language.
d. Write program to generate 8086 assembly code from the abstract syntax tree or three address code generated by the parser. The target assembly instructions can be simple move, add, sub, and jump. Also simple addressing modes are used.

19ECS302: ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

This course enables the students to think critically about what makes humans intelligent, and how computer scientists are designing computers to act more like us Artificial Intelligence (AI) is the study of how to make computers make things which at the moment people do better. AI plays an important role in the design and development of systems with intelligent behaviour. The primary objective of this course is to provide an introduction to the basic principles and applications of Artificial Intelligence. Upon successful completion of the course, students will have an understanding of the basic areas of Artificial Intelligence - problem solving, search mechanisms, constraint satisfaction, and knowledge representation using logic, reasoning and their applications.

Course objectives:

- The fundamentals of Artificial Intelligence, the concept of Intelligent Agents and problem solving process through uninformed and informed searches.
- How to gain an insight into competitive environments which give rise to adversarial search problems, often known as games.
- Viewing many problems in AI as problems of constraint satisfaction.
- Getting complete idea of knowledge representation and understand the two knowledge representation techniques Propositional and First-order logics.
- How to trace the inference mechanism in First-order logic.

UNIT I: 8 L

Introduction: What is AI?

Intelligent Agents: Agents and Environments, The Nature of Environments, The Structure of Agents.

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

- define Artificial Intelligence (L1)
- explain how agents work in environments (L2)
- explain the nature of environments (L2)
- classify various structures of agents (L2)
- compare various types of agents (L2)

UNIT II: 10 L

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.
Beyond Classical Search: Local Search Algorithms and Optimization Problems.

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

- define unformed search techniques (L1)
- compare various unformed search techniques (L2)
- list various heuristic search techniques (L1)
- outline the working of heuristic functions (L2)
- contrast among heuristic search techniques (L2)

UNIT III: 8 L

Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Games that include an Element of Chance, State-of-the-Art Game Programs.

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Learning Outcomes:After completion of this unit, the student will be able to:
- explain how games improve intellectual abilities of humans (L1)
- illustrate alpha-beta pruning (L2)
- demonstrate the working of game playing algorithms (L2)
- define backtracking search for CSPs (L1)
- contrast backtracking search and local search for CSPs (L2)

UNIT IV: 8 L

Logical Agents: Knowledge-based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Reasoning Patterns in Propositional Logic.

First-Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic.

Learning Outcomes:

After completion of this unit, the student will be able to:
- define knowledge-based agents (L1)
- show the representation of real world facts in propositional and first-order logic (L1)
- explain the wumpus world problem-solving process (L2)
- infer proofs in propositional logic (L2)
- illustrate the usage of first-order logic (L2)

UNIT V: 8 L

Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution: Conjunctive Normal Form for first-order logic, The resolution inference rule, Example proofs.

Learning Outcomes:

After completion of this unit, the student will be able to:
- compare propositional and first-order inference (L2)
- outline unification and lifting (L2)
- infer proofs in first-order logic (L2)
- experiment with forward chaining and backward chaining (L3)
- illustrate the human reasoning process through propositional and first-order logic (L2)

Text Books(s)

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson.

Reference Book(s)

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, TMH Education Pvt. Ltd., 2008.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson.

Course Outcomes:
- illustrate artificial intelligence, the role of intelligent agents, uninformed and informed search techniques (L2)
- examine competitive environments like game problems (L4)
- interpret many real-world problems as constraint satisfaction problems (L2)
- illustrate what knowledge representation is and distinguish propositional and first-order logics (L2)
- infer proofs using resolution in first-order logic (L4)

19ECS334: WEB APPLICATION DEVELOPMENT

L	T	P	C
2	0	2	3

This course enables the students to learn developing web applications right from web application design, web content development, client-side scripting, server-side scripting and creation of responsive web pages. The course imparts knowledge of relevant architectures and technologies required for web application development.

Course objectives:

- Design static web page using Markup languages.
- Design and implement web pages using style sheets.
- Implement with java script web applications with dynamic web pages.
- Understand working of Web servers and Design Methodologies with MVC Architecture.
- Develop web applications using XML.

UNIT I: Introduction to Web Application Designing — L 6 P 5

HTML5: Basic syntax, HTML document structure, text formatting, images, lists, links, tables, forms, frames.

Cascading Style Sheets (CSS3): Levels of style sheets, style specification formats, selector forms, font properties, list properties, colour properties, alignment of text, background images, The Box Model.

Learning Outcomes:

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

- outline various steps to design static websites. (L2)
- demonstrate the importance of HTML tags for designing web pages. (L2)
- distinguish the design from content using various levels of Style Sheets. (L4)

UNIT II: Client Side Scripting — L 7 P 5

JavaScript: Introduction, Functions, Arrays, DOM, Built-in Objects, Regular Expression, Event handling, Validation, Dynamic documents.

Learning Outcomes:

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

- design dynamic, interactive web pages by embedding Java script code in HTML (L6)
- demonstrate validations of user input and perform dynamic documents. (L2)

UNIT III: XML, JSON — L 7 P 6

Syntax of XML, document structure, and document type definition, namespaces, XML schemas, document object model, presenting XML using CSS, XSLT, XPath, XQuery, FLOWR.

JSON: Features, JSON vs. XML, JSON Data Types, JSON Objects, JSON Arrays, JSON HTML.

Learning Outcomes:

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

- Create XML documents and use Xquery to retrieve data (L6)
- Develop application using JSON environment (L3)

UNIT IV: Server side processing with Java — L 6 P 6

Introduction to Servlet, Life cycle of Servlet, Servlet methods, Java Server Pages. Working with tomcat webserver

Database connectivity – Servlets, JSP, JDBC, Practice of SQL Queries

Learning Outcomes:

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

- develop application using JSP (L6)
- demonstrate running of application on Tomcat server instance (L2)
- develop database driven web application (L6)

UNIT V: Web Application Frameworks **L 6** P 6

Introduction to application development frameworks – AngularJS, ReactJS

Angular JS: Introduction,Angular JS Expressions, Modules, Data Binding, Controllers, DOM, Events, Forms, Validations.

Learning Outcomes:

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

- Illustrate various application development frameworks (L2)
- develop application using AngularJS Framework (L6)

Text Books(s)

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Pro Mean Stack Development, 1st Edition, ELad Elrom, Apress O'Reilly, 2016
3. Java Script & jQuery the missing manual, 2nd Edition, David sawyer mcfarland, O'Reilly, 2011.
4. Web Hosting for Dummies, 1st Edition, Peter Pollock, John Wiley & Sons, 2013.
5. RESTful web services, 1st Edition, Leonard Richardson, Ruby, O'Reilly, 2007.
6. FULL STACK REACT – The complete guide to ReactJS and Friends ,1st Edition,Anthony Accomazzo,Leanpub,2020.

Reference Book(s)

1. Dietel and Nieto, Internet and World Wide Web - How to program, PHI/Pearson Education, 2006.
2. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009.
3. Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012

Course Outcomes:

- Demonstrate the importance of HTML & DHTML tags for designing web pages and separate design from content using Cascading Style Sheet (L2)
- Design interactive web pages with client and server side scripting (L6)
- Apply validations on user input using Javascript (L3)
- Compare and analyze XML and JSON documents. (L2)
- Create and deploy Web Applications over web server. (L6)

For Laboratory courses:

List of Experiments:

1. Design static web pages required for any online services web site.
2. Apply Cascading Style Sheets to the Web pages.
3. Design dynamic webpages using Java script.
4. Write JavaScript to validate input fields
5. Write an XML file to display various contents.
6. Write a XSD to validate an XML file.
7. Design a web application and deploy on Tomcat webserver
8. Connect to a Database (MySQL/SQLServer/Oracle/MongoDB) and create data and query data using JDBC
9. Implement a Simple Application using JSON
10. Develop a Complete Web Application for a simple case study.

19EHS302: ENGINEERING ECONOMICS AND MANAGEMENT

L	T	P	C
3	0	0	3

Course objectives

Define the basic terms of economics and analyze law of demand and elasticity of demand

- Explain cost concepts and interpret Financial statements
- Apply break even analysis concept in business organization
- Discuss the advantages of different forms of organization
- Elaborate the principles of Management

Unit I **8 hours**

Economics: Utility, value, wealth, consumption, wants necessaries, comforts and luxuries.
Demand: Law of demand, elasticity of demand, price elasticity of demand, factors affecting elasticity of demand, simple problems.
Learning outcomes :
Student will be able to

- Define utility and value of goods.
- Distinguish between necessities, comforts and luxuries.
- Classify demand
- Analyze the elasiticity of demand for various economic goods.

Unit II **8 hours**

Costing: Cost concepts, elements of cost, methods of distribution of overhead costs, unit costing, job costing and process costing; Simple problems. Accounts: Preparation of profit and loss account and balance sheet (outlines only).
Learning outcomes:
Student will be able to

- List types of costs
- Apply cost analysis in finding profit
- Classify accounts
- Compose & Interpret balance sheet for a given enterprise

Unit III **6 hours**

Break-Even Analysis: Assumptions, break-even charts, simple problems.
Depreciation: Depreciation methods - Simple problems.
Learning outcomes:
Student will be able to

- Apply break even analysis in business organization
- Examine the impact of fixed and variable costs on profits
- List depreciation methods
- Compute the depreciation of assets.

Unit IV **10 hours**

Forms of Business Organization: Single trader, partnership and public limited company.
Principles of Organization: Types of organization; Span of management; Authority, delegation and decentralization, source of formal authority, difference between authority and power, line and staff authority, simple case studies.

Learning outcomes :
Student will be able to

- Categorize forms of business organization
- Distinguish types of organization
- Illustrate advantages and disadvantages of each form of organization
- Evaluate the effect of span of management on decision making

Unit V **10 hours**

Principles of Management: Importance of management, definition of management, management process, roles of a manager; Management, a science or art - Management, a profession; Functions of management. Leadership: Difference between a leader and a manager, characteristics of leadership, functions of a leader, simple case studies.

Learning outcomes:

Student will be able to

- Summarize the function of management
- Assess the role of manager
- Compare and contrast between Leader and Manager
- List the characteristics of Leader

Course Outcomes

- Interpret and summarize the country's economy and market economics, as an entrepreneur.
- Develop the background behind making cost implications and related concepts.
- Analyze various accounting concepts and financial management techniques for preparingeffective profit and loss statements
- Discover the optimal production strategies.
- Examine and analyze break even evaluation concepts for identification of minimum productionvolume for survival and to gain profits.
- Adapt and build good manager skills by employing the concepts of various skills like goodleadership qualities, utilizing motivation capabilities and incorporating communications skills.

19EMC382: ENGINEERING ETHICS

L	T	P	C
3	0	0	0

Unit I **8 hours**

Basic Concepts: Terminology, morals, ethics, values, integrity and spiri-tuality, edicts-religious, social and constitutional edicts, the question of universality, personal and professional ethics, emotional intelligence, dimensions of ethics.

Unit II **8 hours**

Rights and Responsibilities: As citizens, as professionals, concepts ofjustice and fairness, preservation, production, exchange for mutual fulfilment vs. storage for future use, social responsibility and individual rights.

UNIT III **9 hours**

Global Issues in Ethics: Technology and globalization, business ethics,corporate social responsibility, environmental ethics, media ethics, pro-tecting the common good while respecting the values and beliefs of nations/ ethnic groups, issues of compliance and governance, equal opportUNIT Ies.

Unit IV **8 hours**

Ethical Integrity and Attitudes: Integrity as wholeness and consistencyof character, beliefs, actions, methods and principles, core group of values, accountability, prioritization, subjectivity and objectivity, attitude, com-ponents (cognitive, behavioral and affective), attitude formation and at-titude change.

Unit V **9 hours**

Ethical Living: Needs of life, materialistic and non-materialistic, quali-tative and quantitative, harmony in living, self (physical and mental well being), family, building trust, sharing of responsibilities, cultivating sense of security, society, peace, non-violence, diversity, multiculturalism and oneness, nature, environmental sustainability, reorganizing living condi-tions, reappraising economic sectors and work practices, developing green technologies, ethical consumerism.

References

1. G. Subba Rao, Roy Chowdhury, P.N. Ethics, Integrity and Aptitude: For Civil Services Main Examination Paper V, Access Publishing, 2013.
2. Singer, Peter. Practical Ethics, Cambridge University Press, 1999.
3. Swami Tathagatananda, Healthy Values of Living, Advaita Ashrama, Kolkata, 2010.
4. M. Frost (Ed), Values and Ethics in the 21st Century, BBVA,
   Available at https://www.bbvaopenmind.com/wp-content/uploads/2013/10/Val-ues-and-Ethics-for-the-21st-Century_BBVA.pdf

19ECS342: DATA WAREHOUSING AND MINING

L	T	P	C
2	0	2	3

Due to advent of technology, internet, and advanced applications like social media, huge amount of digital data has been accumulated in data centers/Cloud Databases, which has led to a situation "we are drowning in data but starving for knowledge". Various data mining techniques like Association Analysis, Classification, Clustering, Outlier Analysis and Web mining are applied on the data to extract golden nuggets useful for decision making process.

Data warehousing (DW) is an integral part of knowledge discovery process, where DW plays a vital role. DW is an integration of multiple heterogeneous data repositories under a unified schema at a single site. The students will acquire knowledge in Data modeling, design, architecture, Data warehouse implementation and further development of data cube technology.

Course objectives:

- Understand the importance of Data Mining and its applications
- Introduce various types of data and pre-processing techniques
- Learn various multi-dimensional data models and OLAP Processing
- Study concepts of Association Analysis
- Learn various Classification methods
- Learn basics of cluster analysis

UNIT I: Introduction 7 L

Motivation for Data Mining, Importance of Data Mining, Definition, kinds of data, Data mining functionalities, kinds of patterns to be mined, pattern interestingness, Classification of data mining systems, data mining task primitives, integration of a data mining system with a database or data warehouse system.

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

- understand the basic concepts of data mining(L2)
- learn the KDD process(L2)
- learn different data mining tasks(L2)

UNIT II: Data preprocessing 13 L

Types of data sets and attribute values, Basic statistical descriptions of data, Data visualization, Measuring data similarity, data quality, Major tasks in data preprocessing, data cleaning and data integration, data reduction, data transformation and discretization.

Data Warehousing and On-Line Analytical Processing: Data Warehouse- Basic concepts, data warehouse modeling: Data cube and OLAP, data generalization by attribute-oriented induction.

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

- understand various types of data sets and attributes(L2)
- apply different statistical techniques on different types of attributes to find the similarities and dissimilarities(L3)
- learn different data preprocessing techniques and apply them on data sets(L2)
- learn the basics of data warehousing and different OLAP operations(L2)

UNIT III: Mining frequent patterns, associations and correlations 7 L

Basic concepts, applications of frequent pattern and associations, frequent pattern and association mining: A road map, Apriori algorithm, FP growth algorithm, mining various kinds of association rules, Pattern evaluation methods.

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

- understand the use of frequent patterns in business analysis(L2)
- implement Apriori algorithm and FP-growth algorithm(L3)
- learn different types of association rules(L2)

UNIT IV: Classification Analysis 8 L

Classification - Basic concepts, Decision tree induction, Bayes classification methods, Rule-based classification, Classification by neural networks, Model evaluation and selection, Techniques to improve classification accuracy: Ensemble methods.

Learning Outcomes:

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

- understand the basic concepts of classification(L2)
- implement the classification algorithms(L3)
- compare the performance of various classification algorithms(L2)

UNIT V: Cluster Analysis 8 L

Basic concepts and methods, Clustering structures, Major clustering approaches, Partitioning methods, Hierarchical methods, Density-based methods, Grid based methods, Evaluation of clustering.

Learning Outcomes:

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

- understand the basic concepts of clustering(L2)
- implement the clustering algorithms(L3)
- compare the performance of various clustering algorithms(L2)

Text Books(s)

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Morgan Kaufmann publishers, 3/e, 2011. (Modules 2 – 5)
2. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann publishers, 2/e, 2006. (Module 1)

Reference Book(s)

1. Michael Steinbach, Vipin Kumar, Pang-Ning Tan, Introduction to Data Mining, Addison-Wesley, 1/e, 2006
2. Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Pearson publishers, 1/e, 2006

Course Outcomes:

- understand the functionality of various data warehousing and data mining components(L2)
- understand various OLAP operations(L2)
- understand the strengths and limitations of various data mining models(L2)
- implement the data mining algorithms with different datasets(L3)
- compare various approaches of data mining implementations(L2)
- identify and apply appropriate data mining technique to solve a problem(L3)

19ECS344: MACHINE LEARNING

L	T	P	C
2	0	2	3

Machine Learning is a flourishing subject in Computer Science which devises models that can automatically learn from data and detect patterns from data. The applications of machine learningare diverse ranging from self-driven cars to disaster management systems. With easy availability of data from different devices and measurements, machine learning techniques become imperative in analysing trends hidden in the data. This course focuses on the major tasks of machine learning viz., supervised and unsupervised learning approaches that can robustly address data that is non-linear, noisy as well as high-dimensional in nature.

Course objectives:

- Objective 1: Introduce the concepts of machine learning and the complete process model for working with real data
- Objective 2: Impart the various approaches to supervised learning.
- Objective 3: Demonstrate unsupervised learning approaches.
- Objective 4: Illustrate the performance of ensemble models and familiarize with dimensionality reduction techniques
- Objective 5: Differentiate between shallow and deep neural networks.

UNIT I: Machine Learning Fundamentals 9 L

Details of UNIT I:**Machine Learning Fundamentals:** Use of Machine Learning, Types of machine learning systems, machine learning challenges, testing and validating, working with real data, obtaining the data, visualizing the data, data preparation, training and fine tuning the model.

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

- Identify different machine learning approaches and applications (L1)
- Demonstrate basic machine learning approach using real world data (L2)
- Use machine learning approach to train and fine tune a learner (L3)

UNIT II: Supervised Learning 9 L

Supervised Learning: Classification, training a binary classifier, performance measures, multiclass classification, error analysis, multi label classification, multi output classification.
Linear Regression, Gradient Descent, Polynomial Regression, learning curves, regularized linear models, logistic regression.

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

- Demonstrate various supervised learning approaches(L2)
- Describe classification techniques for real-time data. (L2)
- Apply regression to make good predictions (L3)

UNIT III: Unsupervised Learning 9 L

Unsupervised Learning: Clustering, K-Means, Using clustering for image segmentation, Semi-supervised learning, DBSCAN, other clustering algorithms.
Gaussian Mixtures, anomaly detection, selecting number of clusters, Bayesian Gaussian Mixture Models, anomaly and novelty detection algorithms.
Learning Outcomes:

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

- Illustrate various clustering techniques (L2)
- Construct Gaussian Mixture Models to implement anomaly detection (L3)

- Analyze suitability of different clustering techniques for real-time data (L4)

UNIT IV: Dimensionality Reduction&Ensemble Learning 9 L

Dimensionality Reduction: The curse of dimensionality, main approaches for dimensionality reduction, PCA, Kernel PCA, LLE, other dimensionality reduction techniques.

Ensemble Learning: voting classifiers, bagging, random patches and random spaces, random forests, boosting, stacking.

Learning Outcomes:

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

- choose best features defining a dataset through dimensionality reduction (L3)
- apply PCA and its variants to find the significant feature subset (L3)
- compare the performance of ensemble learners to weak learners (L4)

UNIT V: Neural Networks&Deep Neural Networks 9 L

Neural Networks: From biological to artificial neurons, implementing MLPs with Keras, fine tuning neural network hyperparameters.

Deep Neural Networks: Vanishing/Exploding Gradients Problem, reusing pretrained layers, faster optimizers, avoiding overfitting through regularization.

Learning Outcomes:

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

- Show the working of neural networks (L3)
- Differentiate between shallow and deep neural networks(L4)
- Evaluate the performance of deep neural networks on real time data (L5)

Text Books(s)

1 AurelionGeron, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools and Techniques to build Intelligent Systems, 2/e, O'Reilly Media, 2019.

Reference Book(s)

1. Tom M. Mitchell, Machine Learning, McGraw Hill, 2017.
2. EthemAlpaydin, Introduction to Machine Learning, 3/e, PHI, 2015.

Course Outcomes:

- Describe different machine learning categories (L2)
- Apply supervised learning approaches on real-time problems (L3)
- Utilize unsupervised learning approaches for applications such as anomaly detection(L3)Analyze ensemble models for performance improvement (L4)
- Estimate significant feature subset to handle high dimensionality issue (L5)
  Construct deep neural networks for computer vision applications (L6)

For Laboratory courses: List of Experiments:

1. Introduction to Python libraries- Numpy, Pandas, Matplotlib, Scikit-learn, Tensorflow and Keras.
2. Build classification models and evaluate performance measures on them.
3. Implement Linear Regression
4. Implement Logistic Regression
5. Apply unsupervised learning algorithms for Anomaly detection.
6. Demonstrate clustering on image segmentation application.
7. Build models using different ensemble models.
8. Tackle the curse of dimensionality by implementing PCA algorithm on a high dimensional dataset.
9. Implement Multilayer Perceptron.
10. Implement Deep Neural Network for Computer Vision applications.

19ECS346: INFORMATION SECURITY

L	T	P	C
2	0	2	3

This course aims to present Information Security concepts to the students. This course offers a good understanding of basics of Information Security and security model. It provides knowledge about various Threats, Attacks, Legal, Ethical and Professional Issues. The course will present an overview of the risks encountered in information systems security, and the tools used for resolving these risks. This course also provides few case studies of information security.

Course objectives:

- To know the concepts of Security services, threats, mechanisms and attacks.
- To understand the role of security in the systems development life cycle.
- To know the legal, ethical and professional issues in Information security
- To know the aspects of risk management
- To know the technological aspects of information security
- To analyze information security case studies.

UNIT I: Introduction to Information Security 9 L

History, What is Information Security?, Critical Characteristics of Information, CNSS Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, Approaches to Information Security Implementation, The Security in the SDLC, Security Principles, Security Services.

Learning Outcomes:

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

- explain basic information security concepts and principles. (L2)
- illustrate possible approaches to Information Security Implementation. (L3)
- explain the Security in the SDLC (L2)

UNIT II: The Need For Security 9 L

Introduction, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues –Planning for security – Information Security Planning and Governance, Information Security Policy, Standards, and Practices.

Learning Outcomes:

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

- list and describe the threats posed to information security and common attacks associated with those threats. (L1)
- explain Legal, Ethical, and Professional Issues in Information Security. (L2)
- explain planning for security. (L5)

UNIT III: Security analysis 9 L

Risk Management: An overview of Risk management, Identifying and Assessing Risk, Assessing and Controlling Risk – Systems: Access Control Mechanisms, Information Flow and Confinement Problem.

Learning Outcomes:

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

- explain the aspects of Risk management. (L2)
- identify the categories that can be used to classify controls(L3)
- identify Security Risk and evaluation. (L3)

UNIT IV: Network Access Control and Cloud Security 9 L

Network Access Control, Extensible Authentication Protocol, Cloud Computing and architecture, Cloud Security Risks and Countermeasures, Data Protection in the Cloud, Cloud Security as a Service.

Learning Outcomes:

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

- explain cloud computing architecture and security risks. (L2)
- explain cloud security services. (L2)
- identify several transport level security protocols. (L3)

UNIT V: Security Technologies 9 L

Firewall and VPNs: Access Control, Firewalls, Protecting Remote Connections, Intrusion Detection and Prevention Systems-Security tools.

Learning Outcomes:

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

- understand firewall technologies and the various categories of firewalls (L2)
- understand virtual private networks (VPNs) and discuss the technology that enables them(L2)
- identify the various approaches to control remote and dial-up access by authenticating and authorizing users(L3)

Text Book(s)

1. Michael E Whitman and Herbert J Mattord, ―Principles of Information Security, Cengage Learning, 6/e ,2018.
2. William Stallings. Cryptography and Network Security – Principles and Practice, Pearson Education, 7/e, 2017.

Reference Book(s)

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", CRC Press LLC, 6e, 2012.
2. Atul Kahate, Cryptography and Network Security, Mc Graw Hill, 3/e, 2013.
3. Forouzan and Mukhopadhyay. Cryptography and Network Security, Mc Graw Hill, 3/e, 2015.

19ECS348 ADVANCED OPERATING SYSTEMS

L	T	P	C
2	0	2	3

This course motivates the student to get the knowledge of various types of advanced operating systems, learn the basics of distributed operating systems, and understand the working of the algorithms and its application at different conditions

Course objectives:

- To learn the basics of operating systems
- To understand the concepts of distributed operating systems
- To suggest an algorithm in the distributed operating system environment
- To assess the performance of the distributed operating system algorithms

UNIT I: Introduction 8 L

Introduction: Overview, Functions of an Operating System, Design Approaches, Types of Advanced Operating System, Synchronization Mechanisms, Concept of a Process, Concurrent Processes, The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs, Process Deadlocks : Preliminaries, Models of Deadlocks, Resources, System State, Necessary and Sufficient conditions for a Deadlock, Systems with Single-Unit Requests, consumable Resources, Reusable Resources.

Learning Outcomes:

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

- differentiate the various types of advanced operating systems. (L2)
- summarize the concept of process, concurrent processes & synchronization problems:(L2)
- define the deadlocks and their necessary conditions(L1)
- investigate the factors leading to deadlocks(L4)

UNIT II: Distributed Operating Systems: 10 L

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations, Lamport's Logical Clock, Vector Clock, Causal Ordering, Global State, Cuts,and Termination Detection. Distributed Mutual Exclusion: Non-Token Based Algorithms, Lamport's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm. Distributed Deadlock Detection: Issues, Centralized Deadlock Detection Algorithms, Distributed Deadlock Detection Algorithms, Agreement Protocols: Classification, Solutions, Applications

Learning Outcomes:

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

- to specify the various issues of distributed operating systems. (L1)
- to understand the basic concepts of distributed operating systems. (L2)
- to illustrate the algorithms for distributed mutual exclusion and deadlock detection. (L3)
- to examine the agreement protocols. (L4)

UNIT III: Distributed Resource Management 8 L

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory: Architecture, Algorithm, Protocols, Design Issues, Distributed Scheduling: Issues, Components, Algorithms.

Learning Outcomes:

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

- identify the basics of distributed file systems and shared memory. (L2)
- classify the different distributed scheduling algorithms. (L2)
- propose a particular distributed scheduling algorithms basing on the system load. (L5)

UNIT IV: Failure Recovery and Fault Tolerance 8 L

Failure Recovery and Fault Tolerance: Basic Concepts, Classification of Failures, Basic Approaches to Recovery, Recovery in Concurrent System, Synchronous and Asynchronous Check pointing and Recovery, Check pointing in Distributed Database Systems, Fault Tolerance, Issues, Two-phase and Non-blocking Commit Protocols, Voting Protocols, Dynamic Voting Protocols.

Learning Outcomes:

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

- define failure, fault and error. (L1)
- understand recovery techniques, synchronous & asynchronous checkpointing. (L2)
- formulate different algorithms for various system failure conditions. (L5)

UNIT V: Multiprocessor and Database Operating Systems 8 L

Multiprocessor: Structures, Design Issues, Threads, Process Synchronization, Processor Scheduling, Memory Management, Reliability / Fault Tolerance.

Database Operating Systems: Introduction, Concurrency Control, Distributed Database Systems, Concurrency Control Algorithms.

Learning Outcomes:

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

- comprehend the basics of multiprocessor and database operating systems. (L2)
- examine the processor scheduling and concurrency control algorithms. (L4)
- adapt the necessary algorithm for processor scheduling and concurrency control. (L5)

Text Books(s)

1. Mukesh Singhal and N. G. Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill, 2000

Reference Book(s)

1. Abraham Silberschatz, Peter B. Galvin, G. Gagne, Operating System Concepts, 6/e, Addison Wesley 2003.
2. Andrew S. Tanenbaum, Modern Operating Systems, 2/e, Addison Wesley, 2001

Course Outcomes:

- define the basics of operating systems(L1)
- understand the concepts of distributed operating systems(L2)
- discuss the working of distributed operating systems algorithms(L2)
- propose an algorithms for distributed operating systems environment(L5)
- evaluate the performance of distributed operating systems algorithms(L6)

For Laboratory course: List of Experiments

1. Write a program to implement first come first serve CPU scheduling algorithm
2. Write a program to implement shortest job first CPU scheduling algorithm
3. Write a program to implement deadlock avoidance algorithms.
4. Write a program to implement concurrent programming constructs through semaphores - dining philosophers' problem
5. Write a program to implement consumer-producer problem
6. Write a program to implement page replacement algorithms
7. Write a program to implement non token based algorithm for Mutual Exclusion
8. Write a program to implement Lamport's Logical Clock
9. Write a program to implement locking algorithm.
10. Write a program to implement Remote Procedure Call.
11. Write a program to implement Chat Server
12. Write a program to implement termination detection

19ECS352: IMAGE PROCESSING

L	T	P	C
2	0	2	3

This course, image processing, emphasizes on an area of information science and engineering whose importance is growing with a wide range of applications. Image processing deals with processing of images which are digital in nature and provides basic concepts, methodologies and algorithms of digital image processing focusing on the major problems concerned with digital images.

Course objectives:

- To study the fundamental concepts involved in Digital Image Processing
- To implement image enhancement techniques in spatial domain.
- To implement image enhancement techniques in frequency domain.
- To work with various image compression techniques.
- To understand morphological and segmentation techniques.

UNIT I: Introduction 8 L

Digital image representation, fundamental steps in digital image processing, elements of digital image processing systems. Digital Image Fundamentals: Elements of visual perception, a simple image model, image sensing and acquisition, image sampling and quantization, basic relationships between pixels, mathematical operations used in digital image processing.

Learning Outcomes:

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

- learn creation and manipulation of digital images (L3).
- describe different modalities and techniques in image acquisition (L2).
- describe the ways of representing digital images and storing it efficiently depending on the desired quality (L4).
- learn the representation of images in two-dimensional data form (L2).

UNIT II: Image Enhancement in Spatial Domain and Fourier Transform 8 L

Image Enhancement in Spatial Domain: Basic intensity transformation, histogram processing, histogram equalization, histogram matching, fundamentals of spatial filtering, smoothing filters, sharpening filters.

Fourier Transform: Discrete Fourier Transform (DFT) on one variable and two variables, Properties of DFT.

Learning Outcomes:

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

- use the mathematical principles of digital image enhancement (L3).
- apply the concepts of feature detection and shape finding algorithms (L3).
- enhance image characteristics by adjusting the image intensity and isolating the region of interest (L4).
- understand how block processing works and investigate the implementation of spatial domain filters(L2).

UNIT III: Image Enhancement in Frequency Domain 6 L

Image Enhancement in Frequency Domain: Basics of filtering in the frequency domain, smoothing filters, sharpening filters, homomorphic filters. Color Image Processing: Color fundamentals, color models, smoothing and sharpening.

Learning Outcomes:

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

- understand how block processing works and investigate the implementation of frequency domain filters (L2).
- reduce the effects of unwanted distortions, such as noise, blurring, and background illumination (L3).

- enhance image characteristics by adjusting the image intensity and isolating the region of interest (L4).

UNIT IV: Image Compression 6 L

Image Compression:. Image compression: Fundamentals, basic compression methods: Huffman coding, arithmetic coding, run length coding, LZW coding, contour coding, predictive coding,wavelet coding.

Learning Outcomes:

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

- understand the fundamental algorithms and how to implement them (L2).
- apply Image transforms used in digital image processing (L3).
- design and implement algorithms that perform basic image processing (L4).

UNIT V: Morphological Image Processing and Segmentation 8 L

Morphological Image Processing: Erosion and dilation, opening and closing, hit or miss transform morphological algorithms, grey level morphological processing.

Segmentation: Image Segmentation: Fundamentals, point, line, and edge detection, basic global thresholding, region-based segmentation, watersheds, image segmentation based on color.

Learning Outcomes:

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

- extract image features and measurements using different segmentation and edge detection methodologies (L4).
- familiar with Morphological Image Processing, Image Segmentation (L2).
- acquaint the representation and description of image processing techniques and object recognition (L4).

Text Books(s)

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image processing, 3/e, Pearson Education, 2009.

Reference Book(s)

1. B. Chanda, D. Dutta Majumder, Digital Image Processing and Analysis, PHI Publications, 2006.
2. A.K. Jain, Fundamentals of Digital Image Processing, PHI Publications, 2006.
3. Qidwai and Chen, Digital Image Processing, An algorithmic approach with MATLAB, Taylor & Francis,2010.
4. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing using MATLAB, TMH Publications, 2011.

Course Outcomes:

- illustrate the fundamental concepts involved in Digital Image Processing (L2).
- To implement image enhancement techniques in spatial domain (L3).
- To implement image enhancement techniques in frequency domain (L3).
- To analyse with various image compression techniques (L4).
- To apply morphological and segmentation techniques (L3).

For Laboratory courses: List of Experiments:

1. To create a program to display grayscale image using read and write operation.
2. To create a program to display basic image processing operations and histogram algorithms
3. To create a vision program for application of smoothening filters
4. To create a vision program to determine the edge detection of an image using different edge enhancement techniques.
5. To create a program which performs Discrete Fourier transform on image

6. To create a program to eliminate the high frequency components of an image.
7. To create a program for conversion of RGB image to CYK image using a color box
8. To create a program that performs Erosion and Dilation on an image
9. To create a program for coding a image using Huffman coding
10. To create a program for segmentation of an image using Region based technique.

19ECS354: DESIGN PATTERNS

L	T	P	C
2	0	2	3

This course will introduce what design patterns really are, and are not. How to add functionality to Designs while minimizing complexity How to use design patterns to keep code quality high without Overdesign. This course presents design patterns addressing normally encountered design issues and possible implementations. This course helps in learning software design in a real world perspective.

Course Objectives

- This course will introduce the student to the concept of design patterns, examine several patterns in detail, apply these patterns to specific problems and point the student to design pattern resources.
- Review of object oriented analysis and design principles, Definition of design patterns Identification of recurring design problems.
- Possible solutions to these problems through the general arrangement and composition of objects and classes.
- Discussion of the advantages and disadvantages of the various solutions and providing implementation examples.

UNIT I: Introduction 9 L

History and origin of patterns, design patterns in MVC, describing design patterns, how design patterns solve design problems, selecting a design pattern, using a design pattern.
Design and implement
Case study – Design and implement using Object-Oriented Programming language .
Learning Outcomes:
After completion of this unit, the student will be able to:

- define and specify the characteristics of a design pattern(L1)
- learn how to evaluate the different patterns(L1)
- list different methods/Patterns(L1)
- learn how to select the different patterns(L2)

UNIT II: Design Patterns-1 9 L

Creational: Abstract factory, builder, factory method, prototype, and singleton.
Case study – Design and implement using Object-Oriented Programming language

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

- learn how to select the different patterns(L2)
- learn about the advantages and disadvantages of using design pattern variants(L1)
- learn how to evaluate the different patterns(L1)
- apply the method for various application(L2)

UNIT III: Design Patterns-2 9 L

Structural Patterns: Adapter, bridge, composite, decorator, façade, flyweight, proxy.
Case study – Design and implement using Object-Oriented Programming language

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

- list different methods/Patterns. (L1)
- learn how to evaluate the different patterns. (L1)
- analyze the performance the Patterns. (L4)

UNIT IV: Design Patterns-3 9 L

Behavioral patterns: Chain of responsibility, command, interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

Case study – Design and implement using Object-Oriented Programming language

Learning Outcomes:

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

- illustrate techniques of searching. (L2)
- implementation of behavioral patterns and providing solutions to real world software (L2)
- list different methods/Patterns(L1)

UNIT V: Advanced Patterns 9 L

Pattern catalogs and writing patterns. Patterns and Case Study: Designing a document editor, anti-patterns, case studies in UML, pattern community.

Learning Outcomes:

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

- implement the Gang of Four (GoF) design patterns, for example: creational patterns (Singleton, Factory, and Abstract Factory), structural patterns (Adapter, Composite, Façade) behavioral patterns (Iterator, Observer), etc(L4)
- describe solutions to programming problems using design patterns(L3)
- distinguish between performances of various Patterns(L4)
- choose an applicable design pattern or patterns for a given problem(L4)

Text Books(s)

1. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Design patterns: Elements of Reusable Object Oriented Software, Addison Wesley, 1995.

Reference Book(s)

1. Alan Shalloway and James R. Trott, Design Patterns Explained: A New Perspective on Object Oriented Design, 2/e, Addison-Wesley, 2004.
2. Craig Larman, Applying UML and Patterns: An Introduction to object, oriented analysis and design and the unified process, 2/e, Prentice Hall, 2001.
3. William J Brown, Raphael J Malveau, Hays W. “Skip” McCormickIII, Thomas J. Mowbray, Anti Patterns: Refactoring Software, Architectures and Projects in Crisis, 1/e, John Wiley & Sons, 1998.
4. Head First Design Patterns: Building Extensible and Maintainable Object-Oriented Software” 2e, 2021, OReilly

Course Outcomes:

- identify the appropriate design patterns to solve object oriented design problems. (L3)
- understand and develop design solutions using creational patterns(L3)
- understand and apply structural patterns to solve problems. (L3)
- understand and Construct solutions by using behavioral patterns. (L3)
- identify and Construct appropriate patterns for design of given problem(L6)

19ECS356: SOCIAL NETWORK ANALYSIS

L	T	P	C
2	0	2	3

This course enables the students to gain knowledge on various aspects of different key concepts of social science data, how this data is producing, the underlying networks and what type of analysis can be done. This course also provides different measures of social network analysis by using SNA tools for network analysis and visualization.

Course objectives:

- Learn Development of Social Network Analysis
- Understand the basic mathematical concept of social network.
- Understand Ontological representation of social relationships.
- Learn Building Semantic Web applications.
- Understand the Evaluation of web-based social network extraction

UNIT I: Social Network Analysis 8 L

Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis. Electronic sources for network analysis:Electronic discussion network, Blogs and online commUNIT Ies, Web-based networks.

Learning Outcomes:

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

- Outline about network analysis: (L2)
- Classify different Social Networks: (L2)
- Organize Key concepts and measures in network analysis: (L3)
- Analyze Blogs and online commUNIT Ies: (L4)
- Categorize Web-based networks: (L4)

UNIT II: Mathematical Representation Of Social Network 8 L

Networks and Graphs, Degree, Average Degree and Degree Distribution, Adjacency Matrix, Real Networks are Sparse, Weighted Networks, Bipartite Networks, Paths and Distances, Connectedness, Clustering Coefficient.

Learning Outcomes:

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

- Define Networks and Graphs: (L1)
- Explain Degree, Average Degree and Degree Distribution: (L2)
- Develop Adjacency Matrix for Real Networks: (L3)
- Demonstrate Weighted Networks, Bipartite Networks: (L2)
- Discover Paths, Distances, Clustering Coefficient of Social network: (L4)

UNIT III: Aggregation Social Network Data 10 L

State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data.

Learning Outcomes:

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

- Summarize the network data representations: (L2)
- Illustrate Ontological representation of social individuals: (L2)
- Model Ontological representation of social relationships: (L3)
- Analyse Aggregating in social network data: (L4)
- Choose reasoning with social network data: (L3)

UNIT IV: Social Semantic Applications 9 L

Building Semantic Web applications with social network features, Flink: the social networks of the Semantic Web community, open academia: distributed, semantic-based publication management.

Learning Outcomes:

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

- Explain Semantic Web: (L2)
- Demonstrate Building Semantic Web applications with social network features: (L2)
- Apply Flink: Social network: (L3)
- Analyze Semantic Web community, open academia: (L4)
- Classify semantic-based publication management: (L4)

UNIT V: Evaluation Of Web-Based Social Network Extraction 10 L

Differences between survey methods and electronic data extraction, Context of the empirical study, Data collection, Preparing the data, Optimizing goodness of fit, Comparison across methods and networks , Predicting the goodness of fit, Evaluation through analysis, Discussion.

Learning Outcomes:

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

- Distinguish survey methods and electronic data extraction methods: (L4)
- Apply the empirical study: (L3)
- Identify the process of Data collection and preparing the data: (L3)
- Analyze methods and networks: (L4)
- Predict the goodness of fit, evaluation through analysis: (L6)

Text Books(s)

1. Peter Mika, "Social Networks and the Semantic Web", Springer, 1/e, 2007.
2. ALBERT-LÁSZLÓ BARABÁSI,"Network Science", Cambridge university press, 1/e 2016.

Reference Book(s)

1. BorkoFurht, —Handbook of Social Network Technologies and Applications, Springer, 1/e, 2010
2. GuandongXu,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, Springer,1/e, 2011.

Course Outcomes:

- Defining Social Network analysis and its related applications: (L1)
- Demonstrate social networks using graph theory: (L2)
- Illustrate Modeling and Aggregation of Social network data: (L2)
- Analyze human behavior in social web and related commUNIT Ies: (L4)
- Classify, Create and visualize of social networks using tools: (L4)

For Laboratory courses: List of Experiments:

1. Select some graphs and identify the following
   Nodes and Edges, Edge Direction, Edge Weight, Connected Components and Bridges, Hubs and Authorities, Dyads and Cliques
2. Select some sample graphs and perform the following Centrality Measures, Network-Level Measures, Path-Level Measures
3. Download and install any free open source social network analysis package like Gephi/Graphtool/SocNetV and study the features of that tool
4. Select a dataset and load the dataset into the social network analysis tool
5. Calculate Layout Functions, Density of Network, Network-Level Measures, Centrality

Measuresfor the loaded dataset using the SNA tool

6. Implement edge weights, colour and size in network graphs for the dataset using the SNA tool
7. Visualize the dataset in different models for doing analysis using the SNA tool

19ECS358: CYBER SECURITY

L	T	P	C
2	0	2	3

This course enables the students to gain knowledge on various Cybercrimes. The course briefs the students regarding the Indian IT Act, Global perspective of Cybercrimes, Cyber stalking, cyber cafe, key loggers, DoS attacks, crimes on mobile, wireless devices, etc. The knowledge gained in this course can be applied to identify, classify, estimate the criminal plans of the attackers and predict the web threats and security implications.

Course objectives:

- Introduce the fundamentals of Cybercrime and its legal perspectives with respect to India.
- Acquaint the student with various types of attacks and Cyber offenses
- Make the student aware of securing devices and Inner perimeter
- Familiarize the student with methods to secure the perimeter.

UNIT I: Introduction to Cybercrime 9 L

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

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

- classify the types of Cybercrimes(L4)
- outline the Indian stance and Acts towards Cybercrime(L2)
- compare the Indian perspective to Global perspective(L4)

UNIT II: Cyber Offenses 9 L

How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

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

- interpret how attacks are formulated(L2)
- explain the concepts of Cyber stalking and Cyber cafe(L2)
- infer how Botnets and cloud computing provide base for cultivating Cybercrime(L2)

UNIT III: Tools and Methods Used in Cybercrime 9 L

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow

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

- list various tools and methods that assist attackers in performing the Cybercrime(L1)
- analyse how password cracking is done(L4)
- distinguish between Viruses and Worms and Trojan Horses(L4)

UNIT IV: Securing Devices and Inner Perimeter 9 L

The Three Layers of Security, Securing Host Devices, Securing Outer-Perimeter Portals, Additional Inner-Perimeter Access Options, The Inner Perimeter, Operating Systems, Operating System Security Choices, Common Operating System Security Tools, Using Local Administrative Tools, Implementing Data Encryption

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

- list various layers of security(L1)
- analyseways of securing devices(L4)
- Learn methods to secure inner perimeter(L4)

UNIT V: Securing the Perimeter 9 L

Perimeter Security in the Real World, Security Challenges, The Basics of Internet Security, Understanding the Environment, Hiding the Private Network, Understanding Private Networks, Protecting the Perimeter, Understanding the Perimeter, Firewalls, Network Appliances, Proxy Servers, Demilitarized Zones (DMZs), Honeypots, Extranets.

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

- identify the challenges in perimeter security(L3)
- assess the requirements for hiding private networks(L5)
- Analyse the various methods to protect the perimeter (L6)

Text Books(s)

1. Charles J. Brooks,ChristopherGrow,PhilipCraig,Donald Short, Cyber Security Essentials 1/e,Sybex Wiley

Reference Book(s)

1. James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, 1/e, CRC Press, 2011.
2. Chwan-Hwa(John) Wu,J.DavidIrwin, Introduction to Cyber Security, 1/e, CRC Press T&F Group, 2013
3. Nina Godbole and Sunil Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1/e, Wiley INDIA

Course Outcomes:

- explain the types of Cybercrimes happening all around(L3)
- select tools and practices that boost up the crime rate(L5)
- demonstrate the tools to secure inner perimeter(L2)
- demonstrate the contribution of key loggers, password crackers, viruses, and worms towards enabling the possibilities of Cybercrime(L2)
- assess the methods to protect the perimeter(L5)

19ECS362: CLOUD COMPUTING

L	T	P	C
2	0	2	3

This course will help the students to get familiar with Cloud Computing Fundamental concepts, technologies, architecture and state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations

Course objectives:

- To understand basic concepts related to cloud computing technologies and the concept of cloud delivery models IaaS, PaaS and SaaS.
- To evaluate the underlying principles of Data Center, cloud virtualization, cloud multitenant and service technologies.
- To implement different infrastructure and specialized mechanisms related to cloud storage and usage monitor.
- Fundamentals of cloud computing architectures based on current standards, protocols, and best practices.

UNIT I: Understanding Cloud Computing 9 L

Cloud origins and influences, basic concepts and terminology, goals and benefits, risks and challenges.

Fundamental Concepts and Models: Roles and boundaries, cloud characteristics, cloud delivery models, cloud deployment models.

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

- define the cloud and the IT resource(L1)
- name the cloud consumers and cloud providers(L1)
- infer the goals and benefits(L2)
- classify the characteristics of cloud(L2)
- illustrate the delivery and deployment models(L2)

UNIT II: Cloud Enabling Technology 9 L

Data center technology, virtualization technology, web technology, multitenant technology, service technology

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

- list the various Internet Service Providers(L1)
- illustrate the various technologies and components(L2)
- compare the computing hardware technologies(L2)
- select the web-based services(L3)

UNIT III: Cloud Infrastructure Mechanisms 9 L

Logical network perimeter, virtual server, cloud storage device, cloud usage monitor, resource replication

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

- compare the various cloud infrastructure mechanisms(L2)
- build the hypervisor mechanism(L3)
- compare the physical server and virtual servers(L4)
- test for cloud storage device(L4)

UNIT IV: Specialized Cloud Mechanisms 9 L

Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-Per-Use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi-Device Broker, State Management Database. Case Studies.

Learning Outcomes:
After completion of this unit, the student will be able to:
- compare the various specialized cloud mechanisms(L2)
- apply the cloud service instances(L3)
- apply the load balancer(L3)
- examine the case studies(L4)

UNIT V: Fundamental Cloud Architectures 9 L

Workload distribution architecture, resource pooling architecture, dynamic scalability architecture, elastic resource capacity architecture, service load balancing architecture, cloud bursting architecture, elastic disk provisioning architecture, redundant storage architecture.

Cloud Delivery Model Considerations: The cloud provider perspective: Building IaaS environments, equipping PaaS environments, optimizing SaaS environments, the cloud consumer perspective: Working with IaaS environments, working with PaaS environments, working with SaaS services.

Learning Outcomes:
After completion of this unit, the student will be able to:
- compare the various architectures(L2)
- categorize the context of IaaS, PaaS and SaaS environments(L4)
- distinguish between the environments(L4)
- evaluate the working of cloud delivery models(L5)

Text Books(s)

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013.

Reference Book(s)

1. John W. Rittinghouse, James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2012.
2. Anthony T.Velte, Toby J Velte Robert Elsenpeter, Cloud Computing a practical approach, Mc Graw Hill,2010.
3. Michael Miller, Cloud Computing: Web based Applications That Change the Way You Work and Collaborate Online, Que Publishing, 2008.

Course Outcomes:
- define the basic concepts, terminology and the fundamental models(L1)
- demonstrate the set of primary technology components and characteristics associated with cloud computing(L2)
- identify the building blocks of cloud environments(L3)
- evaluate the specific runtime function in support of one or more cloud Characteristics(L4) elaborate the cloud delivery model issues pertaining to cloud providers and consumers(L4)

For Laboratory courses: List of Experiments:
1. Installing and using identity management feature of OpenStack.
2. Installing and using JOSSO.
3. Installation and Configuration of virtualization using KVM.
4. Study and implementation of Infrastructure as a Service.
5. Study of Cloud Computing & Architecture.
6. Study and implementation of Infrastructure as a Service.
7. Study and implementation of Storage as a Service.
8. Case study on AWS/Microsoft Azure/Google Cloud Platform.
9. Basic programs using DBMS on cloud.

19ECS364: INTRODUCTION TO PATTERN RECOGNITION AND MACHINE LEARNING

L	T	P	C
2	0	2	3

Pattern recognition theory and practice is concerned with the design, analysis, and development of methods for the classification or description of patterns, objects, signals, and processes. At the heart of this discipline is our ability infer the statistical behavior of data from limited data sets, and to assign data to classes based on generalized notions of distances in a probabilistic space. Many commercial applications of pattern recognition exist today, including voice recognition, fingerprint classification, and retinal scanners. Recent developments in statistical modeling using Bayesian techniques, neural networks, decision trees, fuzzy logic, and syntactic structures have accelerated the growth of pattern recognition applications. The objective of this course is to Foundations of pattern recognition algorithms and machines, including statistical and structural methods. Data structures for pattern representation, feature discovery and selection, classification vs. description, parametric and nonparametric classification, supervised and unsupervised learning, use of contextual evidence, clustering, recognition with strings, and small sample-size problems.

Course objectives:

- Understand the basic concepts of a pattern and apply the techniques for pattern recognitionalgorithms.
- Understand the basic methods of feature extraction, feature evaluation, and extend thesemethods for mining data
- Understand and apply both supervised and unsupervised classification methods to detect andcharacterize patterns in real world data.
- Develop prototype pattern recognition algorithms that can be used to study algorithmbehaviour and performance against multivariate data in real time scenarios.
- Acquire the knowledge about non-parametric and non-metric techniques

UNIT I: 6 L

Introduction: Basics of pattern recognition system, various applications, Machine Perception, classification of pattern recognition systems
Design of Pattern recognition system, Pattern recognition Life Cycle, Statistical Pattern Recognition: Review of probability theory, Gaussian distribution, Bayes decision theory and Classifiers, Normal density and discriminant functions

Learning Outcomes:

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

- Acquire a basic understanding of the Pattern recognition(L2)
- Have the understanding of the Classification and Decision algorithms (L2)
- Explain Gaussian distribution for pattern recognition (L2)
- Analyse the pattern recognition problems (L4)
- Illustrate machine perception(L2)

UNIT II: 9 L

Parameter estimation methods: Maximum-Likelihood estimation, Expectation-maximization method, Bayesian parameter estimation Concept of feature extraction and dimensionality, Curse of dimensionality, Dimension reduction methods - Fisher discriminant analysis, Principal component analysis Hidden Markov Models (HMM) basic concepts, Gaussian mixture models.

Learning Outcomes:

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

- experiment with Maximum likelihood Estimations (L3)
- make use of the non-parametric Techniques. (L3)

- outline EM methods (L2)
- list various methods for dimensionality reduction (L1)
- make use of HMM concepts for real time problems (L3)

UNIT III: 9 L

Non-Parameter methods: Non-parametric techniques for density estimation - Parzen-window method, K-Nearest Neighbour method. Decision trees, CART, Other Tree Methods

Learning Outcomes:

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

- understand K-Nearest Neighbour method, CART Model. (L2)
- visualize real time problems as decision trees (L3)
- experiment with KNN (L3)
- apply parzen – window method (L3)
- define non parametric techniques for density estimation (L1)

UNIT IV: 9 L

Non-metric methods for pattern classification: Non-numeric data or nominal data Decision trees: Concept of construction, splitting of nodes, choosing of attributes, overfitting, pruning

Learning Outcomes:

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

- apply Non numeric Methods for data analysis. (L3)
- understand Classifiers. (L2)
- illustrate overfitting (L2)
- distinguish non-numeric and nominal data (L2)
- explain about how to choose attributes for decision trees (L2)

UNIT V: 9 L

Unsupervised Learning and Clustering: Mixture Densities and Identifiability, Maximum-Likelihood Estimates, Application to Normal Mixtures, Hierarchical Clustering, Component Analysis, Low-Dimensional Representations and Multidimensional Scaling.

Learning Outcomes:

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

- have a basic understanding of the Machine Learning Algorithms (L2)
- have the understanding clustering and dimensionality. (L2)
- infer maximum likelihood estimates (L2)
- compare hierarchical clustering with other clustering mechanisms(L2)
- make use of Normal mixtures (L3)

Text Books(s)

1. Bishop C M "Pattern recognition and Machine learning", 1/e, Springer, 2006.
2. Duda R O, Hart PE and Stork DG," Pattern Classification", 2/e, john Wiley and Sons, 2003.

Reference Book(s)

1. Bishop C M "Neural Networks for Pattern Recognition" Oxford University Press, 1995.
2. Gose E, Johnsonbaugh R and Jost S "Pattern Recognition and Image Analysis" Prentice hall of India, 2002
3. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons,New York, 1993

Course Outcomes:

- Design and construct a pattern recognition system
- Know the major approaches in statistical and syntactic pattern recognition.
- Become aware of the theoretical issues involved in pattern recognition system designsuch as the

curse of dimensionality.

- Implement pattern recognition techniques.
- distinguish between supervised and unsupervised techniques for pattern recognition.

For Laboratory courses: List of Experiments:

1. Write a python program to characterize the density functions
2. Write a python program to model statistically the feature space using distribution functions
3. Write a python program to understand the distribution functions (Normal, Binomial, Poisson etc)
4. Write a python program to estimate co variance matrix and its properties
5. Write a python program to visualize the changes of distribution as changes in parameters (mean vector, covariance matrix)
6. Write a python program for perceptron learning and test the linear separability
7. Write a python program for Bayesian classification and analizethe decision boundaries by varying the means and covariance matrices
8. Write a python program to classify the given data using maximum likelihood estimationWrite a program to solve Robot traversal problem (Understanding Means End Analysis)
9. Write a phyton program to understand MorkovChians and Monto Calro methodsWrite a program to implement Hangman game
10. Write a python program to Decision trees
11. Write a python program to build a Bayesian network for given data set
12. Write a python program to understand Kernel methods.
13. Write a program to implement a linear regression problem
14. Write a program to implement kNN neighbour problem
15. Write a program to implement logistic regression

19ECS366: SOFTWARE METRICS

L	T	P	C
2	0	2	3

This course is aimed at helping students build up an understanding of basic understanding and knowledge of the software metrics and measurement techniques. This course will initiate students to understand the importance of Metrics data collection, analysis and metrics for object-orientedsystems, external product attributes, dynamic Metrics and Resource measurement.

Course objectives:

- Understand the software measurement and metrics.
- The ability to successfully estimate/measure/predict the quality of a software project
- The ability to define effective metrics for any software development situation Understand the issues of product and process metrics
- Able to understand the various software management models

UNIT I: 9 L

Measurement: What is it and Why do it: Measurement in everyday life, Measurement in software engineering, Scope of software metrics.

The Basics of Measurement: The representational theory of measurement, Measurement and models, Measurement scales and scale types.

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

- define Measurement(L1)
- list the measurements in software engineering(L1)demonstrate the theory of measurement(L2)
- list the measurement models(L1)
- explain measurement scales and types(L2)

UNIT II: 8 L

Empirical investigation: Principles of empirical studies, Planning experiments.
Software metric data collection: Defining code data, Data collection for incident reports.

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

- summarize the planning experiments(L2)
- relate metrics are collected for a particular software(L3)
- apply analysis methods to measure a software project(L3)
- apply statistical methods to measure a software project(L3)

UNIT III: 9 L

Measurement of internet product attributes - Size: Properties of software size, Code size, Design size, Requirements analysis and specification size, Functional size measures and estimators, Applications of size measures.

Measurement of internet product attributes - Structure: Aspects of structural measures, Control flow structure of program units

Learning Outcomes:

- After completion of this unit, the student will be able to:
- identify the intent of a product metrics(L3)

- choose efficient metrics to measure size(L3)
- examine the metrics to measure size and structure(L4)
- list the different external product attributes(L4)

UNIT IV: 8 L

Software quality metrics overview: Product quality metrics, In-Process quality metrics, Metrics for software maintenance, Examples of metrics programs, Collecting software engineering data
Learning Outcomes:

- After completion of this unit, the student will be able to:
- classify the software quality metrics(L4)
- compare process and product metrics(L4)
- examine different metrics for maintenance of the software(L4)
- test metrics on different environments(L4)

UNIT V: 8 L

Quality management models: The Rayleigh model framework, Code integration pattern, The Problem Tracking report (PTR) sub-model, The PTR arrival and backlog projection model, Reliability growth models, Criteria for model evaluation, In-process metrics and reports, Orthogonal defect classification
Learning Outcomes:
After completion of this unit, the student will be able to:

- explain about different models to manage the product(L5)
- importance of Rayleigh model to maintain the project(L5)
- determine the reliability growth model(L5)
- evaluate the model for manage the metrics(L5)

Text Books(s)

1. Norman Fenton, James Bieman, Software Metrics – A Rigorous and Practical Approach, 3rd Edition, CRC Press
2. Stephen H.Kan, Metric and models in software quality engineering,2nd Edition, Addison-Wesley Professional

Reference Book(s)

1. William A. Florac and Areitor D. Carletow, Measuring the Software Process, Addison - Wesley, 1995.
2. Robert B.Grady, Practical Software Metrics for Project Management and Process Improvement, Prentice Hall.

Course Outcomes:

- Understand and analyze the various measurements for software (L2)
- Apply various data analysis methods produce efficient, reliable, robust and cost-effectivesoftware solutions(L3)
- Measure the various internet based s/w product attributes including size and structure (L2)
- Apply quality metrics for any s/w project and validate it(L5)
- Implement a case study of - Rayleigh Model for s/w management for any software company.(L6)

19ECS392 – COMPREHENSIVE SKILL DEVELOPMENT - V
OPTION – I (MOBILE APPLICATION DEVELOPMENT

L	T	P	A	C
0	0	0	6	1

Course introduction:

For the students in Penultimate semester, an application oriented session with whatever they have learnt so far may be suggested. As smart phones are widely used, an application for a mobile can be given which tests their application specific skills.

Course objectives:

- Build an application for a mobile (preferably Android due to its popularity).
- Construct specific cases which can be utilized for academic purposes.

Week- I & 2: Android Studio
Installation and familiarity with Android Studio.
Build, launch and emulate a simple application on an Android Phone.
Week- 3 & 4: Android App Components -1
Android app components, such as intents, activities, and broadcast receivers.
Week- 5 & 6: Android App Components -2
Program core Android components together with Android concurrency frameworks and basic Java file I/O classes (such as File and InputStream) and Android storage mechanisms (such as Shared Preferences)
Week- 7 & 8: Interactive Application
Build a graphical user interface with an activity controlling it, resulting in a first interactive application.
Week- 9 & 10 : Analysis of smart phones components and the mobile network.
Analyze the components of smartphones and check the mobile network. Focus on the characteristics and operations of the smartphone Operating Systems.
Week- 11 & 12: Analysis of smartphones components and the mobile network.

Analyze the components of smartphones and check the mobile network. Focus on the characteristics and operations of the smartphone Operating Systems.

References:

1. Build Your First Android App (Project-Centered Course) offered by CentraleSupelee in Coursera (sponsored by GITAM)
2. Smart Device & Mobile Emerging Technologies offered by Yonsei University in Coursera (sponsored by GITAM)
3. Android App Components - Intents, Activities, and Broadcast Receivers offered by Vanderbilt University

OPTION II (DEVOPS)

L	T	P	A	C
0	0	0	6	1

Introduction

DevOps Training Program will provide you with in-depth knowledge of various DevOps tools including Git, Jenkins, Docker, Ansible, Terraform, Kubernetes, Prometheus, and Grafana. This DevOps Certification training is completely hands-on and designed in a way to help you become a certified practitioner through best practices in Continuous Development, Configuration Management and Continuous Integration, and finally, Continuous Monitoring of software throughout its development life cycle.

Course Objectives:

After completing this module, you should be able to

- understand the benefits of DevOps over other software development processes
- Gain insights into the DevOps environment
- Get an overview of different DevOps Tools
- Get a picture of the working of the DevOps Delivery Pipeline

Topics:

Introduction to DevOps: Benefits of working in a DevOps environment, DevOps Lifecycle, DevOps Stages, DevOps Delivery Pipeline

Git, Jenkins & Maven Integration

Goal: In this module, you will learn about the different actions performed through Git and will be introduced to Jenkins and Maven.

Objectives: After completing this module, you should be able to:

- Execute branching and merging operations
- Perform various Git commands
- Understand Maven Architecture and dependencies
- Learn about Continuous Integration & its importance
- Understand Jenkins and its features

Topics:

Branching and merging in Git, Merge Conflicts, Stashing, Rebasing, Reverting and Resetting Git Workflows, Introduction to Maven Maven Architecture, Introduction to Continuous Integration Introduction to Jenkins

Hands On:

Branching and MergingMerge Conflicts, Stashing, Rebasing, Reverting, and ResetingConfiguring Maven

Version Control with Git

Goal: In this module, you will gain insights into Source Control Management and learn thefunctionalities of Git.

Objectives: After completing this module, you should be able to

- Understand Version Control
- Perform management of files for small as well as large projects
- Perform various Git commands such as git add, git fetch, git commit, git init, etc. Work with remote repositories

Topics:

Version Control, Git Introduction, Git Installation, Commonly used commands in Git, Working with Remote repository

Hands On:

Git Common Commands, Working with Remote Repository

Configuration Management Using Ansible

Goal: Learn how to manage and configure your infrastructure using Ansible Ad-Hoc commands, Playbooks, and Roles.

Objectives: After completing this module, you should be able to

- Utilize Ansible CLI
- Execute Ansible Ad-Hoc Commands for one-off tasks
- Automate host servers
- using Ansible Playbooks
- Use Variables in Playbooks Using Handlers

Topics:

Introduction to Configuration Management, Infrastucture as Code, Introduction to Ansible, Ansible Architecture

Inventory Management, Ansible Modules, AD-HOC Commands, Ansible Playbooks, Ansible Roles

Hands On:

Ad- Hoc Commands. Running a Simple Playbook, Using Variables and handlers, Using Ansible Rol

Continuous Integration using Jenkins

Goal: In this module, learn how to perform Continuous Integration by building applications with thehelp of Maven and create deployment pipelines using Jenkins.

Objectives: After completing this module, you should be able to

- Managing authorization in Jenkins
- Jenkins notification management
- Master-slave architecture in Jenkins
- Add a slave node to Jenkins master
- Build and deploy codes
- using Jenkins Build pipeline plugin in Jenkins

- Use Declarative pipeline in Jenkins

Topics:

Jenkins Architecture, Plugin Management in Jenkins, Jenkins Security Management, Notification in Jenkins, Jenkins Master-slave, architecture Jenkins Delivery Pipeline, Jenkins Declarative pipeline

Hands On:

Create pipeline view using DevCompile and QAUnitTest, Adding Slave node in Jenkins, Build Pipeline project using Groovy script

Containerization using Docker Part – I

Goal: This UNIT Introduces learners to the core concepts and technology behind Docker. Learn indetail aboutcontainers and various operations performed on them.

Objectives: After completing this module, you should be able to

- Understand Containerization
- Learn the evolution of virtualization to containers
- Understand the Docker Architecture
- Perform Various actions using Docker CLI
- Bind container ports to the Machine ports
- Run containers in different modes
- Write and build a Dockerfile to create a Docker Image

Topics:

Containerization, Namsepaces, Docker, Docker Architecture, Container Lifecycle, Docker CLI , Port Binding

Detached and Foreground Mode, Dockerfile, Dockerfile Instructions, Docker Image

Hands On :

Docker CLI Commands, Port Binding, Starting Containers in Different Modes , Writing a Dockerfile to Create an Image

Containerization using Docker Part – II

Goal: Learn how to use Docker Hub registry, deploy a multi-tier application using Docker Compose,and create a swarm cluster.

Objectives: After completing this module, you should be able to

- Use Docker Hub to store custom Images
- Store data in Container Volumes for persistent
- storage Setup Docker Compose
- Deploy a multi-container application using Docker
- Compose Deploy a Swarm Cluster

Topics:

Docker Registry, Container Storage, Volumes, Docker Compose, Docker Swarm

Hands On:

Setting up Docker Hub, Docker Volumes, Installing Docker Compose, Installing a Multi-Container Application using Compose

Orchestration using Kubernetes Part – I

Goal: In this module, you will learn about Container Orchestration and Basic of container management using Kubernetes.

Objectives: After completing this module, you should be able to

- Understand Container Orchestration
- Learn about Kubernetes Core Concept
- Deploy Pods
- Create Deployments to manage Pods
- Launch DaemonSets for Background applications
- Update and Rollback your Deployments
- Scale your containerized Applications

Topics:

Introduction to Container Orchestration, Kubernetes Core Concepts ,Understanding Pods, ReplicaSet and Replication Controller, Deployments, DaemonSets, Rolling Updates and Rollbacks , Scaling Application

Hands On:

Kubectl Common Commands, Deployments, Daemon Sets, Rolling-update and Rollbacks, Scaling in Kubernets

Monitoring using Prometheus and Grafana

Goal: In this module, you will learn how to collect, monitor, and visualize data using Prometheus andGrafana.

Objectives: After completing this module, you should be able to

- Understand Continuous Monitoring
- Use Prometheus to monitor services
- Create an alerting mechanism using Prometheus
- Deploy Grafana dashboards to visualize data
- Integrate Prometheus and Grafana to monitor a full pipeline

Topics:

Introduction to Prometheus and Grafana , Prometheus and Grafana Setup, Monitoring using Prometheus, Dashboard Visualization using Grafana, Creating a Dashboard to monitor the Pipeline

Hands On:

Monitoring Service using Prometheus, Alerting using Prometheus, Grafana Dashboards, Monitoring a Pipeline

Orchestration using Kubernetes Part - II

Goal: Learn and deploy different service discovery mechanisms, utilize Volumes for persistent storage and deploy Stateful Sets for stateful applications.

Objectives: After completing this module, you should be able to

- Deploy different Kubernetes Services
- Utilize Volumes to store Persistent Data
- Create Persistent Volume Claims to attach volumes to Pods

- Understand Persistent Volume Claims Primitives
- Use Headless Services in Stateful Sets
- Deploy Helm Charts

Topics:

Services, Persistent Storage in Kubernetes , Primitives for PersistentVolumeClaims , Secrets and ConfigMaps, Headless Services , StatefulSets, Helm Charts

Hands On:

Deploying Services, Persistent Volumes and Persistent Volume Claims, StatefulSets, ConfigMaps and Secrets, Helm Charts

Provisioning using Terraform Part - I

Goal: Learn how to provision and manage infrastructure on a Cloud Platform (AWS) using Terra form Configuration Files.

Objectives: After completing this module, you should be able to

- Understand Provisioning using Terraform
- Learn the Difference between Terraform vs Ansible
- Understand Terraform Architecture
- Deploy a Terraform Configuration File
- Use Basic Terraform Commands
- Manage Terraform Resources

Topics:

Introduction to Terraform, Terraform vs Ansible , Terraform Architecture, Terraform Configuration, Terraform Common Commands, Managing Terraform Resources

Hands On:

Setting Up AWS and Terraform, Executing a Terraform Configuration, Managing Terraform Resources, Referencing Terraform Resources

Provisioning using Terraform Part - II

Goal: Use Terraform State commands to manage the current state of your infrastructure. Deploy a fully usable and working infrastructure using Terraform.

Objectives: After completing this module, you should be able to

- Perform Terraform State Commands
- Deploy a Terraform Project on AWS
- Topics
- Terraform State
- Terraform Project

Selenium (Self-Paced)

Goal: In this module, you will learn about selenium and how to automate your test cases for testing web elements. You will also get introduced to X-Path, TestNG and integrate Selenium with Jenkins.

Objectives: After completing this module, you should be able to

- Learn and install Selenium
- Create Test Cases in Selenium WebDriver
- Utilize X-Path and TestNG to locate elements
- Execute code on several browsers using Selenium suite of tools, Integrate Selenium with Jenkins

Topics:

Introduction to Selenium, Why Selenium?, Selenium – Webdriver, Creating Test Cases in Selenium, WebDriver (Waits) What and why X-Path, Handling different controls on Webpage, Framework in Selenium, Selenium Integration with Jenkins, Implementation of Selenium in the Project

Hands On

Installing Selenium, Creating Test Cases in Selenium WebDriver, Integrating Selenium with Jenkins

Nagios (Self-Paced)

Goal: Learn how to continuously monitor your tasks using various plugins and implementing NagiosCommands

Objectives: After completing this module, you should be able to

- Operate Continuous Monitoring tools
- Use various plugins and objects associated with Nagios
- Implement Nagios commands

Topics:

Introduction to Continuous Monitoring, Introduction to Nagios, Installing Nagios, Nagios Plugins(NRPE) and Objects

Nagios Commands and Notification

Hands-On:

Installing Nagios, Monitoring of different servers using Nagios

DevOps on Cloud (Self-Paced)

Goal: Learn about various cloud services and service providers, also get the brief idea of how to implement DevOps using AWS.

Objectives: After completing this module, you should be able to

- Understand about cloud and its advantages
- Learn about Various cloud computing services
- Get an idea of how to implement DevOps using AWS

Topics:

Why Cloud?, Introduction to Cloud Computing, Why DevOps on Cloud?, Introduction to AWS , Various AWS services,

DevOps using AWS

AWS EC2 and IAM (Self-Paced)

Goal: Get a brief idea of how Security and EC2 Compute service works in AWS Cloud.

Objectives: After completing this module, you should be able to

- Describe AWS Global Infrastructure and its Benefits
- Sign-up an AWS free-tier account
- Work with AWS Management Console and AWS CLI
- Work with IAM Service
- Understand Virtualization
- Work with EC2
- Analyze various EC2 box configurations available

Topics:

Virtualization, Amazon Web Services (AWS), Benefits of AWS, AWS Global Infrastructure, AWS: IAM, Components of IAM , Managing users with IAM, Amazon Machine Image (AMI), Security Groups in AWS, Virtualization, Amazon Elastic Compute Cloud (EC2) and Its Benefits, Networking components associated with EC2, Instance Store

Hands-on:

- Signing up for a Free Tier Account with AWS
- Creating New User to Log in to AWS Management Console
- Creating Policies for New User to Have All Admin or Limited Privileges
- Different Approaches to connect to an EC2 instance
- Creating a Custom AMI
- Host your Website Inside your EC2 Instance
- To Attach EFS Volume to an EC2
- Instance Login to AWS Console via MFA

HSMCH102: UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY

L	T	P	C
2	1	0	3

Human Values Courses: During the Induction Program, students would get initial exposure to human values through Universal Human Values -1. This exposure is to be augmented by this compulsory entire semester foundation course. It is an introductory foundational input and desirable to follow it up by Faculty-student or mentor-mentee programs throughout their time with the institution.

Course objectives:

- Development of a holistic perspective based on self-explanation about themselves (human being), family, society, and nature/existence
- Understanding (or developing clarity) of the harmony in the human being, family, community, and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

UNIT I: Course Introduction – Need, basic guidelines, content, and process for value education 8 L

1. Purpose and motivation for the course, recapitulation from universal human values-1
2. Self-exploration-what is it? – It's content and process; 'Natural Acceptance' and Experimental Validation – as the process for self-exploration
3. Continuous happiness and prosperity – A look at basic human aspirations
4. Right understanding, relationship, and physical facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding happiness and prosperity correctly – A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Include practice sessions to discuss natural acceptance in human beings as the innate acceptance for living with responsibility (living in relationship, harmony, and co-existence) rather than arbitrariness in choice based on linking-dislinking.

UNIT II: Understanding harmony in the human being – harmony in myself? 9 L

1. The understanding human being as a co-existence of the sentient 'I' and the material 'Body.'
2. Understanding the needs of self ('I') and 'Body' – happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer, and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I.'
5. Understanding the harmony of I with the Body; Sanyam and health; correct appraisal of physical needs, the meaning of prosperity in detail
6. Programs to ensure Sanyam and Health

Include practice sessions to discuss the role others have played in making material goods available to me. They are identifying from one's own life.

Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with the disease.

UNIT III: Understanding harmony in the family and society-harmony in human-human relationship 9 L

1. Understanding values in a human-human relationship; the meaning of justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; trust and respect as the foundational values of relationship
2. Understanding the meaning of trust; the difference between intention and competence

3. Understanding the meaning of respect, the difference between respect and differentiation; the other salient values in a relationship
4. Understanding the harmony in the society (society being an extension of the family); resolution, prosperity, fearlessness (trust), and co-existence as comprehensive human goals
5. Visualizing a universal harmonious order in society – undivided society, universal order – from family to world family

Include practice sessions to reflect on relationships in the family, hostel, and institute as extended family, real-life examples, teacher-student relationship, the goal of education, etc. Gratitude is a universal value in relationships—discuss with scenarios. Elicit examples from students' lives.

UNIT IV: Understanding harmony in the nature and existence – whole existence as co-existence 9 L

1. Understanding the harmony in the nature
2. Inter-connectedness and mutual fulfillment among the four orders of nature – recyclability, and self-regulation in nature.
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
4. Holistic perception of harmony at all levels of existence.
5. Include practice sessions to discuss human beings as the cause of imbalance in nature, pollution, depletion of resources and role of technology, etc.

UNIT V: Implications of the above Holistic Understanding of Harmony on Professional Ethics 10 L

1. Natural acceptance of human values
2. The definitiveness of Ethical Human Conduct
3. The basis for Humanistic Education, Humanistic Constitution, and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems.
5. Case studies of typical holistic technologies, management models, and production systems
6. Strategy for the transition from the present state to Universal Human Order:
7. At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers
8. At the level of society: as mutually enriching institutions and organizations
9. Sum up.

Include practice exercises and case studies to discuss the conduct of an engineer or scientist.

Text Books(s)

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Book(s)

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakash an, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditS underlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - M aulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Course Outcomes:

By the end of the course, students will expect:

- to become more aware of themselves and their surroundings (family, society, nature);
- to become more responsible in life and handle problems with sustainable solutions while keeping human relationships and human nature in mind.
- to be sensitive to their commitment to what they have understood (human values, human relationships, and society).
- to apply what they have learned to themselves in different day-to-day settings.

19EOE302: GERMAN FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Introduction to the German language, grammar and pronunciation. Lan-guage: Greetings; Introducing oneself, asking the way, giving directions. Grammar: The nouns, gender distinctions, cases, definite and indefinite articles. Pronunciation: Vowels.

Unit II **8 hours**

Language: Asking for and giving information; Discussing home and the household. Grammar: Conjugation of verbs, verbs with separable and inseparable prefixes, modal verbs. Pronunciation: Vowels.

Unit III **8 hours**

Language: Describing people and their qualities, describing shape, size and colour of objects. Grammar: Personal pronouns, possessive pronouns, reflexive pronouns. Pronunciation: Consonants.

Unit IV **8 hours**

Language: The Working World: Returning faulty goods to a shop, asking someone to repeat something; Refusing or declining politely. Grammar: Cases: nominative, accusative, dative. Pronunciation: Diphthongs.

Unit V **9 hours**

Language: Making Comments and Suggestions: Asking for and giving opinions. Grammar: Structure of sentence and categories of sentences; subordinate clause - causative and conditional sentences. Pronunciation: Umlaut.

References

1. Deutsch als Fremdsprache IA Grundkurs
2. Ultimate German Beginner - Intermediate (Coursebook), Living Language, 2004.

19EOE304: CHINESE FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Introduction to the Chinese language and pronunciation system; Tones; Chinese numbers; Language: Saying hello, greetings. Pronunciation: Initials: b p m n l h; Finals: a o e I u ü / ao en ie in ing uo; First tone.

Unit II **8 hours**

Language: Asking what someone wants; Identifying people; Asking someone's name and nationality Grammar: Word order in Chinese sen-tence. Pronunciation: Initials: d t g k f; Finals: ei ou an ang eng iao iou(iu); Second tone.

Unit III **8 hours**

Language: Introducing oneself; Asking for permission. Grammar: Sentence with an adjectival predicate; "Yes-no" question. Pronunciation: Initials: zh ch sh r; Finals : -I / ai uai ong; Third tone.

Unit IV **8 hours**

Language: Introducing oneself; Asking for permission. Grammar: Ques-tions with an interrogative pronoun. Pronunciation: Initials: j q x; Finals: ia ian iang / uei(-ui) uen(-un) üe üan; Fourth tone.

Unit V **9 hours**

Language: Making comments and suggestions; Asking someone to repeat something; Refusing or declining politely. Grammar: Sentences with a verbal predicate. Pronunciation: Initials: z c s; Finals:-i er iong ua uan uang ün; Neutral tone; Retroflex ending.

*The course will focus on the pronunciation system, the introduction of common Chinese expressions and every-day phrases in the context of communicative activities.

References

1. Liu, Yuehua, Integrated Chinese: Simplified Characters Textbook, Level 1, Part 1. Cheng and Tsui Company, Inc. Boston, 2008.

19EOE306: ANALYTICAL ESSAY WRITING

L	T	P	C
3	0	0	3

Unit I **9 hours**

Mechanics of Essay Writing: Framework of an essay, introduction,hypothesis/statement of claim, body-claims and counter claims, refuting or disproving the opposing position with reasons and examples, providing evidence and examples that prove or support one's claim, conclusion-restatement of the claim and summary of the main ideas, paragraphing, discourse markers.

Unit II **9 hours**

Analyzing an Argument: Terms and definitions, statement, argument,claim, truth value, premise, identifying premises and claims/conclusions, strengths and weaknesses of an argument, discussion on the validity of a claim, scope for counter-argument if any, critiquing an argument.

Unit III **8 hours**

Analyzing an Issue: An issue statement or statements followed by specifictask instructions, discussing the extent to which one agrees or disagrees with the statement, rationale for the position one takes, developing and supporting one's position, discussion on the validity of the given statement/ claim, addressing the different views that are presented, remaining unbi-ased in assessing a claim, taking a stand and justifying it, writing a re-sponse.

Unit IV **9 hours**

Writing an Argumentative Essay on a Topic of Contemporary Inter-est: Planning, writing and revising, clear, concise and defined thesis state-ment that occurs in the introduction, clear and logical transitions. BodyParagraphs that include Evidential Support (factual, logical, statisticalor anecdotal), conclusion that does not simply restate the thesis, but re-addresses it in light of the evidence provided.

Unit V **7 hours**

Peer Review: Preparing a template for peer review that is derived fromthe response rubric given to the student and assessment rubric used for evaluation, formulating and communicating constructive feedback on a peer's work, responding to feedback on one's work, checklist for peer review-lead strategy use in the introduction, thesis statement, supporting details given in the body, the writer's acknowledgement of a counterargument and his/her response to it, closing strategy used in the conclusion.

References

1. Bailey S., Academic Writing: A Handbook for International Students, Routledge, London and NewYork, 2001.
2. Jordan R.R., Academic Writing Course, Nelson/Longman, London, 1999.
3. Hamp-Lyons L., Heasley B., Study Writing, Cambridge University Press, 2006.

19EOE308: INDIAN ECONOMY

L	T	P	C
3	0	0	3

Unit I **9 hours**

Structure of Indian Economy: Meaning of economic growth and development, features of Indian economy, changing structure of Indian economy, trends in national income, sources of growth, agriculture, industry and service sectors.

Unit II **8 hours**

Demography, Poverty and Unemployment in India: Demography: Population size and growth rates, age and gender distribution, trends of urbanization, occupational distribution of labour force. Poverty: Nature of poverty causes for poverty, measures to eradicate poverty. Unemployment: Nature and types of unemployment, causes for unemployment, remedial measures of unemployment.

Unit III **8 hours**

Public Finance: Sources of government revenue, Indian tax structure, direct and indirect taxes, composition of the government expenditure, role of monetary and fiscal policies, federal finance in India, 14th finance com-mission.

Unit IV **8 hours**

Foreign Trade: Importance, composition and direction of foreign trade, foreign direct investment, BoPs equilibrium, Foreign Exchange Management Act (FEMA).

Unit V **8 hours**

Economic Reforms in India: Industrial policy 1991, economic reforms, liberalization, privatization, and globalization.

Text Book(s)

1. V. K. Puri, S.K. Misra, Indian Economy, 31/e, Himalaya Publishing House, 2014.

References

1. R.C. Dutt, K.P.M. Sundaram, Indian Economy, S. Chand and Company, 2010.
2. A. N. Agarwal, Indian Economy, New Age International Limited, 2012.
3. I.C Dhingra, Indian Economy, Sultan Chand and Company, 2007.

19EOE310: PUBLIC ADMINISTRATION

L	T	P	C
3	0	0	3

Unit I **10 hours**

Introduction: Meaning, scope and significance of public administration, evolution of the discipline and its present status, challenges of liberalisation, privatization and globalization, good governance, electronic governance-concepts and applications, New Public Management (NPM).

Unit II **8 hours**

Administrative Thought: Scientific management theory, classical theory, bureaucratic theory, human relations theory, system theory.

Unit III **8 hours**

Accountability and Control: Legislative, executive and judicial control over administration, role of media, interest groups, NGOs, civil society, Right to Information Act (RTI), social audit, citizen chapters.

Unit IV **8 hours**

Union and State Governments Administration: President, prime min-ister, council of ministers, cabinet, central and state secretariats, boards and commissions, governor, chief minister and council of ministers, cen-tral- state relations, finance commission, Neeti ayog.

Unit V **8 hours**

Civil Services: Recruitment, training and other condition of services, district administration, role of collector, local self governing institutes-73rd and 74th constitutional amendments act.

Text Book(s)

1. Avasti, Maheswari, Public Administration, 31/e, Lakshmi Narain Agarwal Books, India, 2014.
2. B. L. Fadia, Kuldeep Fadia, Indian Administration, 8/e, Sahitya Bhawan, India, 2014.

References

1. Nicholas Henry, Public Administration and Public Affairs, 21/e, Prentice Hall of India, 2012.
2. D. Ravindra Prasad, V. Sivalinga Prasad, P. Satyanarayana, Administrative Thinkers, 2/e, Sterling Publishers, 1991.
3. D. D. Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis Butterworths, Wadhwa Nagpur, 2013.
4. Ramesh K. Arora, Rajni Goyal, Indian Public Administration, 3/e, New Age International Publishers, India, 1995.

19EOE 312: ENVIRONMENTAL MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize with basic with basic concepts of green buildings
- To acquire an insight on characteristics, collection transportation and disposal of different
- types ofbiomedical wastes
- To acquaint the basic principles of EIA.
- To impart about e-waste management.
- To understand the activities in environmental auditing.

Unit – I - Green Building Technology
Introduction to Green Technology-Use of technology towards sustainability. IGBC rating systems, Understanding of green building measures in the areas of Site Preservation, Energy Efficiency, Materials, Water Conservation, Solar Energy- Wind energy- Basic Concepts- Sources and uses .

Unit – II – Biomedical Waste Management
Definition-Sources-Classification of biomedical waste – Objectives of Biomedical waste management-segregation-containers for biomedical waste-Labeling Collection-Transport-Disposal methods.

Unit – III - Environmental Impact Assessment (EIA)
Introduction-Definition-Scope-Objectives of EIA-Basic EIA Principles, Classification of EIA-Life Cycle Assessment-Environmental Policy of India. BASELINE DATA ACQUISITION: Environmental Inventory- Rapid EIA.

Unit – IV - E-Waste management
E-waste : Sources- Types- components; Collection process- Segregation-Disposal methods; Effect on air, water and soil; Health hazards; Role of individual for E-waste management. Current E-waste Management Rules.

Unit – V- Environmental Audit
Introduction- Environmental audit Significance for Industry-Elements of Environmental audit. Process of environmental audit-Pre audit- Activity -Activities at site- Post audit.

Course outcome:

1. To explain the concepts of green buildings –L2.
2. To outline the disposal techniques in biomedical waste –L2.
3. To explain the preparation of EIA statements-L4
4. To Summarize e-waste management rules-L2
5. To identify various acytiviites involved in environmental audit –L3

Text Books

1. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007.

2. Rittmann, B.E., and McCarty, P.L., Environmental Biotechnology : Principles and Applications, McGraw Hill, 2001.

Reference Books

1. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000
2. Industrial Wastewater Management, Treatment and Disposal, WEF Manual of practice No. FD-3, 3rd Ed., WEF Press and McGrawHill, 2008

19EOE327: PROFESSIONAL COMMUNICATION

L	T	P	C
3	0	0	3

Unit I **8 hours**

Internal Communication: Memo-structure, layout and style, e-mail-structure, style, content and etiquette, notice-structure, content and layout, conducting a meeting, purpose and preparation, drafting agenda and minutes, conducting effective meetings, meeting etiquette.

Unit II **9 hours**

Making a Business Presentation: Planning-define the purpose, analyze audience and occasion, preparation-developing central idea, main ideas, gathering supporting materials, audio-visual aids, organization-introduction, body and conclusion, delivery-addressing the audience, body language, eye contact, use of appropriate language, style and tone.

Unit III **8 hours**

Business Letters: Form and structure, style and tone, letters of enquiry, letters placing orders/ giving instructions/urging action, letters of complaint and adjustment.

Unit IV **9 hours**

Proposals and Reports: Proposals, types, structure, prefatory parts, body of the proposal, supplementary parts, reports, types, informative, analytical, formal/informal, oral/written, individual/group, format and structure.

Unit V **8 hours**

Resume, Cover Letter, Interview and Telephone Etiquette: Resume, design and structure, cover letter, cover letters, accompanying resumes, opening, body, closing; Interview, planning, purpose, pre-interview preparation, conversation, two-way interaction, projecting a positive image, telephone etiquette- guidelines for telephone conversations in a professional context.

References

1. Seely, John, Oxford Guide to Effective Writing and Speaking, Oxford University Press, India, 2013.
2. Olsen Leslie, Huckin Thomas, Technical Writing and Professional Communication for Non-Native Speakers, McGraw Hill, 1991.
3. Rizvi, M. Ashraf, Effective Technical Communication, Tata McGraw Hill, 2005. 193

19MOE301: BASICS OF FINANCE

L	T	P	C
3	0	0	3

Unit I

Financial Management: An Introduction - Meaning and Definition of financial Management, objectives of Financial Management, Finance Functions, Organization of finance function, functions of finance Manager - Interface between Finance and other business functions.

Unit II

Sources of finance – classification of sources- security financing – kinds of ownership securities-debentures-bonds- types of bonds -internal financing– loan financing – innovative source of finance-venture capital-seed capital –private equity.

Unit III

Time value of money – introduction – concept – techniques of time value of money –compounding technique- doubling period-compound value of annuity-discounting or present value of technique – present value of annuity.

Unit IV

Financing Decisions: Cost of Capital - Cost of Debt, Cost of Preference Shares, Cost of Equity Shares, Cost of Retained Earnings, Weighted Average Cost of Capital.

Unit V

Working capital management- meaning – concept – components of working capital -factors determining working capital management – operating cycle- determinants of working capital -estimation of working capital management.

Textbook(s):

1. Shashi K. Gupta & R.K. Sharma, "Financial Management –theory and practices" 8th revised edition, 2014, Kalyani Publishers.

References:

1. Pandey, I. M., "Financial Management", Vikas Publications Print, New Delh, 2012
2. Khan, M. Y., & Jain, P. K., "Financial Management", Tata McGraw Hill, New Delhi, 2012
3. Maheswari, S. N., "Financial Management", Sultan Publications, New Delhi, 2013

Journals:

1. Chartered Financial Analyst - ICFAI - Hyderabad
2. Journal of Accounting and Finance - Research Development Association, Jaipur
3. GITAM Journal of Management, GITAM Institute of Management, GITAM University, Visakhapatnam

19LOE301: FUNDAMENTALS OF CYBER LAW

L	T	P	C
3	0	0	3

Course Objectives: The objective of this course is to make students familiar with the developments that are taking place in different areas of study with the help of Computer and Information Technology. The students will acquire knowledge in national and international legal order on the Fundamentals of Cyber Laws. The abuse of computers has also given birth to a gamut of new age crimes that are addressed by the Information Technology Act, 2008 (as amended). The chief aim of this course is to encourage inter-disciplinary studies.

UNIT-I

Conceptual and theoretical perspectives of Cyber Law - Computer and Web Technology –Evolution of Cyber Law – National &International Perspectivesof Cyber Law - Legal Issues &Challenges in India, USA and EU - Data Protection - Cyber Security, etc.

UNIT-II

International Perspectives - Budapest Convention on Cybercrimes - ICANN's core principles and the domain names disputes - Net neutrality - EU electronic communications regulatory framework - Web Content Accessibility Guidelines (WCAG).

UNIT-III

Information Technology Act, 2008 as amended - Overview of the Act - Jurisdiction -Electronic Governance - Electronic Evidence (Relevant portions of Indian Evidence Act) - Digital Signature Certificates (DSCs) - Duties of Subscribers of DSCs - Role of DSC Certifying Authorities - The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability – Powers of Police - Impact of the Act on other Laws - Social Networking Sites vis-à-vis Human Rights.

UNIT-IV

Cyber Laws vis-à-vis IPRs - Copyright in Information Technology - Software - Copyrights Vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Patents - European Position on Computer related Patents - Legal position of U.S and India on Computer related Patents - Trademarks in Internet - Domain name registration - Domain Name Disputes & World Intellectual Property Organization (WIPO) - Databases in Information Technology - Protection of database in USA, EU &India.

UNIT-V

Mobile Technology- SIM (Subscriber Identity Module) cloning–Mobile frauds - Usage of mobile software - Special reference to the relevant provisions of IT ACT 2008, India Penal Code and Evidence Act.

Textbooks:

a. Yatindra Singh : Cyber Laws
b. Vakul Sharma, Handbook of Cyber Laws

References:

1. Linda Brennan and Victoria Johnson: Social, ethical and policy implication of Information Technology.
2. Kamath Nandan : Law relating to Computer, Internet and E-Commerce.
3. Mike Godwin: Cyber Rights Defencing free speech in the Digital Age.

19EOE313: PERSONALITY DEVELOPMENT

L	T	P	C
3	0	0	3

Unit I **8 hours**

Self Awareness: Know yourself, have a snapshot of yourself, assess your personal traits, discover natural potential. Activities and Tasks: Class discussion, questionnaires, Johari Window, SWOC analysis (strengths, weaknesses, opportUNIT Ies and challenges).

Unit II **8 hours**

Self Discipline: Importance of self discipline, characteristics of a self disciplined achiever, self discipline in personal life and career. Activities and Tasks: Viewing short videos followed by discussion and analysis, brainstorming in small groups, creating an action plan to realize academic and career goals.

Unit III **8 hours**

Motivating Oneself: Self motivation, confidence building, goal setting, decision making. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

Unit IV **9 hours**

Managing Oneself: Handling emotions, time management, stress management, change management. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

Unit V **9 hours**

Interpersonal Behaviour: Attitude towards persons and situations, team work, leadership skills, problem solving skills, interpersonal adaptability, cultural adaptability. Activities and Tasks: Team-building games and activities.

References

1. Hurlock Elizabeth B., Personality Development, McGraw Hill Education, India, 1979.
2. Covey, Stephen R., The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change, Free Press, 2004.
3. Carnegie, Dale, Levine, Stuart. R., The Leader In You: How to Win Friends, Influence People and Succeed in a Changing World, Pocket Books, 1995.
4. Swami Vivekananda, Personality Development, Advaita Ashrama, 1993.

*This will be supplemented by materials and activities from internet-related sources.

19MOE305: BASICS OF MARKETING

L	T	P	C
3	0	0	3

Unit I: Introduction to Marketing – Nature, Scope and Importance of Marketing – Concepts and Approaches to Marketing – Product Vs. Service Marketing, Role of Marketing in the Economic Development – Latest Trends in Marketing.

Unit II: Analyzing Consumer Markets and Buyer Behaviour – Factors Influencing the Buyer Behaviour; Market Segmentation and Targeting.

Unit III: Marketing Mix Strategies & Extended Marketing Mix : Product, Service Product, Classification of Products – Product Life Cycle Stages, New Product Development

Unit IV: Pricing & Channels of Distribution: Pricing Objectives – Factors Influencing the Pricing Policy – Pricing Methods, Channels of Distribution – Channel Design Decisions – Channel Management.

Unit V: Promotion Mix – Importance of Promotion – Managing Advertising – Sales Promotion –, Personal Selling and Direct Marketing– Publicity and Public Relations.
Case study (Not exceeding 250 words).

Textbook(s)

1. Philip Kotler (2014), *A Framework for Marketing Management*, New Delhi: Pearson Education.

Reference books

1. W.J. Stanton (2011), *Fundamentals of Marketing* , New Delhi: McGraw Hill Publishing Co. Ltd.,
2. Gravens Hills & Wood Ruff (2012), *Marketing Management*, New Delhi: Cravens Hills, AITBS.
3. Rajan Saxena (2010), *Marketing Management,* New Delhi: Tata Mc-Graw Hill.
4. Sontakki C.N. (2012), *Marketing Management*, New Delhi: Kalyani Publications.

Journals

1. GITAM Journal of Management, Visakhapatnam.
2. Journal of Marketing, New Delhi.
3. Advertising & Marketing, New Delhi.
4. Indian Management, New Delhi.
5. Indian Journal of Commerce, New Delhi.

GEL345: WORKPLACE COMMUNICATION –BASIC

L	T	P	C
3	0	0	3

Introduction

The course is used to teach contemporary international business communication. An integrated skills approach is followed to enable students to communicate effectively in business contexts. It is a topic- based course with ample opportunity for practise to develop LSRW skills. It motivates and engages the students who wish to pursue various careers.

Course Objectives

- To enable students to hone their language skills with special focus on effective communication in business contexts
- To reinforce learning and enhance the ability to understand business communication
- To conduct business correspondence, write reports and suggestions, make presentations and participate in discussions
- To prepare students for BEC certification (B2 Level)

Unit 1: Listening

Understanding general idea; listening for specific information to complete notes, forms, and messages based on telephone conversations; recognising functions such as complaining, greeting, apologising; recognising topics and contexts; ability to follow extended speech during interviews, discussions, and presentations; ask relevant questions to indicate one's understanding of the main points of the speech

Learning Outcomes

At the end of the Unit the learners will be able to

- understand and follow a range of spoken business communication
- collect specific information from telephone conversations, interviews, discussions and presentations
- recognise different language functions such as greeting, apologising, and complaining
- make inferences and draw conclusions

Unit 2: Speaking

Interactive communication: sharing and participating in a conversation; giving a presentation or speaking at a business meeting: structuring a speech and connecting ideas; discussing on a given topic and expressing opinions, agreeing, disagreeing, comparing and contrasting ideas to reach a decision; speaking at length about the topic in a logical way

Learning Outcomes

At the end of the Unit the learners will be able to

- communicate with clarity and precision in business contexts
- understand and apply effective discourse management strategies
- make structured mini presentations/ elevator pitches
- participate in targeted discussions

Unit 3: Reading

Understanding the meaning, structure and cohesion of the text; reading in detail; scanning for specific details/information; identifying the writer's purpose and main idea of a paragraph; understanding opinions and ideas expressed in the text; understanding sentence structure; identifying and correcting errors in text.

Learning Outcomes

At the end of the Unit the learners will be able to

- comprehend business texts with focus on meaning, structure and cohesion
- get the gist, identify specific details and understand the writer's purpose
- make inferences and draw conclusions
- read short texts for error identification and correction

Unit 4: Writing

Writing for internal communication: a note/memo/email/message (formal); writing requests, instructions, explanations, ask for information, etc.; writing concisely and cohesively: linking your ideas; writing reports and proposals based on notes, charts, and tables.

Learning Outcomes

At the end of the Unit the learners will be able to

- identify formal internal communication contexts and write a note/ memo/ email/ message accordingly
- write instructions and explanations for process oriented activities
- produce different pieces of writing concisely and cohesively with appropriate discourse markers based on charts and tables.
- write effective letters, emails, reports, and proposals

Unit 5: Grammar and Vocabulary in Context

Countable and uncountable nouns; present perfect and past simple; phrasal verbs; collocations; linking words; infinitives and verb + -ing; formal requests; first and second conditionals; prepositions in time clauses; modal verbs: perfect forms; referencing; passives; the definite article; tense changes in reported speech; relative clauses

Learning Outcomes

At the end of the Unit the learners will be able to

- demonstrate appropriate use of a range of grammatical structures and vocabulary
- understand various forms of nouns, verb tense, voice, and reported speech
- use phrasal verbs, collocations and discourse markers as required
- be consistent in the correct use of grammar and effective word choice in written and oral communication

References:

1. Whitby, N. (2014). *BusinessBenchmark: Upper Intermediate.* Cambridge English: CUP.
2. Seely, John.*Oxford Guide to Effective Writing and Speaking.*Oxford University Press, (India), 2013
3. Rizvi, M Ashraf. *Effective Technical Communication*.Tata McGraw Hill. 2005.
4. Olsen, Leslie & Huckin, Thomas.*Technical Writing and Professional Communication for Non-native Speakers.*McGraw-Hill. 1991

GEL347: Workplace Communication –Advanced

L	T	P	C
3	0	0	3

Introduction

The aim of the course is to equip students with advanced language skills for successful communication in business contexts. This course will enhance students' employability and add value to their career prospects. This course will be taught through integration of the four language skills, using a blended approach.

Course Objectives

- To enhance critical thinking skills through challenging tasks and activities
- To train students for effectively using advanced language functions such as persuading, negotiating, interpreting data, hypothesizing and speculating
- To enable students to become independent and proficient users of English

Unit 1: Listening

Comprehending extended speech about complex topics in situations such as interviews, lectures, talks and meetings; identifying the purpose of speech and understanding advanced functions such as persuasion and negotiation; practising active listening strategies such as reflecting on what has been said during an extended conversation by paraphrasing, asking specific questions, and responding appropriately; dropping assumptions while listening; inferential listening: picking up on cues from what is said and not said

Learning Outcomes

At the end of the unit, the learners will be able to

- follow complex discussions, talks and presentations on business related topics
- understand the use of language in different situations for different purposes
- demonstrate an understanding of implicit language use

Unit 2: Speaking

Talking about one's work and experience; speaking at length on specific business related topics and demonstrating knowledge of relevant topics based on the conversation/discussion; developing, presenting, and defending an argument; use of persuasive language; use of appropriate register and tone

Learning Outcomes

At the end of the unit, the learners will be able to:

- express views/opinions and take part in discussions on business/work related topics using appropriate vocabulary and register
- contribute effectively to meetings and seminars
- engage in extended conversation on different topics in workplace contexts

Unit 3: Reading

Comprehending complex texts including articles on business related topics; reading with specific goals; using suitable strategies such as making connections, predicting, questioning, visualising, and summarising to become independent readers; using knowledge of text structure to enhance comprehension; interpreting opinions and ideas expressed in the texts; developing critical reading skills toidentify generalizations, spot errors in reasoning, and draw inferences/conclusions

Learning Outcomes

At the end of the unit, the learners will be able to:

- comprehend complex texts on business/workplace related topics
- understand implicit meaning and purpose of texts read
- develop critical reading skills to enhance comprehension at the inferential level

Unit 4: Writing

Writing brief reports: describing and interpreting graphical representation of data; writing proposals: describing, summarising, recommending a course of action, and persuading the reader; writing letters for specific purposes; planning and organising content in a coherent manner; using appropriate register for specific task types (correspondence, report or proposal)

Learning Outcomes

At the end of the unit, the learners will be able to

- produce different pieces of writing such as letters, reports, and proposals using language withclarity, precision, and accuracy
- consistently produce desired written message using a wide range of grammatical structures andvocabulary
- understand the use of appropriate register for different contexts

Unit 5: Grammar and vocabulary in context

Verb forms; modal verbs; defining and non-defining relative clauses; compound nouns; embedded questions; position of adverbs; cleft sentences; conditional sentences; future time clauses; complex sentences; infinitive and verb + ing; reference devices; articles; devices of concession; business vocabulary/ vocabulary related to workplace

Learning Outcomes

At the end of the unit, the learners will be able to:

- demonstrate understanding of a range of business vocabulary
- refine the ability to use English grammar as a tool for comprehension
- identify and correct select grammatical and word choice errors in texts
- speak fluently and write effectively

References

1. Whitby, N. (2014). *Business Benchmark: Advanced.* Cambridge English: CUP.
2. Seely, John. *Oxford Guide to Effective Writing and Speaking.* Oxford University Press, (India),2013
3. Rizvi, M Ashraf. *Effective Technical Communication*. Tata McGraw Hill. 2005.
4. Olsen, Leslie & Huckin, Thomas. *Technical Writing and Professional Communication for Non-native Speakers.* McGraw-Hill. 1991

19ECS431: EMBEDDED SYSTEMS

L	T	P	C
2	0	2	3

An embedded system is a multidisciplinary course which requires the knowledge of both hardware and software. The applications of embedded systems are enormous, few applications are line following robots, GPS systems, cameras, ATM cards etc. Embedded systems are broadly classified into three types- small, medium, and large embedded systems. The objective of this course is to provide the knowledge of hardware and software used in embedded systems. A course is also giving the insides of interfacing techniques and importance of real time operating system.

Course objectives:

1. To understand purpose of Embedded systems and its building blocks.
2. To familiarize advanced 32-bit ARM architecture.
3. Understand the ASM programming.
4. Understand instruction set of ARM 7 controller.
5. Understand various peripheral interfacing techniques.

Module I: Module Name (if any) Number of hours(LTP) 6 0 4

Introduction to Embedded Systems: Embedded systems vs general computing systems, history of embedded systems, classification of embedded systems, major application of embedded systems, purpose of embedded systems, elements of an embedded systems

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

1. Define an embedded system.
2. Explain the difference between general and embedded computing system.
3. Explain classification of embedded system.
4. Know the purpose and applications of embedded system.
5. Understand the basic elements required for embedded system.

Module II: Module Name(if any) Number of hours(LTP) 6 0 4

ARM Architecture: The RISC design philosophy, ARM design philosophy, The General-Purpose Registers in the ARM Section, ARM Programmers model, The ARM Memory Map, ARM CPSR (Current Program Status Register), LPC2148 processor architecture.

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

1. Explain architecture of LPC2148 processor.
2. Explain ARM program model.
3. Differentiate GPR & SFR available in LPC2148.
4. Know the ARM execution modes.
5. Can demonstrate flags.

Module III: Module Name(if any) Number of hours(LTP) 6 0 4

ARM Instruction Set and Assembly Language Programming: Arithmetic and Logic Instructions and Programs, Rotate and Barrel Shifter, Shift and Rotate Instructions in ARM, Branch Call and Looping in ARM, Calling Subroutine with BL, Simple ALP programs on Arithmetic & logical operations, Factorial.

Learning Outcomes:
After completion of this unit, the student will be able to:
1. Know Structure of ASM program.
2. Understand use of program counter
3. Explain instruction set.
4. Know the addressing modes.
5. Can develop simple Assembly language programs.

Module IV: Module Name(if any) Number of hours(LTP) 6 0 4
Introduction to ARM Programming: Simple C programs for application with LED, Control of LED with software and hardware timer, LCD interfacing, programming of LCD, ADC, Interfacing of LM35 temperature sensor, UART programming.

Learning Outcomes:
After completion of this unit, the student will be able to:
1. Explain the structure of C program.
2. Demonstrate the control of led using software and hardware timers.
3. Apply the interfacing techniques led and lcds.
4. Explain data acquisition using sensors.
5. Can program serial communication.

Module V: Module Name(if any) Number of hours(LTP) 6 0 4
RTOS BASED EMBEDDED SYSTEM DESIGN: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing, and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling, Task Synchronization Techniques, led blinking with free RTOs with Arduino.

Learning Outcomes:
After completion of this unit, the student will be able to:
1. Explain the difference between normal OS and RTOS
2. Demonstrate various operating systems and its features
3. Understand the task and its states
4. Know the different scheduling algorithms
5. Can develop simple RTOS programs

Text Books(s)
1. Rajkamal, 'Embedded system-Architecture, Programming, Design', 3/e,Tata McGraw Hill Education,2017 (UNIT 1).
2. Muhammad Ali Mazidi, SarmadNaimi, SepehrNaimi and Janice Mazidi, ARM Assembly Language Programming & Architecture, MicroDigitalEd, 2/e 2016 (UNIT 2, 3).
3. Trevor Martin, Insider 's Guide To Philips Arm7 Based Microcontroller, hitex(UK) Ltd., 1/e, 2005 (UNIT 4).
4. Shibu.K.V, "Introduction to Embedded Systems", TataMcgraw Hill, 2009(UNIT 5).
Reference Book(s)
1. Bishop C M "Pattern recognition and Machine learning", 1/e, Springer, 2006.
2. Bishop C M "Neural Networks for Pattern Recognition" Oxford University Press, 1995.

Course Outcomes:
1. Identify hardware and software needed for an embedded system.
2. Demonstrate the philosophy of RISC architecture of ARM 7.

3. Explain the structure of ASM and C program and addressing modes
4. Interface display devices, sensors and UART.
5. Understand the need of RTOS in an embedded system

19EEC475: MICROCONTROLLERS AND INTERFACING

L	T	P	C
2	1	0	3

The knowledge on Microcontroller based embedded system design is much essential in the field of automation. This course begins with the detailed discussion of the architecture and on-chip resources of 8051 followed by complete instruction set and assembly language programming. Further, this course covers C programming for 8051 which is the common platform that any designer would use to program a microcontroller. Concepts of interfacing peripherals like LCD, keypad DAC, ADC and sensors to 8051 are also discussed in the course.

Course Objectives:

- To explain the detailed architecture of 8051 microcontrollers and on chip resources.
- To familiarize with 8051 Instruction set and addressing modes.
- To get acquainted with the C programming model of 8051 microcontroller.
- To explain the functionality of serial communication, timers and other peripherals
- To design an embedded system using 8051 microcontroller.

UNIT-I **10L**

The 8051 Microcontroller: Microcontrollers and embedded processors, overview of the 8051 family, 8051 architecture-on chip resources, internal and external memory configuration, 8051 register banks, PSW, clock generator, other special function registers and their purpose, 8051 pin description.

Learning Outcomes*:*

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

- state architectural differences between microprocessors and microcontrollers (L1).
- describe the features of 8051 and compare features of family of 8051 (L2).
- understand the purpose of on chip resources and register banks (L2).
- illustrate the structure and purpose of different SFRs.(L3)
- interpret the functionalities of different pins of 8051(L4)

UNIT-II **8L**

8051 assembly language programming: Addressing modes, Instruction set: arithmetic instructions and programs, signed number concepts, logic and compare instructions, rotate instructions and data serialization, BCD, ASCII and other application programs, branch instructions-JUMP, LOOP, CALL instructions and programs.

Learning Outcomes:

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

- demonstrate the purpose of different types of instructions supported by 8051 (L2).
- interpret the operations of arithmetic, logical, branch and other instructions (L2).
- construct assembly language programs to access SFRs & other on-chip resources (L3).
- estimate the execution time of an assembly language program (L6).

UNIT-III **8L**

8051 programming in C: Data types and time delay in 8051 C, I/O programming in 8051 C, logic operations in 8051 C, accessing code ROM space in 8051 C, data serialization using C.

Learning Outcomes:

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

- identify the data types that are used for different variables (L1).
- apply time delay functions to generate different amount of delays (L3).
- demonstrate 8051 C program to perform logical operations (L3).
- develop 8051 C program to send data serially (L3).

UNIT-IV **8L**

Timers, serial port, Interrupts programming in C: Programming 8051 timers, counter programming, basics of serial communication, 8051 connections to RS232, serial port programming in assembly and C, 8051 interrupts, interrupt priority and interrupt programming in C.

Learning Outcomes:

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

- explain the functions of timers, serial communication and interrupts of 8051 (L1).
- develop C programs for serial communication and delay generation (L3).
- state different sources of interrupts supported by 8051 and their importance in embedded applications (L1).

UNIT-V **8L**

Interfacing: LCD interfacing, keyboard interfacing, ADC, DAC and sensor interfacing, 8051 interfacing to external memory.

Learning Outcomes:

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

- explain the functions of different pins, control signals of LCD (L2).
- discuss the basic operation of keyboard and describe the key press and detection mechanisms with key de bouncing (L2).
- illustrate the features and basic operations of DAC, ADC, and temperature sensor (L3).
- demonstrate the interfacing and LCD, 4X4 keypad, ADC, DAC and sensors with the 8051 (L5).

Text Book:

Mazidi and Mazidi, The 8051 Microcontroller and Embedded Systems – Using Assembly and C, 2nd Edition, Pearson Education, 2002.

References:

1. Kenneth J Ayala, “The 8051 Micro Controller Architecture, Programming and applications.
2. Raj kamal, Microcontrollers - Architecture, Programming, Interfacing and System Design- 2e-Pearson education.

Course Outcomes:

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

- explain the detailed architecture of 8051 micro controllers and on chip resources (L1).
- write 8051 Instruction sets and addressing modes (L1)
- illustrate the C programming model of 8051 microcontroller (L3).
- explain the functionality of serial communication, timers and other peripherals (L1).
- develop the on chip hard ware for the embedded system using 8051 microcontroller (L3).

19EEI471: ROBOTICS AND AUTOMATION

L	T	P	C
2	1	0	3

Robotics and automation is a branch of engineering that involves the design, manufacturing and operation of robots. It overlaps many fields of engineering including electronics, computer science, artificial intelligence, automation and nanotechnology. This course has its applications in industries related to aerospace, defense contractors, entertainment, manufacturing and medical research (development of prosthetic parts).

Course Objectives:

- To be familiar with history of robotics, technological advances and to gain insight on different types of End Effectors.
- To learn about different robotic drive systems, actuators and their control.
- To analyze the robotic kinematics in different degrees of freedom.
- To study the principles of various sensors used in robotics
- To explore industrial applications of robotics.

UNIT I **9L**

Introduction: Historical robots, robots in science fiction, future trends of robots, definitions of robots, present application status.

Robot End Effectors: Classification of end effectors, drive systems for grippers, mechanical grippers, magnetic grippers, vacuum grippers, adhesive grippers, hooks, scoops and other miscellaneous devices, active and passive grippers.

Learning Outcomes:

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

- list important developments of robot history and future trends of robots (L1).
- classify robot end effectors (L3).
- identify appropriate grippers for a given application (L2).
- compare active and passive grippers (L4).
- discuss merits and demerits of grippers (L2).

UNIT II **9L**

Robot Drives, Actuators and Control: Functions of drive systems, general types of control, pump classification, introduction to pneumatic systems, electrical drives, dc motors and transfer functions, stepper motor, drive mechanisms.

Learning Outcomes:

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

- list the functions of robot drive system (L1).
- classify robot Pump mechanisms in hydraulic system (L3).
- explain the principle operations of DC motor and stepper motor (L2).
- discuss merits and demerits of Robot actuators (L2).
- choose an apt drive mechanism for a robot application (L2).

UNIT III **7L**

Robot Kinematics: Forward and reverse kinematics of 3 degrees of freedom robot arm, forward and reverse kinematics of a 4 degree of freedom, arm manipulator in 3-D, homogeneous transformations.

Learning Outcomes:

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

- define forward and reverse kinematics of a robot (L2).
- contrast between forward and reverse kinematics of a robot (L4).
- compare a 3 degree of freedom of robot with a 4 degree of freedom of robot (L4).
- analyze the robotic Kinematics in different degrees of freedom (L4).
- apply homogenous transformation in deriving kinematics of a robot (L3).

UNIT IV **9L**

Robot Sensors: Need for sensors, types of sensors, robot vision systems, robot tactile systems, robot proximity sensors, robot speech and hearing, speech synthesis, noise command systems, speech recognition systems.

Learning Outcomes:

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

- understand the need of sensors in robot development (L2).
- classify types of sensors used in robot development (L2).
- identify appropriate sensor for a given robot application (L2).
- explain the principles of various Sensors used in robotics (L2).
- elaborate robot vision system and speech recognition system (L2).

UNIT V **9L**

Robot Applications: Capabilities of robots, materials handling, machine loading and unloading, machining and fettling, robot assembly, welding, future applications.

Learning Outcomes:

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

- list capabilities of robots (L1).
- contrast between machine loading and unloading (L4).
- explain different industrial applications of robotics (L2).
- discuss future applications of robot (L2).

Text Book:

1. S.R. Deb, Robotics Technology and Flexible Automation, TMH, 2010.

References:

1. Satya Ranjan, Robotics Technology and Flexible Automation, TMH, 2001.
2. James L.Fuller, Robotics: Introduction, Programming and Projects, Maxwell Macmillan, 2000

Course Outcomes:

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

- explain the history of robotics, technological advances and many types of end effectors (L2).
- acquire knowledge on different robotic drive systems, actuators and their control (L2).
- understand the robotic kinematics (robotic movements, position and orientation) (L2).
- select the sensors based on different applications (L4).
- understand industrial applications of Robotics (L2).

19EEC473: FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

L	T	P	C
2	1	0	3

Signal processing is an area of engineering that has developed rapidly over the past few decades. Starting with a review of discrete time systems, the course proceeds to discrete Fourier transform, fast Fourier transform algorithms, digital filter design, its implementation, filter analysis and the architectural features of DSP processor.

Course Objectives:

- To discuss about the characteristics of LTI discrete time systems.
- To explain the frequency analysis of DT signals and systems using DFT and FFT.
- To make the students understand various techniques for IIR filter design.
- To make the students understand various techniques for FIR filter design.
- To introduce the students the architectural features of DSP.

UNIT I **9L**

Discrete-Time Signals and Systems: Discrete time signals, linear shift invariant systems, stability and causality, frequency domain representation of discrete time signals and systems described by linear constant coefficient difference equations.

Learning Outcomes:

The students will be able to

- analyse the discrete time LTI systems in frequency domain (L4)
- determine the stability and causality of LTI systems(L3)
- solve the transfer function of systems described by difference equations (L3)

UNIT II **9L**

Discrete Fourier Transform: The discrete Fourier transform, properties of discrete Fourier transform, linear convolution using circular convolution, Radix - 2 Decimation-in-time (DIT) FFT algorithms and Decimation-in-frequency (DIF) FFT algorithms.

Learning Outcomes:

The students will be able to

- explain and apply the properties of Discrete Fourier Transform (L2).
- demonstrate the methods of computing DFT/ FFT values (L2).

- calculate the circular convolution, linear convolution and output response of discrete time LTI system using DFT (L6).

UNIT III **9L**

IIR Filter Design: Design of analog low pass and high pass filters using Butterworth approximation, design of IIR digital low pass and high pass filters using Bilinear transformation.

Learning Outcomes:

The students will be able to

- design low pass and high pass analog Butterworth filters (L5)
- apply the analog to digital transformation techniques (L3)
- design digital IIR Butterworth filter using Bilinear transformation (L5)

UNIT IV **9L**

FIR Filter Design: Properties of FIR digital filters, design of FIR filters using rectangular and hamming windows, comparison of IIR and FIR digital filters.

Learning Outcomes:

The students will be able to

- interpret the concept of linear phase of FIR Filters (L2)
- design linear phase FIR filters using rectangular and hamming windows (L5)
- compare IIR and FIR digital filters (L4)

UNIT V **6L**

DSP Processors Architecture: DSP architecture for signal processing - Harvard architecture, pipelining, hardware multiplier-accumulator.

Learning Outcomes:

The students will be able to

- explain about the Harvard architecture of DSP Processors (L2)
- illustrate pipelining in DSP processors and hardware multiplier- accumulator (L3)

Text Books:

1. A.V. Oppenheim, R. W. Schafer, Discrete-Time Signal Processing, 2/e, Prentice Hall of India, 2004.
2. Ifeachor E.C, Jervis B.W, Digital Signal Processing – A Practical Approach, 2/e, Pearson Education, 2002.

References:

1. Sanjay K.Mitra, Digital Signal Processing - A Computer based Approach, 4/e, TMH Publications, 2011.
2. J.G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4/e, Pearson Education, 2007.

Course Outcomes:

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

- identify the characteristics of LTI discrete time systems.
- compute the DFT of a sequence using DFT and FFT algorithms (L6)
- identify and design the IIR filter from the specifications (L4)
- identify and design the FIR filter from the specifications (L4)
- explain the architectural features of DSP processors (L2)

19EBT473: Introduction To Bioinformatics

L	**T**	**P**	**C**
2	1	0	3

Modern high throughput methods generate vast amounts of biological data. Bioinformatics enables us to validate, store, retrieve and analyse these data sets. This course introduces the data structures and algorithms that enable us to compare, classify and predict the function of biological sequences.

Course objectives:

1. describe nature and type of information available in biological databases (L1)
2. explain the principles of sequence alignment (L2)
3. analyze the algorithms for phylogenetic analysis (L3)
4. explain the principles of protein structure prediction (L2)
5. explain the principles of structural and functional genomics (L2)

Module I: Module Name (if any) Number of hours(LTP) 6 0 6

Introduction to Biological data types and databases.
Brief introduction to information available in the following databases: NCBI-Genebank, PIR, PFAM, PDB.
Sequence analysis: concepts of sequence alignment.
BLAST Tool for searching sequence databases. Description of the BLAST algorithm
Learning Outcomes:
After completion of this unit, the student will be able to:

1. summarize the advantages of storing information in databases (L2)
2. identify the most appropriate database for each type of biological entity (L5)
3. calculate similarity of two aligned sequences (L3)
4. summarize the principles of the BLAST algorithm (L2)
5. describe the applications of BLAST and its variants (L1)

Module II: Module Name(if any) Number of hours(LTP) 6 0 6

Pairwise sequence alignment using dynamic programming. Needleman & Wunsch algorithm for global alignment. Smith-Waterman algorithm for local alignment.
Searching for repeats and partial overlaps using dynamic programming.
Multiple sequence alignment. Multidimensional dynamic programming.
Learning Outcomes:
After completion of this unit, the student will be able to:

1. apply dynamic programming for pairwise sequence alignment algorithms (L3)
2. evaluate the score for optimal global alignment of a pair of sequences (L5)
3. evaluate the score for optimal local alignment of a pair of sequences (L5)
4. evaluate the score for optimal end overlap alignment of a pair of sequences (L5)
5. predict the optimal alignment to find repeats of one sequence in another (L2)

Module III: Module Name(if any) Number of hours(LTP) 6 0 6

Phylogenetic analysis. Distance based methods: UPGMA and Neighbour joining.
Classical parsimony and weighted parsimony methods.
Branch and bound for phylogenetic analysis.
Sankoff and Cedergren method for Simultaneous alignment and phylogeny.
Learning Outcomes:
After completion of this unit, the student will be able to:

1. describe the principles and algorithms used for molecular phylogenetic analysis (L1)
2. describe algorithm for simultaneous alignment and phylogeny (L1)
3. compare the distance based and character-based algorithms for phylogenetic analysis (L5)
4. apply distance-based algorithms for phylogenetic analysis (L3)

5. apply character based algorithms for phylogenetic analysis (L3)

Module IV: Module Name(if any) Number of hours(LTP) 6 0 6

Prediction of transmembrane helices. Prediction of secondary structure from protein sequence – Chou-Fasman rules, neural networks. Prediction of protein conformation from protein sequence. Protein structure prediction with Homology, Threading and Neural Networks. Protein structure prediction with Force fields. Virtual screening for drug discovery.

Learning Outcomes:

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

6. compare the methods for prediction of transmembrane helices and secondary structure (L5)
7. describe the principles of neural networks (L1)
8. describe the concepts related to force fields (L1)
9. compare the information theoretical and force field-based methods for protein structure prediction (L5)
10. describe the principles of virtual screening (L1)

Module V: Module Name(if any) Number of hours(LTP) 6 0 6

Computational problems in genome sequencing. Graph theoretical formulation of the fragment assembly problem. Hamiltonian path and Eulerian path-based algorithms for fragment assembly. Gene and promoter prediction from genome sequence using Position Specific Score Matrices. K-means and SOM algorithms for analysis of gene expression data.

Learning Outcomes:

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

1. understand the computational problems and concepts of structural and functional genomics (L2)
2. compare the algorithms available for structural and functional genomics (L4)
3. predict genomic sequence from fragment sequence data by using a Hamiltonian path-based algorithm (L6)
4. predict genomic sequence from fragment sequence data by using a Eulerian path-based algorithm (L6)
5. predict promoter sites by using genomic sequence data and a position specific score matrix (L6)

Textbook(s)

1. R. Durbin, S. Eddy, A. Krogh, G. Mitchison, Biological sequence analysis: Probabilistic models of proteins and nucleic acids, Cambridge University Press. 1998.
2. P. Pevzner and R. Shamir. Bioinformatics for Biologists. Cambridge University Press. 2011.

Reference Book(s)

1. A. Leach, Molecular modelling: principles and applications, 2/e, Pearson, 2009.
2. Teresa K. Attwood, Stephen R. Pettifer, David Thorne. Bioinformatics Challenges at the Interface of Biology and Computer Science: Mind the Gap. John Wiley & Sons, 2016. 047003548X, 9780470035481.
3. D. Mount, Bioinformatics: Sequence and Genome analysis, 2/e. CBS publishers. 2005.

Course Outcomes:

1. list biological databases related to biochemicals, proteins and nucleic acids (L1)
2. assess similarity of biological sequences (L5)
3. solve problems in phylogenetic analysis (L6)
4. predict protein structure based on sequence information and structure of homologs (L6)
5. construct genomic sequences from fragments (L6)

19EPH471-QUANTUM COMPUTING

L	T	P	C
2	1	0	3

Course objectives

The objective of this course is to impart necessary knowledge to the learner so that he/she can implement the well-known algorithms of quantum computing.

Unit 1: Introduction to quantum computing (9 hours)

Motivation for studying Quantum Computing
Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.)
Origin of Quantum Computing
Overview of major concepts in Quantum Computing

- Qubits and multi-qubits states,
- Bra-ket notation.
- Bloch Sphere representation
- Quantum Superposition
- Quantum Entanglement

Learning outcomes

After completion of this unit the student will be able to

1. ***relate*** *to the relevance of the emerging field of quantum computing (L1)*
2. ***interpret*** *the basics of quantum computing (L2)*
3. ***summarize*** *the concept of quantum entanglement (L2)*

Unit 2: Mathematical foundation for quantum computing (9 Hours)

Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, eigenvalues and eigenvectors.

Learning outcomes

After completion of this unit the student will be able to

1. ***interpret*** *the basis, and their properties over Hilbert spaces (L2)*
2. ***apply*** *unitary operators (L3)*
3. ***make use of*** *the braket notation of Dirac (L3)*
4. ***solve*** *for eigenvalues and eigenvectors of a matrix (L3)*

Unit 3: Building blocks for quantum program (9 Hours)

Architecture of a Quantum Computing platform
Details of q-bit system of information representation:

- Bloch sphere
- Multi-qubits states
- Quantum superposition of qubits (valid and invalid superposition)
- Quantum entanglement
- Useful states from quantum algorithmic perspective e.g. Bell states
- Operation on qubits: Measuring and transforming using gates.
- Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc.

Programming model for a quantum computing program

- Steps performed on classical computer
- Steps performed on quantum computer
- Moving data between bits and qubits

List of Practicals

1. Building Quantum dice
2. Building Quantum Random No. Generation
3. Composing simple quantum circuits with q-gates and measuring the output into classical bits.

Learning outcomes

After completion of this unit the student will be able to

1. ***explain*** *Bloch sphere representation. (L2)*
2. ***interpret*** *the concepts of quantum bits, their superposition and quantum entanglement. (L2)*
3. ***make use of*** *various quantum logic gates. (L3)*
4. ***compare*** *the programming model of a classical and quantum computer. (L2)*
5. ***generate*** random numbers and ***evaluate*** simple quantum circuits (L5, L6)

Unit 4: Techniques for quantum algorithms (9 Hours)

Basic techniques exploited by quantum algorithms.

- Amplitude amplification
- Quantum Fourier transform
- Phase kick-back
- Quantum phase estimation
- Quantum walks

List of Practicals

1. Simulate quantum walks using numpy/scipy

Learning outcomes

After completion of this unit the student will be able to

1. ***interpret*** *the idea of amplitude amplification used for many, including Grover's search algorithm*(L3)
2. ***make use of*** *the idea of quantum Fourier transform that is used in Shor's algorithm* (L3)
3. ***relate*** *phase kick-back to quantum phase estimation* (L3)
4. ***summarize*** *the quantum walks and compare them to classical random walks* (L2)
5. **generate** quantum walks and compare with classical random walk (L5)

Unit 5: Quantum algorithms and toolkits (9 Hours)

Major Algorithms

- Shor's Algorithm
- Grover's Algorithm
- Deutsch's Algorithm
- Deutsch -Jozsa Algorithm

OSS Toolkits for implementing Quantum program

- IBM quantum experience
- Rigetti PyQuil (QPU/QVM)

List of Practicals

1. Implementation of Shor's Algorithms
2. Implementation of Grover's Algorithm

3. Implementation of Deutsch's Algorithm
4. Implementation of Deutsch-Jozsa's Algorithm
5. Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm

Learning outcomes

After completion of this unit the student will be able to

1. ***apply*** *the widely used quantum algorithms for several basic problems (L3).*
2. **assess** Shor's quantum algorithm used for integer factorization and discrete logarithm computation (L5).
3. ***examine*** *the deterministic algorithms* - Deutsch's and Deutsch -Jozsa algorithm (L4).
4. **compare** two well-known opensource toolkits (L2).

Course Outcomes

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

- **explain** the working, architecture and program model of a quantum computer. (L2).
- **interpret** and **make use of** quantum logic gate circuits. (L2, L3).
- **make use of** several quantum algorithms (L3).
- **experiment with** quantum algorithm on major toolkits (L3).

Text Books:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley
3. IBM Experience: https://quantumexperience,ng,bluemix.net
4. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit
5. Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/

19EME456: Optimization Techniques

L	T	P	C
2	1	0	3

This course exposes the evaluation of the best possible solution for various engineering planning and design problems. The aim of the course is to train the students to develop a mathematical model and to solve the model by applying an appropriate mathematical programming technique. This course also covers advanced optimization techniques to solve dynamic and integer programming problems.

Course objectives:

1. To illustrate the importance of optimization techniques in theory and practice.
2. To formulate and solve engineering design problems in the industry for optimal results
3. To test the analytical skills in solving real engineering problems by applying appropriate optimization technique
4. To demonstrate various advanced optimization techniques being developed in recent times.
5. To develop and promote research interest in problems of Engineering and Technolog

Module I: Introduction to optimization; Classical Optimization techniques; Number of hours(LTP) 9 0 0

Introduction to optimization Introduction, engineering applications of optimization, statement of an optimization problem-design vector, design constraints, constraint surface, objective function, classification of optimization problems.

Classical Optimization techniques Introduction, single variable optimization, multi variable optimization with no constraints, multi variable optimization with equality and inequality constraints.

Module II: One Dimensional Minimization Methods Number of hours(LTP) 9 0 0

One Dimensional Minimization Methods Introduction, unimodal function, elimination methods-exhaustive search, interval halving method, Fibonacci method, golden section method, interpolation methods-quadratic & cubic interpolation methods, direct root methods-Newton method, secant method.

Module III: Unconstrained Minimization Methods Number of hours(LTP) 9 0 0

Unconstrained Minimization Methods: Introduction, Direct Methods- random search methods, univariate method, Powell’s method. Descent method - steepest descent method (Cauchy’s method)

Module IV: Dynamic Programming Number of hours(LTP) 9 0 0

Dynamic Programming Introduction, Bellman’s optimality principle, application of Dynamic Programming - Shortest Path Problem, cargo-loading problem, optimal subdividing problem, Linear programming problem.

Module V: Integer Programming Number of hours(LTP) 9 0 0

Integer Programming Introduction, All Integer and Mixed Integer Programming problems-Gomory’s cutting plane method & Branch-and-bound method. Balas algorithm for zero-one programming.

Text Books(s)

1. S.S.Rao, Engineering optimization theory and practice,3rd Edition, New age international,2007

Reference Book(s)

1. H.A.Taha, Operations Research, 9th Edition, Prentice Hall of India, 2010
2. F.S.Hillier, and G.J.Lieberman, Introduction to Operations Research, 7th Edition, TMH, 2009.

Course Outcomes:

1. classify optimization problems and apply classical optimization techniques to solve NLPPs having differentiable functions [L2&L3]
2. apply the concept of uni-modal function to solve one dimensional minimization problems [L3]
3. solve any multi variable optimization problems[L3]
4. solve any complex optimization problem as a dynamic programming problem and analyze its solution [L3&L4]
5. recognize the significance of integer and/or binary solutions and apply a suitable algorithm for better decision making [L1&L3]

19ECS441: Information Retrieval Systems

L	T	P	C
2	0	2	3

This course studies the basic principles and practical algorithms used for information retrieval and text mining. The contents includes: statistical characteristics of text, several important retrieval models, text categorization, recommendation system, clustering, information extraction, etc. The course emphasizes both the above applications and solid modeling techniques (e.g., probabilistic modeling) that can be extended for other applications.

Course Objectives

1. Introduce the objectives and functionalities of information retrieval systems.
2. Learn data structures and indexing the information.
3. Familiarize the Document, Term Clustering and User Search Techniques.
4. Explore Information Visualization and Text Search Algorithms.
5. Understand Information System Evaluation and Multimedia Information Retrieval.

Module I:	**Introduction to Information Retrieval Systems**	9	L

Motivation: Information versus Data Retrieval, Information Retrieval at the Center of the Stage. Basic Concepts: The User Task, Logical View of the Documents. Past, Present, and Future: Early Developments, Information Retrieval in the Library, The Web and Digital Libraries, Practical Issues. The Retrieval Process. Introduction to modeling; A Taxonomy of Information Retrieval Models.

Learning Outcomes:

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

1. Enlist the objectives and functionalities of Information Storage and Retrieval System (L1).
2. Differentiate DBMS and IRS (L2).
3. Identify Digital Libraries available across web and data warehouses (L1).
4. Explain thesaurus, rank, item, token, precision, recall, document and stop words (L2).
5. Describe Search and Browsing capabilities of an IRS (L2).

Module II:	**Data Structures and Automatic Indexing**	9	L

Data Structure & Automatic Indexing: Introduction, stemming algorithms, inverted file structures, n-gram data structure, PAT data structure, signature file structure, classes of automatic indexing, statistical indexing, natural language, concept indexing.

Learning Outcomes:

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

1. Describe the process of Indexing (L2).
2. Demonstrate the working of Data Structures (L2).
3. Sketch working of Signature File Structure (L2).
4. Enlist different types of Indexing Techniques (L1).
5. Apply the Concept of Indexing (L3).

Module III:	**Document Clustering, Term Clustering and User Search Techniques**	9	L

Document Clustering, Term Clustering and User Search Techniques: Introduction, thesaurus generation, item clustering, hierarchy of clusters. search statements and binding, similarity measures and ranking, relevance feedback, selective dissemination of information search, weighted searches of Boolean systems.

Learning Outcomes:

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

1. Identify various clustering algorithms (L1).
2. Apply different clustering algorithms to retrieve the information (L3).
3. Describe User Search Techniques (L2).
4. Describe similarity measures and ranking (L2).
5. Identify the techniques used for evaluation of feedback strategies (L1).

Module IV:	**Information Visualization and Text Search Algorithms**	9	L

Information Visualization & Text Search Algorithms: Introduction, cognition and perception, information visualization technologies: Histogram, Pie chart, Scatter Plot, Dendrogram. introduction, software text search algorithms: Knuth –Morris –Pratt Algorithm ,Boyer Moore Algorithm

Learning Outcomes:

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

1. Differentiate Different types of text search algorithms (L2).
2. Explain cognition and perception (L2).
3. Demonstrate information visualization technologies (L3).
4. Apply software text search techniques (L3).

Module V:	**Information System Evaluation &Multimedia Information Retrieval**	9	L

Information System Evaluation and Multimedia Information Retrieval: Introduction, measures used in system evaluation, measurement example - TREC results, models and languages: Data modelling, query languages, Spoken language audio retrieval, non-speech audio retrieval, graph retrieval, image retrieval and video retrieval.

Learning Outcomes:

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

1. Enlist different measures used in system evaluation (L1).
2. Demonstrate System Evaluation with an Example (L3).
3. Identify different types of Data models (L1).
4. Identify different Query Languages (L1).
5. Apply Data Modelling Techniques and Query Languages(L3)

Text Books(s)

1.Kowalski, Gerald, Mark T Maybury, Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 2013.

Reference Book(s)

1. Ricardo Baeza-Yates, Modern Information Retrieval, Pearson Education, 2008.
2. Robert Korfhage, Information Storage & Retrieval, John Wiley & Sons, 1997.
3. C. J. van Rijsbergen, Information Retrieval, (PDF Version), 1979

Course Outcomes:

After successful completion of the course the student will be able to:

1. Explain the functions of Information Retrieval Systems (L2).
2. Demonstrate the working of Data Structures and Indexing (L3).
3. Apply different clustering algorithms to retrieve the information (L3).
4. Demonstrate information visualization technologies (L3).
5. Demonstrate the System Evaluation and Data Modelling and Query Languages (L3).

19ECS443: Natural Language Processing

L	T	P	C
2	0	2	3

Ability to understand and interpret complex language utterances is a crucial part in design of intelligent agents. Natural language processing is the sub-field of linguistics and computer science which helps in interpreting the human language by a machine. More specifically, natural language processing is the computer understanding, analysis, manipulation, and/or generation of natural language. This course enables the students to learn Natural language processing at different levels like Morphological Level, Syntactic Level, Semantic Level, Discourse Level and Pragmatic Level.

Course objectives:

1. To understand the architecture and design of Natural language processing
2. To analyse various tagging techniques
3. To adopt concepts of Context free grammars for NLP
4. To provide knowledge on semantic properties of embeddings
5. To implement and learn the applications like sentiment analysis

Module I: Number of hours (LTP) 6 0 6

Introduction to natural language processing, ambiguities in language, Regular expression, words, morphology, morphology parsing, word tokenization, lemmatization & stemming, edit distance. N-grams language models, smoothing-Laplace smoothing, Good-Turing discounting, Interpolation-Backoff, and perplexity

Learning Outcomes:

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

1. acquire a basic understanding of the natural language processing (L2)
2. have the understanding of tokenization. (L2)
3. explain lemmatization and stemming (L2)
4. differentiating smoothing and Laplace smoothing(L4)
5. illustrate Good Turing discounting (L2)

Module II: Number of hours (LTP) 6 0 6

Introduction, English word classes, tagsets in English, rule-based part of speech tagging, HMM part of speech tagging, transformation-based part of speech tagging, Evaluation and error analysis, Issues- tag indeterminacy and tokenization, Unknown words

Learning Outcomes:

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

1. experiment with tagging (L3)
2. make use of the part of speech tagging(L3)
3. outline the knowledge of issues of tagging (L2)
4. understand tag indeterminacy (L2)
5. make use of evolution and error analysis(L3)

Module III: Module Name (if any) Number of hours (LTP) 6 0 6

Syntactic Parsing, Ambiguity, CKY parsing, Early parsing, probabilistic context free grammar, PCGFS for language modelling, Probabilistic CKY parsing of PCFGs, ways to learn rule probability, Problems with PCFGs

Learning Outcomes:

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

1. understand the problems with PCFGs (L2)
2. visualize probabilistic CKY parsing (L3)
3. experiment with context free grammar(L3)
4. apply rule of probability (L3)

5. define parsing(L1)

Module IV: Number of hours (LTP) 6 0 6

Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, word2Vec, Visualizing Embeddings, semantic properties of embeddings, bias and embeddings, Evaluating vector models.

Learning Outcomes:

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

1. apply lexical semantics (L3)
2. understand semantic properties of embeddings (L2)
3. illustrate cosine similarity (L2)
4. differentiate between lexical and vector semantics (L2)
5. explain about how to evaluate vector models (L2)

Module V: Discourse Analysis Number of hours (LTP) 6 0 6

Coreference Resolution - Text Coherence - Discourse Structure, word sense disambiguation, semantic role labelling. Machine Translation -Transfer Metaphor–Interlingua- Statistical Approaches- IBM1 model. Application of NLP: Sentiment classification, Text summarization and Factoid Question Answering

Learning Outcomes:

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

1. have a basic understanding of discourse coherence (L2)
2. have the understanding disambiguation (L2)
3. infer co-reference resolution (L2)
4. understanding sentiment classification (L2)
5. make use of NLP for text summarization (L3)

Text Books(s)

1. Daniel Jurafsky, James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2/e, Prentice Hall, 2008.
2. C. Manning, H. Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, MA, 1999.
3. Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press, 2019.

Reference Book(s)

1. Jalaj Thanaki, Python Natural Language Processing: Explore NLP with machine Learning and deep learning Techniques, Packt, 2017.

Course Outcomes:

1. Understand the morphology, morphology parsing, word tokenization, lemmatization & stemming
2. Understand the concepts tag indeterminacy and tokenization
3. Apply various parsing techniques for natural language processing processors
4. Distinguish and apply lexical and vector semantics to design word embeddings
5. Design a statistical model for IBM1 and sentimental analysis

19ECS445: ADHOC AND SENSOR NETWORKS

L	T	P	C
2	0	2	3

The objective of this course is to build an understanding of the core issues encountered in the design of Wireless ADHOC and Sensors networks. It also focuses on the recent paradigms in the wireless adhoc communication. The course includes the fundamentals of wireless communication and provides an overview of existing and emerging wireless communication networks and also the protocols used. It covers fundamentals of cellular communication, multiple access technologies and various wireless networks including past and future generation networks addressing the security aspects and defending against the various security attacks and design of security protocols.

Course objectives:

1. To learn about the issues and challenges in the design of wireless ad hoc networks.
2. To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
3. To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
4. To understand various security issues in ad hoc and sensor networks and the corresponding solutions.

Module I: MAC &ROUTING IN AD HOC NETWORKS Number of hours(LTP) 9 0 6

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

Learning Outcomes:

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

1. Understands the basics of Wireless and Ad hoc Networks.
2. Understands the various MAC Layer Protocols.
3. Understands the basics of routing.
4. Understands the Routing Principle in AD hoc Networks.
5. Understands the Design Issues in building Routing Protocols.

Module II: TRANSPORT &QOS IN AD HOC NETWORKS Number of hours(LTP) 9 0 6

TCP‟s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model.

Learning Outcomes:

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

1. Understands the TCP Challenges in Ad Hoc Networks.
2. Understands the Design Issues in Ad Hoc Networks.
3. Understands the Issues in Design Transport Protocols.
4. Understands the QoS Model.
5. Understands the Design approach to provide QoS for Various Layers.

Module III: MAC & ROUTING IN WIRELESS SENSOR NETWORKS Number of hours(LTP) 9 0 6

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention- Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols.

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

1. Understands the basics of MAC Protocols.
2. Understands the Design Challenges in Sensor Network Architecture.
3. Understands the Basics concepts of the Protocol design.
4. Understands the various categories of MAC protocols.
5. Understands the IEEE 802.15.4 Zigbee protocols.

Module IV: Number of hours(LTP) 9 0 6

TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples.

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

1. Understands the Concept of Data Centric and Contention Based Networks.
2. Design of QoS for Transport Layer.
3. Understands the basics and strategy involved in the congestion control.
4. Identifying the various Operating Systems for WSN.
5. Understanding the Design principles with examples for WSN operating systems.

Module V: SECURITY IN AD HOC AND SENSOR NETWORKS Number of hours(LTP) 9 0 6

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

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

1. Understands the Basics of Security Attacks and Intrusion Detection.
2. Understands the various strategies to address the different security attacks.
3. Find the various methods to address the routing attacks.
4. Understands the basics of Authentication and WSN Protocols for Authentication.
5. Understands the Security protocols for WSN.

Text Books(s)

1. C.Siva Ram Murthy and B.S.Manoj, —Ad Hoc Wireless Networks – Architectures and 2 Protocols‖, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, —Protocols and Architectures for Wireless Sensor Networks‖, John Wiley & Sons, Inc., 2005.

Reference Book(s)

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, —Ad Hoc Mobile Wireless Networks‖, Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, —Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)‖, World Scientific Publishing, 2011.
3. Waltenegus Dargie, Christian Poellabauer, —Fundamentals of Wireless Sensor Networks Theory and Practice‖, John Wiley and Sons, 2010
4. Xiang-Yang Li , "Wireless Ad Hoc and Sensor Networks: Theory and Applications‖, 1227 th edition, Cambridge university Press,2008.

Course Outcomes:

1. Identify different issues in wireless ad hoc and sensor networks.
2. To analyze protocols developed for ad hoc and sensor networks.
3. To identify and understand security issues in ad hoc and sensor networks.

19ECS447: Parallel Computing

L	T	P	C
2	0	2	3

The goal of this course is to introduce the foundations of parallel computing including the principles of parallel algorithm design, analytical modelling of parallel programs, programming models for shared- and distributed-memory systems, parallel computer architectures, along with numerical and non-numerical algorithms for parallel systems. The course will include emerging multicore hardware, shared-memory programming models, message passing programming models used for cluster computing, data-parallel programming models for GPUs, and problem-solving on large-scale clusters using MapReduce.

Course objectives:

1. Introduction to parallel computing foundations
2. Programming models for shared and distributed-memory systems
3. Data parallel programming models for GPUs
4. Problem-solving on large-scale clusters using MapReduce
5. Writing efficient parallel programs

Module I: Introduction Number of hours (LTP) 6 0 6

Automating Parallel programming, Parallel algorithms, and parallel architecture, measuring the benefits of parallel computing, Amdahl's law for multiprocessor systems, applications of parallel computing, shared-memory multiprocessors (Uniform Memory Access – UMA), distributed-memory multiprocessors (Non-Uniform Memory Access – NUMA)

Learning Outcomes:

1. Introduction to parallel computing
2. Application of parallel computing
3. Uniform vs non-Uniform memory access

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

1. Realize the importance of parallel computing
2. Where exactly parallel computing is needed
3. Differentiate shared vs distributed memory multiprocessors

Module II: Parallel Algorithm Design Number of hours (LTP) 6 0 6

The task / channel Model, Foster's design methodology: Partitioning, communication, agglomeration, mapping

Application: Boundary value problem

Reduction: Finding a maximum value

Data input.

MapReduce Computation: Apache Hadoop, Hadoop Streaming, Example – wordcount

Learning Outcomes:

1. Understanding parallel algorithm design
2. Foster design methodology

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

1. Understand the design of a parallel algorithm
2. Apply parallel algorithm concepts

Module III: Applications Number of hours (LTP) 6 0 6

Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for processor Arrays

Sorting: Enumeration Sort, Lower bounds on parallel Sorting, Odd-Even Transposition sort, Bitonic Merge

Learning Outcomes:

1. Understand the applications and implementation of parallel computing
2. Apply parallel concept for sorting

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

1. Analyse the applications of parallel computing
2. Implement sorting using parallel concepts

Module IV: Searching and Optimization Number of hours (LTP) 6 0 6

Branch-and-Bound Search, Genetic Algorithms: Evolution, Sequential Genetic algorithms, initial population, selection process off-spring production, variations, Termination conditions, parallel genetic algorithms

Successive refinement, Hill climbing

Learning Outcomes:
1. Searching techniques
2. Optimization of genetic algorithms

After completion of this unit, the student will be able to:
1. Understand Genetic algorithms

Module V: Number of hours (LTP) 6 0 6

Dictionary Operations: Ellis's Algorithm, Manber and Ladner's algorithm

Graph algorithms: Searching a graph, connected components,

Combinatorial Search: Divide and Conquer, Branch, and bound, alpha-beta Search

Learning Outcomes:
1. Dictionary operations
2. Parallel graph algorithms
3. Combinatorial search

After completion of this unit, the student will be able to:
1. Understand dictionary operations
2. Understand parallel graph algorithms
3. Understand combinatorial search

Textbooks (s)
1. Algorithms and Parallel Computing by Fayex Gebali, A John Wiley & Sons, Inc. Publication ISBN 978-0-470-90210-3
2. Parallel Programming in C with MPI and Open MP by M.J. Quinn, McGraw Hill. Publication ISBN 978-0072822564
3. Text Book –Parallel Computing Theory and Practice by Michael J. Quinn, McGraw Hill. Publication ISBN 978-0-07-049546-3
4. Parallel Programming Techniques and Applications using Networked Workstations and parallel computers by Barry Wilkinson and Michael Allen, Pearson. Publication ISBN 978-81-317-0239-0

Reference Book(s)
1. Programming on Parallel Machines: GPU, Multicore, clusters and More by Norm Matloff (Open-source Book).

Course Outcomes:
1. Introduction to parallel computing foundations
2. Programming models for shared and distributed-memory systems
3. Data parallel programming models for GPUs
4. Problem-solving on large-scale clusters using MapReduce
   Writing efficient parallel programs

19ECS449: Augmented Reality and Virtual Reality

L	T	P	C
2	0	2	3

The objective of this course is to mainly establish and cultivate a broad and comprehensive understanding of this rapidly evolving and commercially viable growing field of Computer Science. Augmented Reality and Virtual Reality technologies are really hitting the ground right now and are the buzzwords among the technical communities. With these methods, the businesses are trying to get their brands to a whole new level of success and popularity. Integrating AR/VR in Education can increase the experience of learning; in medicine, increases the experience of understanding; in engineering, increases the experience of visualization; in business, increases the In-User Engagement, Boost in Brand Loyalty, Mobility, Better Advertising of products and many more.

Course objectives:
1. To provide an understanding of Mixed reality and the cause for its origins
2. To give a practical understanding of Virtual Reality with an immersive Experience
3. To provide a practical understanding of Augmented Reality with the available devices
4. To make aware of necessary hardware and software to develop AR/VR applications and to enable in attaining skills for using hardware and software.
5. To pave a way to analyse the existing AR/VR applications as case studies and create some new applications.

Module I: Introduction to Mixed Reality (MR) Number of hours(LTP) 6 0 6
Introduction, A history of Mixed Reality Technologies, The Origin of MR Concept

Learning Outcomes:
After completion of this unit, the student will be able to:
1. describe the origins of MR concept – L1
2. understand the concept of Mixed Reality – L2
3. apply in the real time applications of MR technologies – L3
4. analyse the usage of MR Technologies in various fields – L4

Module II: Introduction to Virtual Reality (VR) Number of hours(LTP) 6 0 6
Fundamental of VR, Types of VR, Current VR Technologies, Benefits, Disadvantages, Case study which cover the applications in various fields, like in Education, Military, Engineering, Architecture, Medical etc.,
Learning Outcomes:
After completion of this unit, the student will be able to:
1. describe the types of VR with a practical understanding – L1
2. understand the concept of Virtual Reality – L2
3. analyse the current VR Technologies – L3
4. understand the benefits and disadvantages of VR Technologies – L2
5. analyse the VR Applications in various fields for creating new applications – L3

Module III: Introduction to Augmented Reailty Number of hours(LTP) 6 0 6
Definitions and Terminology, Types of AR- Marker and Marker-less based AR tracking, Current AR Technologies like Hardware, Tracking devices and Headmounted displays along with softwares, Benefits of AR, Disadvantages and Case study AR Applications in Education, Medicine, Military etc.,

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

1. understand the concept of Augmented Reality – L2
2. describe the types of AR with a practical understanding – L1
3. analyse the current AR Technologies and Tracking Techniques – L3
4. understand the benefits and disadvantages of AR Technologies – L2
5. analyse the AR Applications in various fields for creating new applications – L3

Module IV: Development Tools and Frame Works Number of hours(LTP) 6 0 6
Human factors: Introduction, the eye, the ear, the somatic senses.

Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems.
Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to Blender, Meshroom and UNITY

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

1. understand the different sensors available for AR/VR – L2
2. describe the existing Hardware like head mounted displays and haptics – L1
3. hands-on experience with available software – L3
4. analyse and Convert a 2D image to 3D using Meshroom and Blender – L4
5. create an AR-VR application using UNITY – L6

Module V: Mixed Reality in Education - Applications Number of hours(LTP) 6 0 6
Virtual Reality in Education-VR Applications for Primary schools high schools, in-service professional training, Augmented Reality in Education-AR Applications for Primary schools high schools, in-service professional training.
Learning Outcomes:
After completion of this unit, the student will be able to:

1. understand the application of AR/VR in education – L2
2. analyse various case studies for education – L4
3. create an AR/VR application for primary school education – L6
4. test the developed AR/VR applications in real time – L5

Text Books(s)

1. **Zeynep Tacgin, Virtual and Augmented Reality: An Educational Handbook , Cambridge Scholars, 2020, ISBN (10): 1-5275-4813-9** (Chapter-1, 2, 3, 5)

2. **Pangilinan, Erin, Steve Lukas, and Vasanth Mohan. Creating augmented and virtual realities: theory and practice for next-generation spatial computing. " O'Reilly Media, Inc.", 2019.** (Chapter-4)

Reference Book(s)

1. **Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016**

2. **Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.**

Course Outcomes:

1. know how AR/VR systems work and the applications of VR – L1
2. understand the design and implementation of the hardware that enables AR/VR systems to be built – L2
3. understand the system of human vision and its implication on perception and rendering – L2
4. apply the concepts of motion and tracking in AR/VR systems – L3

5. build applications based on understanding the importance of interaction and audio in AR/VR systems – L6

19ECS451: Agile Software Development

L	T	P	C
2	0	2	3

Agile software development practices enable customer centric software development with collaborative teamwork centred around people. This course elaborates agile development principles and techniques covering the entire software development process from problem conception through development, testing and deployment to equip the learner with practical software development methodology

Course objectives:

1. To understand the agile concept and its importance in software development.
2. To acquire complete knowledge on Extreme programming.
3. To know complete modelling of agile processes on the XP environment.
4. To acquire knowledge on Scrum.
5. To familiar with Feature driven development

Module I: Introduction **Number of hours (LTP) 6** 0 **6**

Introduction: The Agile manifesto, Agile methods, XP: Extreme Programming, DSDM, SCRUM, feature- Driven Development, Test Driven Development, modelling misconceptions, agile modelling, tools of misconceptions, updating agile models.

Learning Outcomes:

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

1. Understand Agile concepts (L1)
2. Distinguish different agile methods for software development(L2)
3. Describe the origins and motivations of the Agile Manifesto(L3)
4. Analyse requirements to prepare features and user stories (L4)
5. Construct different agile models(L6)

Module II: Extreme Programming **Number of hours (LTP) 6 0** 6

Extreme Programming: Introduction, core XP values, the twelve XP practices, about extreme programming, planning XP projects, test first coding, making pair programming work.

Learning Outcomes:

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

1. Define core XP values(L1)
2. Explain the twelve XP practices(L2)
3. Identify different XP projects(L4)
4. Justify extreme programming(L5)
5. Construct test first coding and pair programming(L6)

Module III: Agile Modelling and XP **Number of hours (LTP) 6 0 6**

Agile Modelling and XP: Introduction, the fit, common practices, modelling specific practices, XP objections to agile modelling, agile modelling and planning XP projects, XP implementation phase.

Learning Outcomes:

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

1. How Agile Modelling enables developers to develop customized software(L1)
2. Illustrate common practices and specific practices(L3)
3. Apply XP objections to agile modelling(L4)

4. Distinguish agile modelling and planning XP projects(L5)
5. Create XP implementation phase(L6)

Module IV: Scrum **Number of hours (LTP) 6 0** 6

Scrum: Scrum Framework, Agile Principles, Sprints, Requirements and User Stories, Product backlogs, Estimation and Velocity, Roles, Planning, Multi-level Planning, Release Planning, Sprint planning.

Learning Outcomes:

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

1. Understand Scrum enables developers to develop customized software(L1)
2. Demonstrate Scrum practices (L3)
3. Develop user stories (L4)
4. Develop scrum process for implementation of case study (L4)
5. Identify tools for Agile Development (L3)

Module V: Feature-Driven Development: **Number of hours (LTP) 8 0 6**

Feature-Driven Development: Introduction, incremental software development, Regaining Control, motivation behind FDD, planning an iterative project, architecture centric, FDD and XP.

Test Driven Development: Unit Tests, Integration Tests, End-to-End Tests, Customer Tests.

Release Management: Version Control, Continuous Integration.

Learning Outcomes:

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

1. Define Feature-Driven Development(L1)
2. Demonstrate incremental software development(L2)
3. Apply regaining control techniques(L3)
4. Develop application using TDD (L4)
5. Understand Versions, Version control and Integration of Application. (L1)

Text Books(s)

1. John Hunt, Agile Software Construction,1st Edition, Springer,2005
2. Craig Larman, Agile and Iterative Development: A Manager’s Guide, Addison-Wesley,
3. Pearson Education – 2004.
4. Pearson, Robert C. Martin, Juli, James Shore, Chromatic 2013, The Art of Agile Development, O'Reilly Media.
5. Elisabeth Hendrickson, Agile Testing, Quality Tree Software Inc 2008.

Reference Book(s)

1. Andrew Stellman, Jenifer Greene, Headfirst Agile, O’Reilly, 2017
2. Peggy Gregory, Casper Lassenius, Xiaofeng Wang Philippe Kruchten (Eds.), Agile Processes in Software Engineering and Extreme Programming, 22nd International Conference on Agile Software Development, XP 2021 Virtual Event, June 14–18, 2021, Proceedings, Springer
3. Peggy Gregory, Philippe Kruchten (Eds.), Agile Processes in Software Engineering and Extreme Programming – Workshops XP 2021 Workshops Virtual Event, June 14–18, 2021 Revised Selected Papers, 2021
4. Ian Somerville, Software Engineering, 10th edition, Pearson, 2016

Course Outcomes:

1. Use agile methods in various development environments.
2. Apply Xtreme programming confidently.
3. Understanding of Agile Modelling XP Projects.
4. Design and develop applications in Scrum environments.
5. Develop abilities on Feature Driven Development.

19ECS453: Neural Network and Deep Learning

L	T	P	C
2	0	2	3

Neural networks and deep learning currently provide the best solutions to many problems. The purpose of this course is to study the core concepts of neural networks, including modern techniques for deep learning. In this course students will be given an exposure to the details of neural networks as well as deep learning architectures and to build up models.

Course objectives:

1.Introducing the fundamentals of Neural Networks and its basic algorithms
2. Understanding various neural networks algorithms and their architectures
3. Understanding the fundamentals of Deep Neural Networks
4.To design and develop an application specific deep learning models
5.To provide the practical knowledge in building deep learning models for solving real world problems.

Module I: Neural Network Number of hours(LTP) 6 0 6
What is a Neural Network? Human Brain, Models of Neuron, Neural Networks viewed as directed graphs, Feedback, Network Architectures, Knowledge representation, Artificial Intelligence and Neural Networks.

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

1. Neural Network basic
2. Difference between artificial neural network and biological neural network
3. Know about knowledge representation

Module II: Advance Neural Network Number of hours(LTP) 6 0 6
Introduction, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, Credit Assignment problem, learning with a Teacher, Learning without a Teacher, Learning tasks, Memory, Adaptation.

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

1. Explain the underlying mechanism of Hebbian Network
2. Analyze the working principle of Boltzmann learning
3. Understanding supervised and unsupervised learning

Module III: Introduction to Deep Learning Number of hours(LTP) 6 0 6
Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

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

1. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
2. Have a working knowledge of neural networks and deep learning
3. Understand the data needs of deep learning

Module IV: Deep Learning Architecture Number of hours(LTP) 6 0 6

Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders,

Learning Outcomes:
After completion of this unit, the student will be able to:
1. Understand different methodologies to create application using deep nets.
3. Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems.
3.Implement different deep learning algorithms

Module V: Advanced Deep learning Models Number of hours(LTP) 6 0 6
Convolutional neural networks: Introduction to CNNs, Convolution, Correlation, Filtering. CNN architectures, Detection and Segmentation, Visualizing and Understanding, Advanced CNNs for computer vision, Recurrent Neural Networks: Introduction to Recurrent Neural networks (RNNs), LSTM, GRU, Generative Adversarial Networks (GANs).

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

1. Understanding CNN
2. Understanding the architecture of convolutional neural network
3. Gain knowledge about advance network like RNN, LSTM

Text Books(s)

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press,2015

Reference Book(s)

1. Simon Haykin, Neural networks – A Comprehensive Foundation by – Second Edition – Pearson Education.
2. S.M.Zurada, Introduction to Aritifical Neural System, Jaico Publishing House 1992
3. SATISH KUMAR Neural networks-A class room approach --TMH

Course Outcomes:

1. Explain the basics of neural networks in deep learning.
2. To implement algorithms in neural networks and deep learning
3. Construct the architectures of CNN and their usage
4. To present the mathematical, statistical and computational challenges of building neural networks and deep learning.
5. To enable to design deep learning techniques to support real-time applications

19ECS457: Cyber Forensics

L	T	P	C
2	0	2	3

Course Introduction:

Forensics is an essential part of cybersecurity. Any cyber incident must be solved through the cyber forensics team who can find out the exact issue and how the mishap takes place. This chapter will learn about the needs and objectives of cyber forensics, how to approach a crime or incident, and some incident handling categories.

Course Objectives:

1. To find vulnerabilities and security loopholes that facilitate attackers.
2. To have information concerning the laws of assorted regions and areas, as digital crimes are ubiquitous and remote in nature.
3. To understand the usage of correct tools for forensic investigations.
4. Prepare for incidents beforehand to confirm integrity and continuity of network infrastructure.
5. Identify and gather proof of Computer crimes in an exceedingly forensically sound manner.
6. Offer ample protection to information resources and guarantee regulative compliance.

Module I: Digital Investigation Number of hours (LTP) 6 0 6

Digital Investigation: Digital Evidence and Computer Crime, History and Terminology of Computer Crime Investigation, Technology and Law, The Investigative Process, Investigative Reconstruction, Modus Operandi, Motive and Technology, Digital Evidence in the Courtroom.

Learning Outcomes:

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

1. Understand digital evidence and computer crime
2. Understand the investigative process
3. Understand modus operandi
4. Understand motive behind cyber crime

Module II: Understanding Information Number of hours (LTP) 6 0 6

Methods of Storing Data: number systems, character codes, record structures, file formats and file signatures, Structure and Analysis of Optical Media Disk Formats, Recognition of file formats and internal buffers, Extraction of forensic artifacts, understanding the dimensions of other latest storage devices.

Computer Basics for Digital Investigators: Computer Forensic Fundamentals, Applying Forensic Science to computers, Benefits of Professional Forensic Methodology.

Learning Outcomes:

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

1. Understand methods of storing data
2. Understand structure and analysis of optical media disk formats
3. Understand computer forensic fundamentals
4. Understand benefits of professional forensic methodology

Module III: **Types of Computer Forensics Tools and Technology** Number of hours (LTP) 6 0 6

Computer Forensics Tools: Tools and Types of Military Computer Forensics Technology, Tools and Types of Law Enforcement Computer Forensic Technology, Tools and Types of Business Computer Forensic Technology

Learning Outcomes:

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

1. Understand Computer Forensics Tools and Technology
2. Understand Tools and Types of Law Enforcement Computer Forensic Technology
3. Understand Tools and Types of Business Computer Forensic Technology

Module IV: **Standards, Guidelines and Best Practices** Number of hours (LTP) 6 0 6

Standards, Guidelines and Best Practices: Handling the Digital Crime Scene, Digital Evidence Examination Guidelines, ACPO, IOCE, SWGDE, DFRWS, IACIS, HTCIA, ISO 27037.

Learning Outcomes:

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

1. Understand Handling the Digital Crime Scene
2. Understand Digital Evidence Examination Guidelines
3. Understand ACPO, IOCE, SWGDE, DFRWS, IACIS, HTCIA, ISO 27037

Module V: **Cyber Law** Number of hours (LTP) 6 0 6

Cyber Law: Basic of law, understanding cyber space, Defining cyber law, Scope and jurisprudence, Concept of jurisprudence, Overview of Indian legal system, Introduction to IT Act 2000, Amendment in IT Act.

Cyber Crimes - digital signature-concepts of public key and private key, certification authorities and their role, creation and authentication of digital signature. E-contracting – salient features of E-contracts, formation of E-contracts and types, E-governance, E-governance models, E-commerce- salient features and advantages

Learning Outcomes:

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

1. Understand cyber law and cyber space
2. Understand the Concept of jurisprudence
3. Understand IT Act 2000
4. Understand cyber crimes

Text Books:

1. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Cengage Learning, 2nd Edition, 2005. (CHAPTERS 1 – 18) (UNIT I – IV).
2. Marjie T Britz, “Computer Forensics and Cyber Crime: An Introduction”, Pearson Education, 2nd Edition, 2008. (CHAPTERS 3 – 13). (UNIT IV – V)

Reference Books:

1. MariE-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett Learning; 2nd Edition, 2014.
2. Chad Steel, “Windows Forensics”, Wiley, 1st Edition, 2006.
3. Majid Yar, “Cybercrime and Society”, SAGE Publications Ltd, Hardcover, 2nd Edition, 2013.

4. Robert M Slade, “Software Forensics: Collecting Evidence from the Scene of a Digital Crime”, Tata McGraw Hill, Paperback, 1st Edition, 2004.

Course Outcomes:

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

1. Understand cyber forensics concepts
2. Understand various cyber crimes
3. Understand different cyber laws
4. Understand clause of Indian IT ACT 2000

19ECS459: BLOCKCHAIN TECHNOLOGY

L	T	P	C
2	0	2	3

The course enables learners to grasp the concepts of Blockchain Technologies underlying cryptocurrency creation, smart contracts, transactions, storage, verification mechanisms. Cryptography foundation and consensus algorithms for creation of blockchains are elaborated in the course. Bitcoin, Etherium protocols are introduced with practice. Transformation of traditional businesses with blockchains is illustrated through examples.

Course objectives:

1. Understand concepts of blockchain technology
2. Acquire knowledge of bitcoin, Etherium protocols
3. Learn to program and implement Blockchain
4. Develop blockchain applications
5. Analyse blockchain use cases

Module I:	Blockchain Fundamentals	Number of hours(LTP)	6	0	6

Tracing blockchain Origin: The Double Spend problem, Byzantine Generals' Computing Problems. Blockchain concepts: How Blockchain works, Centralization vs. Decentralization, Distributed Consensus, Consensus without identity using a blockchain, Incentives and proof of work, Cryptocurrency, NFTs, Mining.
Types of blockchains: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains. Blockchain Vulnerabilities.

Lab:
Blockchain Case study analysis (identification and learning of tools for blockchain implementation)
Creation of sample blocks to understand blockchain concepts.

- How Blockchain Works: https://andersbrownworth.com/blockchain/
- Build a Blockchain in Python: https://www.activestate.com/blog/how-to-build-a-blockchain-in-python/

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

1. Understand the origin and motivation behind blockchain implementation (L1)
2. Interpret different blockchain concepts (L2)
3. Illustrate the essential components of a blockchain platform. (L3)
4. Analyse blockchain technology impact on traditional applications (L4)
5. Develop roadmap for blockchain implementation(L5)

Module II:	Cryptography and types of consensus algorithms for Blockchain	Number of hours(LTP)	6	0	6

Cryptographic Hash Functions, SHA256, Hash Pointers and Data Structures, Merkle tree, Distributed Ledger.
Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof of Elapsed Time.

Lab: Generate Hash Using Hash function, Working of Distributed Ledger, Working of Blockchain Transaction, Create Blockchain Network. Explore consensus mechanisms
Using the Basic Blockchain, students can implement some projects on top of it.
https://www.activestate.com/blog/how-to-build-a-blockchain-in-python/

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

1. Understand relationship between Cryptography and blockchain (L1)
2. Distinguish different Cryptographic methods(L2)
3. Learn to use different types of Consensus algorithms (L3)
4. Analyse requirements to implement Securing Messages (L4)
5. Develop sample application with hashing and consensus algorithms(L5)

Module III:	Bitcoin Blockchain	Number of hours(LTP)	6	0	6

Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model:
How does Bitcoin work? What makes Bitcoin different? How secure are Bitcoins?
Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Bitcoin network, Bitcoin Mining, Bitcoin Wallets.
Cryptocurrency Regulations

Lab: Understand/ Install a Software Wallet, Generate a Paper Wallet/Web Wallet, Review and Analyse a Bitcoin Block on Explorer, Analyse a Bitcoin Transaction, Understand/ conduct a Transaction Using Electrum Wallet

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

1. Understand relationship between bitcoin and blockchain (L1)
2. Distinguish different bitcoin terminologies(L2)
3. Illustrate bitcoin mechanism (L3)
4. Analyse requirements to implement bitcoin transactions (L4)
5. Develop roadmap for secure bitcoin implementation(L5)

Module IV:	Etherium Blockchain and DApps	Number of hours(LTP)	6	0	6

Etherium Blockchain: Smart Contracts: Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract; Ethereum Structure, Operations, Consensus Model, Incentive Model
Introduction to Ethereum Higher-Level Languages, DApps: Distributed Application development.

Lab: Building A Simple Smart Contract with Solidity, Solc-Compiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.
(Or using Viper -
Smart Contracts in Vyper: https://vyper.readthedocs.io/en/stable/
Learn Vyper: https://learnxinyminutes.com/docs/vyper/
Vyper Examples: https://github.com/vyperlang/vyper/tree/master/examples)
Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand Etherium Protocol (L1)
2. Distinguish different smart contracts(L2)
3. Illustrate the essential components of Etherium (L3)
4. Analyse requirements to implement smart contract (L4)
5. Use the working of an immutable distributed ledger and trust model that defines blockchain. (L5)

Module V:	Open source Blockchains, Use cases of Blockchain	Number of hours(LTP)	6	0	6

Traditional Blockchain Challenges: Security, Performance perspectives.
Introduction to Hyperledger (Linux Foundation), NFTs

New generation blockchain platforms: Solana, Flow, Avalanche, Cosmos, Polkadot, Corda, Openchain, Multichain blockchains
Block Chain Use cases in Healthcare, Government, Finance, Supply Chain, Food traceability, Water Management
Lab: Decentralized app creation: Creating a Hospital Smart Contract / Banking application/ any other domain specific smart contract
Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand various open source blockchain technologies (L1)
2. Distinguish different operating models of open source technologies(L2)
3. Relate the shortcomings of blockchain technology and their corresponding solutions(L3)
4. Develop abilities to build a smart contract in a particular domain(L4)
5. Design and develop a cryptocurrency based application(L5)

Text Books(s)

1. Manav Gupta, BlockChain for dummies, 2nd IBM Limited Edition, Published by John Wiley & Sons, Inc, 2018.
2. Andreas M. Antonopoulos, Mastering Bitcoin: Programming the Open Blockchain, O'Reilly Media, 2/e, 2017.
3. Andreas Antonopoulos and Gavin Wood Mastering Ethereum: Building Smart Contracts and Dapps
Shroff Publisher/O'Reilly Publisher, 2018
4. Imran Bashir, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, Packt Publishing (2017).

Reference Book(s)

1. Melanie Swan ,Blockchain: Blueprint for a New Economy, O'Reilly Media, 1/e, 2015.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies, 2016.
3. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing. 2018
4. Tiana Laurence, Blockchain for Dummies, 2nd Edition, John Wiley & Sons, 2019
5. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House, 2018

Online Resources:

1. https://www.coursera.org/specializations/blockchain
2. https://nptel.ac.in/courses/106105184/
3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview
4. https://www.edx.org/course/blockchain-and-fintech-basics-applications-andlimitations

Course Outcomes:

1. Distinguish between different types of blockchain platforms.
2. Understand the working and importance of smart contracts.
3. Develop blockchain based application.
4. Apply blockchain technology to provide solutions to some real-life problems.
5. Understand the security and performance perspective of blockchain technology.

YouTube Links and Other web references

✓ Blockchain: What It Is, What It Isn't, and What It Means for The Produce Industry
https://www.pma.com/content/articles/blockchain

✓ Learn Web3

https://questbook.notion.site/Questbook-Learn-Web3-a5f4be8b107f4647a91fe84e6aa7e722

- ✓ What is Etherium
  https://ethdocs.org/en/latest/introduction/what-is-ethereum.html
- ✓ Introduction to Smart Contracts — Solidity 0.7.0 documentation
  https://solidity.readthedocs.io/en/v0.7.0/introduction-tosmart-contracts.html
- ✓ How Smart Contracts Will Change the World | Olga Mack | TEDxSanFrancisco (17 minutes. Smart Contracts starts at about 6 minute mark)
  https://www.youtube.com/watch?v=pA6CGuXEKtQ
- ✓ Ethereum Tutorial For Beginners
  https://www.youtube.com/watch?v=uneCaqD6Etk

- ✓ How Bitcoin Works in 5 Minutes (Video, YouTube, 5 minutes)
  https://www.youtube.com/watch?v=l9jOJk30eQs

- ✓ What is an NFT? — properties of blockchain-based non-fungible tokens by Devin Finzer
  https://opensea.io/blog/guides/non-fungible-tokens/#What_is_a_non-fungible_token
- ✓ Create a NFT Minting Website:
  https://openquest.xyz/?github_url=https://raw.githubusercontent.com/vamsisol/create_candy_machine_for_minting_nft/main
- ✓ How to Mint a Pokemon on Solana:
  https://openquest.xyz/?github_url=https://raw.githubusercontent.com/vamsisol/create_nft_minting_website/main

- ✓ What is Hyperledger
  https://www.youtube.com/watch?v=Y177TCUc4g0

- ✓ What is Corda? | Enterprise Blockchain
  https://www.youtube.com/watch?v=FHfZ5X7qn1I

- ✓ Openchain for Blockchain
  https://www.blockchain-council.org/blockchain/openchain-technology-features-working/

- ✓ Multichain for Blockchain
  https://www.multichain.com/developers/
- ✓ BLOCKCHAIN TECHNOLOGY IN THE DEPARTMENT OF DEFENSE
  https://calhoun.nps.edu/handle/10945/61355

- ✓ How blockchain will kill fake news (and four other predictions for 2020)
  https://www.computerworld.com/article/3481633/howblockchain-will-kill-fake-news-and-four-other-predictionsfor-2020.html

- ✓ 8 Reasons why crypto art > art — and the new economy of digital creativity by Scott Belsky
  https://scottbelsky.medium.com/the-furry-lisa-cryptoart-the-new-economy-of-digital-creativity-6cb2300ea081

19ECS461: Multimedia Processing

	L	T	P	C
	2	0	2	3

Please type Course introduction paragraph here

The course offers an introduction to multimedia: images, video and audio. Multimedia has become an indispensable part of modern computer technology. In this course, students will be introduced to principles and current technologies of multimedia systems. Issues in effectively representing, processing, and retrieving multimedia data such as sound and music, graphics, image and video will be addressed.

Course objectives:

1To gain the knowledge in broadcasting, audio recording, media, mass communication and digital animation
2. To Equip students in art and craft of multimedia production as to enable them to emerge as thoroughbred professionals matching the needs of fast growing multimedia industry
3 To develop and analyse the performance of multimedia communication systems

Module I: Basics of Graphics and images Number of hours(LTP) 6 0 6

Understanding Natural Light and Color, Computerized Color, Color Palettes, Look-up table. Graphic/Image File Formats: 24-bit and 8-bit colors ,BitMaps, Gray Scale and Dithering, Graphic Formats: GIF, JPEG, TIFF, PNG, RGB and CMY Color Models

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

1. Understand color palets, look tabe
2. Understand about various Graphic formals and colour models

Module II: Multimedia Communication Number of hours(LTP) 6 0 6

Introduction: What is Multimedia? – Introduction to making Multimedia – Media Skills – Macintosh and Windows Platforms – Basic software tools.
Need for Data compression, General Data compression Scheme, Compression standards, Non-lossy compression for images, Lossy compression for Photographs and video, Hardware Vs Software Compression
Concept of multimedia communication modelling – network requirements – text, audio, images and video
Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand the need for compression
2. Understand various types of compression standards

Module III: Compression Models Number of hours(LTP) 6 0 6

Color model in images-lossless compression algorithms- run-length encoding, variable length coding, dictionary based coding, arithmetic coding, lossy compression algorithms- quantization, transform coding, wavelet-based coding- Multimedia Authoring Tools- Overview of multimedia software tools, Multimedia Authoring systems, editing and authoring tool

Learning Outcomes:

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

1. Understand about lossless compression models
2. Understand about multimedia software tools
3. Know about various multimedia authoring tools

Module IV: Audio Compression Number of hours(LTP) 6 0 6

Multimedia Building Blocks: Text – Sound – Images.
Digitization of sound, MIDI, transmission of audio, audio compression techniques- ADPCM, vocoders
Binary image compression, Audio compression, Fractal compression, advantages / disadvantages

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

1. Understand multimedia building blocks
2. Know Various audio compression techniques
3. Know about the Advantages and disadvantages of Audio compression

Module V: Video Compression Number of hours(LTP) 6 0 6
Multimedia Building Blocks: Animation – Video
Color, Grey Scale and Still-video image compression, JPEG, video image compression, Multimedia Standards for Video, Requirements for Full-motion Video Compression, MPEG

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

1. Understand various types of video compression models
2. Know about video compression standards
3. Know about full motion video compression

Text Books(s)

1. Kamisetty Ramamohan Rao, Z.S.Bojkovic,D.A.Milovanovic, “Multimedia Communication Systems, Techniques, Standards and networks”, PHI learning, 2012.
2. Tay Vaughan – Multimedia (Making it work) – Tata McGraw Hill
3. Ze- Nian Li and M. S. Drew, Fundamental of Multimedia. Pearson Education Second edition 2014

Reference Book(s)

1. Ralf Steinmetz and klara Nahrstedt “Multimedia Applications”,2004
2. Hemant Kapila . “Multimedia and Applications”, 2016
3. Prabhat k. Andleigh, Kiiran Thakrar “Multimedia systems design”,PHI learning, 2010
4. Ze-Nian, Mark S. Drew “Fundamentals of multimedia, PHI learning, 2010

Course Outcomes:

1. Analyze the technical aspects of Graphics and Multimedia systems. 2
2. Understand data interface standards for text, image, graphics, audio, video and animation
3. Apply image representation and compression concepts in real world Multimedia applications

4. Design interactive multimedia software using audio representation and compression concepts
5. Apply various multimedia communication protocols and standards.
6. Use multimedia authoring tools for industry requirements
7. Analyze the technical aspects of Graphics and Multimedia systems.
8. Understand data interface standards for text, image, graphics, audio, video and animation
9. Apply image representation and compression concepts in real world Multimedia applications.
10. Design interactive multimedia software using audio representation and compression concepts

19ECS463: Software Testing Methodologies

L	T	P	C
2	0	2	3

This course aims to provide an understanding of basics of testing concepts and introducing the various testing techniques. It also introduces the concepts of test management and quality management.

Course objectives:

1. Understand the concepts of software testing
2. Familiar with various testing methods
3. Learn the various validation activities
4. Know the concepts of test management
5. Understand the quality management concepts

Module I: Introduction Number of hours (LTP) 6 0 6

Software testing definition, evaluation of software testing, software testing myths and facts, goals and model of software testing, software testing terminology, software testing life cycle, software testing methodology, verification, and validation activities.

Learning Outcomes:

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

1. Describe software testing (L2)
2. Explain model of software testing (L2)
3. Demonstrate software testing life cycle (L2)
4. Differentiate verification and validation (L2)

Module II: Dynamic Testing Number of hours (LTP) 6 0 6

Black-Box testing: Boundary value analysis, equivalence class testing. White-box testing: Introduction, basis path testing, loop testing. Static testing: inspections, structured walkthroughs, technical reviews.

Learning Outcomes:

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

1. Describe various testing methods of Black-Box testing (L2)
2. Describe various testing methods of White-Box testing (L2)
3. Present the process of inspections (L2)
4. Illustrate the technical reviews (L2)

Module III: Validation Activities Number of hours (LTP) 6 0 6

Unit validation testing, integration testing, function testing, system testing, accepting testing. Regression Testing: Objectives of regression testing, regression testing types, regression testing techniques.

Learning Outcomes:

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

1. Illustrate working of unit testing with an example (L3)
2. Describe the performance of integration testing (L2)
3. Explain the concepts of regression testing (L2)

Module IV: Test Management Number of hours (LTP) 6 0 6

Test organization, structure of testing group, test planning, detailed test design and test specifications. Efficient test suite management: Introduction, minimizing the test suite and its benefits, defining test suite minimization problem, test suite prioritization, types of test case prioritization, prioritization techniques.

Learning Outcomes:

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

1. Demonstrate the concepts of test management (L2)
2. Develop test design and test specifications (L3)
3. Apply the efficient test suite management (L3)
4. List the types of test case prioritization (L4)
5. Classify prioritization techniques (L4)

Module V: Software Quality Management Number of hours (LTP) 6 0 6

Software quality, quality cost, quality control and quality assurance, quality management, QM and project management, quality factors, methods of quality management, software quality metrics, SQA models.

Learning Outcomes:

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

1. Illustrate working of software quality management (L3)
2. List the quality factors required to provide the quality (L4)
3. List the methods of quality management (L4)
4. Explain the working of quality metrics (L2)
5. Summarize working of SQA models (L2)

Text Books(s)

1. Naresh Chauhan, Software Testing: Principles and Practices, 1/e, Oxford University Press, 2010

Reference Book(s)

1. William E. Perry, Effective Methods for Software Testing, 3/e, Wiley, 2006.
2. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, 3/e, Auerbach publication, 2015.

Course Outcomes:

1. Understanding software testing life cycle (L2)
2. Design test cases for Black-Box testing and White-Box testing (L4)
3. Analyze the performance of integration testing (L4)
4. Use the concepts of test management (L2)
5. Apply software quality management principles (L3)

19EHS403: Organizational Behaviour

L	T	P	C
3	0	0	3

Module I: Number of hours(LTP) 9 0 0

Introduction; Definition of Organization Behaviour and Historical development, Environmental Context (Information Technology and Globalization), Diversity and Ethics, Design and Cultural, Reward Systems. The Individual: Foundation of individual behaviour, Ability

Module II: Module Name(if any) Number of hours(LTP) 9 0 0

Learning: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social Making, learning theory, continuous and intermittent reinforcement. Perception: Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect.

Module III: Module Name(if any) Number of hours(LTP) 9 0 0

Motivation: Maslow's Hierarchy of Needs, Mc. Gregory's theory X and Y, Herzberg's motivation Hygiene theory, David Mc Cleland three needs theory, Victor vroom's expectancy theory of motivation.

Module IV: Module Name(if any) Number of hours(LTP) 9 0 0

Values and attitudes: Definitions – values, Attitudes: Types of values, job satisfaction, job involvement, professional Ethics, Organizational commitment, cognitive dissonance. Conflict Management: Definition of conflict, functional and dysfunctional conflict, stages of Conflict process.

Module V: Module Name(if any) Number of hours(LTP) 9 0 0

Leadership: Definition, Behavioural theories – Blake and Mouton managerial grid, Contingency theories – heresy - Blanchard's situational theory, Leadership styles – characteristics, Transactional, transformation leaders. The Organization: Mechanistic and Organic structures, Minitberg's basic elements of organization, Organizational Designs and Employee behaviour, organization development – quality of work life (QWL)

Text Books(s)

1. Stephen P Robbins -Organizational Behaviour, Pearson Education Publications,ISBN– 81–7808–561-5, 9th Edn. 2012.
2. Fred Luthans -Organizational Behaviour, Mc Graw Hill International Edition,ISBN–0–07–20412–1, 11th Edn. 2006.

Reference Book(s)

1. Hellriegel, Srocum and woodman, Thompson Learning -Organization Behaviour, Prentice Hall India, 9th Edition -2001.
2. Aswathappa -Organizational Behavior, Himalaya Publishers. 2001.
3. VSP Rao and others -Organizational Behaviour, Konark Publishers 2002.
4. Organizational Behaviour- (Human behaviour at work) John Newstron / Keith Davis 9th Edition 2002.
5. Paul Henry and Kenneth H. Blanchard -Management of Organizational Behaviors, Prentice Hall of India, 1996.

19ECS491: Project Phase I

L	T	P	C
0	0	2	1

Project Phase I intended to train the students to identify a problem of practical significance related to

i) Software design process
ii) Research in specific domain
iii) Application/ software development

The student is encouraged to study of literature based on the guidance received by a project supervisor and identify a specific problem and works for a solution. At the end he is expected to submit a report based on his findings.
The project can be done as a group consisting maximum of four persons.

19ECS493: Industrial Training /Internship /Research Projects in - National Laboratories or Academic Institutions

L	T	P	C
0	0	0	1

This course is designed to expose the students to industrial practices or working on research problems. The student is expected to correlate his theoretical knowledge gained all the way to the industrial needs and or solving practical/ research problems for the benefit of the humanity.
The student goes through the training during the summer after his pre-final year. He has to maintain a dairy of findings he experienced and submit a detailed report after completion of the training.

19ECS495 – COMPREHENSIVE SKILL DEVELOPMENT - VI

OPTION-I (DATA VISUALIZATION USING TABLEAU / POWER BI / ADVANCED EXCEL)

L	T	P	A	C
0	0	0	6	1

Data Visualization is one of the prime tasks in current scenarios of Business Applications/ any product based tasks. Business Analytics is to project the data effectively in order to communicate and present moreeffectively for better understanding of stakeholders both technical and non-technical in simple manner.By the end of the course the student is able to learn how to apply and present the data in order communicating business relevant implications and also the student is able to structure the data analytics projects that ensures better outcome.The aim of this course is in designing and persuasively presenting business data stories through various approaches such as visualizations, capitalizing on business testing methods and design principles in practical approach.

Course objectives/learning outcomes:

1. To understand the data and its variants, present the data.
2. Discuss concepts and principles of data visualization particularly related to decision making, data modeling and compare and contrast
3. Investigate technologies and practices for visualizing data as part of a data management and analytics system.
4. Apply user interface design principles and practices to develop interactive data visualizations, mapping data
5. Design effective dashboard for decision making at various levels.
6. Conduct research on relevant data visualization topics and telling your own data story
7. Project presentations

Module 1:Understanding Data

What is data, where to find data, Types and variants of data and representations, Foundations for building Data Visualizations

Module 2: Creating Your First visualization

Getting started with Tableau Software, Using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Treemaps), Using the Show me panel

Module 3: Tableau Calculations

Overview of SUM, AVR, and Aggregate features, creating custom calculations and fields, Applying new data calculations to your visualization

Module 4: Formatting Visualizations

Formatting Tools and Menus, Formatting specific parts of the view, Editing and Formatting Axes

Module 5: Manipulating Data in Tableau

Cleaning-up the data with the Data Interpreter, Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data Module 6: Advanced Visualization Tools

Using Filters, Using the Detail panel, Using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors

Module 7: Creating Dashboards & Stories

Using Storytelling, Creating your first dashboard and Story, Design for different displays, Adding interactivity to your Dashboard

Module 8: Distributing & Publishing Your Visualization

Tableau file types, Publishing to Tableau Online, Sharing your visualization, Printing, and exporting

MORE ACCURATELY WHAT ALL WE COVER

Introduction (1 Hours)

- Course Introduction

Field Types and Visual Cues (2 hours)

- Tableau Desktop
- Scenario

Objectives

- Application Terminology and Definitions
- Opening and Closing Tableau
- Data Source Page
- Tableau Workspace
- Files and Folders
- Getting Started with Tableau
- View Terminology and Definitions
- View Sections
- Data Terminology and Definitions
- Data Types
- Data Roles: Dimension vs. Measure
- Data Roles: Continuous vs. Discrete
- Changing Data Roles
- Visual Cues for Fields
- Visual Cues for Fields in the Data Pane
- Visual Cues for Fields in the Rows or Column Shelves

Data Connection in Tableau Interface (4 Hours)

- Data Connections in the Tableau
- Connecting to Tableau Data Server
- What is a Join
- Types of Joins
- When to Use Joining
- Enabling Right Outer Join
- Right Outer Join and Custom SQL Enabled
- What is Data Blending
- When to Use Data Blending

- Data Blending in Tableau
- Differences Between Joining and Blending
- Joining vs. Blending
- Writing Custom SQL
- Prepare your Data for Analysis

Organizing and Simplifying Data (5 hours)

- Organizing and Simplifying Data
- Objectives
- Filtering Data
- What is a Filter
- Applying a Filter to a View
- Filtering on Dimensions
- Filtering on Dimensions Functions
- Aggregating Measures
- Filtering on Measures
- Filtering on Dates
- Quick Filters
- Sorting of Data
- What is Sorting
- Sorting Data in Tableau
- Types of Sorting
- Creating Combined Fields
- Combined Fields
- Creating Groups and Defining Aliases
- What is a Group
- What are Aliases
- Defining an Alias
- Working with Sets and Combined Sets
- Sets
- Combined Sets
- Working with Groups and Sets
- Drill to Other Levels in a Hierarchy
- Grand totals and Subtotals
- Adding Totals
- Adding Totals
- How to Define Aggregations
- Changing Aggregation Function
- Tableau Bins
- Bins
- Fixed Sized Bins
- Variable Sized Bins

Formatting and Annotations (5 hours)

- Formatting and Annotations
- Custom Geocoding
- Adding Caption to Views
- Click Interaction Adding Title to View
- Click Interaction2 Adding Captions to View
- Using Titles Captions and Tool tips
- Adding Tooltips to Views
- Using Title Caption and Tooltip
- Formatting the Axes
- Edit Axis Option
- Formatting Views with Labels and Annotations

- Format Window
- Format Mark Labels
- Annotations
- Format Manipulations

Special Field Types (4 hours)

- Special Field Types
- Date Hierarchies
- Drilling in the Time Hierarchy
- Pivoting Date Parts on Shelves
- Differentiate Between Discrete and Continuous Dates
- Using Continuous Dates
- Using Discrete Dates
- Working with Discrete and Continuous dates
- What are Custom Dates
- Creating and Using Custom Dates
- Fiscal Year
- Define a Date Field on a Fiscal Year
- Relative Date Filters
- Importing Date Dimensions in Tableau from a Cube
- Work with Date Hierarchies on Cubes
- Dates in Cube (Multidimensional) Data Sources
- Dates in Cubes Vs. Relational Data Sources

Tableau Generated Fields (2 hours)

- Tableau Generated Fields
- Using Measure Values and Measure Names
- Using Multiple Measures in a View
- Using the Number of Records Measure
- Using Latitude and Longitude Fields

Chart Types (2 hours)

- Chart Types
- Working with Combined Axis
- Working with Combination Charts
- Understanding geocoding and geographic mapping in tableau
- Combined Axis Graph and Scatter Plot
- Describe text and highlight tables
- Work with Pages Shelf and Create Motion Charts
- Heat Maps
- Using Bins and Histograms
- Using Histograms
- Using Pie Charts
- Compare Measures Using Bullet Charts
- Using Bar in Bar Charts
- Define Advanced Chart Types
- Using Pareto Charts
- Creating Pareto Charts
- Using Waterfall Charts
- Using Gantt Charts
- Working with box plots
- Using Sparkline Charts

Calculations (2 hours)

- Calculations

- Objectives
- Strings Date Logical and Arithmetic Calculation
- Working with Strings Date Logical and Arithmetic Calculations
- Using Strings Date Logical and Arithmetic Calculations
- Working with Arithmetic Calculations
- Aggregation Options
- Working with Aggregation Options
- Grand Totals and Sub-Totals
- Quick Table Calculations
- Creating Quick Table Calculations
- Working with Quick Table Calculations
- Automatic and Custom Split
- Ad-hoc Analytics
- LOD Calculations

Creating and using Parameters (2 hours)

- Creating and using Parameters
- Objectives
- What is a Parameter
- Creating a Parameter
- Exploring Parameter Controls
- Work with Parameters
- Click Interaction Working with Parameters

Mapping (2 hours)

- Mapping
- Objectives
- Modifying Locations within Tableau
- Importing and Modifying Custom Geocoding
- Working with Symbol Map and Filled Map
- Using Background Image
- Exploring Geographic Search
- Perform Pan Zoom Lasso and Radial Selection
- Working with WMS Server Maps

Statistics (3 hours)

- Statistics
- Objectives
- Add Reference Lines Bands and Distribution
- Adding Reference Lines
- Adding Reference Bands
- Adding Reference Distribution
- Working Reference Lines Bands and Forecasting
- Trend lines and Trend Models
- Understanding Trend Lines
- Enabling Trend lines
- Click Interaction Understanding Trend Models
- Working with Describe Trend Model Window
- Working with Trend Lines
- Statistical Summary Card
- Perform Drag and Drop Analytics
- Explore Instant Analysis
- Forecasting

Dashboards (3 hours)

- Dashboards
- Objectives
- Build Interactive Dashboards
- What is a Dashboard
- Building Dashboards
- Best practices for creating effective dashboards
- Comprehending Best Practices
- Creating a Dashboard and Importing Sheets
- Interaction Exploring Dashboard Actions
- Use of Running Actions
- Using Dashboard Actions
- Sharing your Work
- How to Share your Reports
- Exporting your Work

Case Study (Assignment)

- Project

Option –II (ROBOTIC PROCESS AUTOMATION)

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About Course

Robotic Process Automation training using UiPath will prepare you for Ui Path's RPA Developer Advanced Certification exam so that you can drive RPA initiatives in your organization. This RPA Certification course using UiPath helps you master the key concepts of RPA, Image and Text automation, Computer Vision activity, Object Repository, Data Manipulation using RPA bots, managing your processes from UiPath Orchestrator, and building a solution with Reframe work. Throughout this online Instructor-led RPA training, you will be working on real-life industry use cases. Enroll now to get started!

RPA Training Curriculum

Introduction to Robotic Process Automation

Goal: In this module, you will learn about the evolution and future of Robotic Process Automation.

Youwill also learn how Robotic Process Automation works and its components.

Objectives: In this module, you will:

- Understand the emergence of Robotic Process Automation (RPA) and its future scope Learn the concepts of RPA and distinguish it from Automation
- Understand the types of Bots Discuss how RPA works
- Gain insights into the RPA development methodology and identify its application areas Get an overview of the relevant RPA tools and their selection criteria

Outcomes:

After completing this module, you should be able to:

- Comprehend the necessity of RPA
- Distinguish between different types of bots in RPA
- Get acquainted with different types of tools used in RPA
- Topics:
- Emergence of Robotic Process Automation (RPA)Evolution of RPA
- Future of RPA
- Differentiating RPA from Automation
- Defining Robotic Process Automation & its benefits
- What RPA is Not Types of Bots
- How Robotic Process Automation works
- RPA development methodology and key considerations Application areas of RPA
- List of Robotic Process Automation Tools

Hands On:

- Demonstrate a typical automation process by developing a process using UiPath to identify elements from website related to a course search and store the results of the searchin a local file.
- Discuss a real-world implementation use case of RPA where involving a large telecommunication and media company. Examine how its critical business processes are automated with the help of UiPath and the benefits achieved by this automation.

Process Components and Activities

Goal: In this module, you will understand the main components of a process namely variables,

arguments and activities. You will learn activities related to UI Automation, System activities andvarious User Events.

Objectives: In this module, you will:

- Identify key UI Elements required for automation
- Know what UI Automation is and the activities involved in it
- Learn System Activities and implement its features in your workflow Create and manage variables in your workflow
- Create and import arguments from different workflows
- Use Import Panel to add or edit your arguments
- Perform User Event activities to create triggers

Outcomes:

- After completing this module, you should be able to: Perform UI Automation activities on different UI Elements
- Automate browser activities, such as opening and typing into a field Perform click, type into and various element activities

Topics:

- UI Automation Activities System Activities Variables
- Arguments Imports Panel User Events

Hands On:

- Build a process in UiPath using UI Automation Activities Create an automation process using key System Activities Using Variables and Arguments
- Automation using System Trigger

Overview of UiPath

Goal: In this module, you will learn about the features and layout of UiPath Studio.

Objectives: In this module, you will:

- Understand what is UiPath and its platform components Install and activate UiPath Community Edition Software
- Get an overview on the types of Projects and Templates in UiPath Get familiarized with the components of the user interface
- Know the usage of Activities Panel and identify different categories Automation Activities Understand the types of workflows

Outcomes:

- After completing this module, you should be able to: Create your own sequence
- Identify different components of UiPath Studio
- Get an overview of user interface and domain activities in UiPath Use different types of workflow

Topics:

- Introduction to UiPath platform and its components Installation details of UiPath's Community Edition Types of Templates
- User Interface Domains in Activities
- Workflow Files in UiPath

Hands On:

- Setup and Configure UiPath Studio Understand the user interface of UiPath Studio
- Create a Sequence to obtain user inputs, display them using a message box Create a Flowchart to navigate to a desired page based on a condition
- Create a State Machine workflow to compare user input with a random number

Data Manipulation & PDF Automation
Goal: In this module, you will learn about Data Manipulation, virtual machines, Citrix, text, image andPDF Automation.
Objectives: In this module, you will:

- Create and reuse elements from your object repository Manipulate Scalar, Collection & Table Data
- Get an overview of Native Citrix Automation feature of UiPath Understand how Text and Image Automation works
- Install and use PDF activities package Perform PDF Automation
- Use Computer Vision activity to identify UI Elements

Outcomes:
After completing this module, you should be able to:

- Manipulate your data
- Extract text from PDF files Perform Image automation

- Topics:
  - Object Repository Data Manipulation
  - Automation of Virtual Machines Introduction to Native Citrix Automation
  - Text and Image Automation
  - PDF Automation Computer Vision

Hands On:

- Data manipulation in the workbook PDF Data Extraction

App Integration, Recording and Scraping
Goal: In this module, you will learn about Recording, Scraping Data and integrate these activities with the corresponding apps.
Objectives: In this module, you will:

- Perform App Integration activities, such as Excel and Mail Record your mouse and keyboard actions
- Implement or edit Selectors of activities Get familiar with UI Explorer
- Scrape data from websites
- Use different types of Recording and Scraping methods

Outcomes:

- After completing this module, you should be able to:
- Collect data from different websites by using data scraping
- Perform different operations on different apps using App Integration Use Excel and Mail Activities

Topics:

- App Integration Recording Scraping Selector
- Workflow Activities

Hands On:

- Automate login to your (web)Email account
- Recording mouse and keyboard actions to perform an operation Scraping data from website and writing to CSV

Programming, Debugging and Logging
Goal: In this module, you will learn about Programming in UiPath, organizing projects, debugging

projects and handling exceptions.
Objectives: this module, you will:

- Use Programming Activities
- Perform Debugging of UiPath Projects Manage and use logs in UiPath
- Understand Error Handling in UiPath processes
- Perform automation in third-party applications using available UiPath Extensions Understand Project Organization and its best practices

Outcomes:

- After completing this module, you should be able to:
- Execute conditional clauses
- Monitor your workflow with debug activity
- Implement message logs to keep track of your workflow Amend your errors in the workflow

Topics:

- Programming Debugging Error Handling Logging Extensions
- Project Organization

Hands On:

- Using Programming Activities in UiPath Debugging errors in a UiPath Project Different ways of Error Handling in UiPath
- Browse through the log files related to UiPath Project

Orchestrator Community Edition and Other RPA Tools

Goal: In this module, you will learn about Orchestrator Community Edition (CE) and other leading RPA tools.

Objectives: In this module, you will:

- Know the capabilities of UiPath Orchestrator Use Orchestrator Activities from UiPath Studio
- Login to the Orchestrator Community Edition
- Understand the different components of Orchestrator Community Edition
- Create & Manage Robots, Processes, Jobs, Schedules & Assets from the Orchestrator Community Edition
- Learn about the different RPA tools available in the market

Outcomes:

- After completing this module, you should be able to:
- Implement various features of orchestrator Register your local machine to orchestrator Connect your bot with the local machine

Topics:

- UiPath Orchestrator Overview Orchestrator activities Introduction to Orchestrator CE Orchestrator CE
- Other RPA tools

Hands On:

- Using various components of Orchestrator Create an automated Gmail Login application
- Create an automated Remote Data Entry application

Implementing REFramework

Goal: In this module, you will learn how to use the REFramework template in UiPath for creating Business processes and understand the various components involved in it.

Objectives: In this module, you will:

- Know the purpose of REFramework
- Understand the framework component functions Use the state machine layout and its states
- Apply the workflows available at different states
- Implement exception handling and logging at different states
- Develop a process using the REFramework using the common development rules

Outcomes:

- After completing this module, you should be able to: Develop your own framework
- Use various activities from different domains to execute your workflow Effectively use message logs and debugging activities to monitor your workflow

- Topics:

- Introduction to REFramework About REFramework
- Purpose of REFramework Using State Machine Layout States of the State Machine Workflows Involved Workflows of the Framework Exception Handling & Logging
- Rules of Developing a Process using REFramework
- Build a business process based on REFramework and utilizing various components of this framework such as its workflows, states, variables and exceptions

Overview of UiPath Products (Self-Paced)

Goal: In this module, you will get an overview on different products such as App Studio, AI Fabric, etc. and learn how to use them with your workflows.

Objectives: In this module, you will:

- Explore UiPath Marketplace and import packages in your workflow Create a small application using UiPath Apps Studio
- Enable AI Fabric and use ML packages in your workflow Get an overview of Task capture and Automation Hub
  Outcomes: After completing this module, you should be able to
- Import packages from Marketplace to your workflow Use packages offered by AI Fabric
- Develop applications that can be used with your workflow

Topics:

- Marketplace Apps
- AI Fabric Task capture
- Automation Hub
- Develop complex automation processes with the help of components offered by Marketplace Develop an application using UiPath Apps Studio

Projects. Which projects will be a part of this RPA with UiPath Course?

Project 1: Candidate Onboarding

Problem Statement – Candidate onboarding process involves tracking candidate's mandatory joiningdocuments, sending them timely reminders, and handling other tasks. Once all the documents are received, then the candidate needs to be sent a formal joining email asking him to join the company.

- We will build a workflow that will automate these entire processes using UiPath. Toachieve this, we will perform the following:
- Create a transactional workflow
- Collecting candidate data using Web Recording Operations on the candidate data usingExcel activities
- Send automated emails for verification and onboarding purposes Publish the project toUiPath Orchestrator
- This is an ongoing project throughout the course designed to implement the concepts asyou learn.

Project 2: GST Verification

Problem Statement – You work in the Risk and Compliance Department for a large trading organization. As a part of the job, it is required to determine the validity of the GST number from GST invoices to verify the details of the vendors who are empaneled in your organization and save these details in a text file.

- Your team has planned to build an automation workflow to verify GST details. To designthe workflow, you will perform the following:
- Use REFramework template for this project Read vendor data from Orchestrator Queues
- UI automation on the given resource for verification
- Write the details on a text file
- Publish the project to UiPath Orchestrator to manage the process and execute with thehelp of bots
- What are the system requirements for this course?
- Your system should have a minimum of 4GB of RAM, a Dual-Core processor, aWindows 7 operating system, and a display resolution of 1024x768.
- CPU:Minimum Requirement – Dual Core 1.8GHz 32-bit (x86) Recommended – QuadCore 2.4GHz 64-bit (x64)
- RAM:4GB (Rercommended 8 Gb)
- Operating System:Minimum Version – Windows 7 Maximum Version – Windows 10
- .Net Framework:Minimum version - 4.6.1
- For Mac users:You can use a Virtualization software like Virtual Box or VMware toinstall Windows as a virtual machine and run the UiPath Studio on it.
- How will I execute the practicals?
  All the Demo/Hands-on of UiPath are to be executed on Latest version (Stable) of UiPathStudio Community Edition.

19EPH472 Semiconductor Physics

L T P C

2 1 0 3

Preamble/course introduction (Italics)

This is an introductory course designed for the students with basic background on solid state physics that serves as a prerequisite for study of semiconducting materials. It also provides the student with a clear and logical presentation of basic concepts and principles associated with semiconductor devices.

Course objectives:

1. To provide knowledge of the energy band structures and their significance in electric properties of solids
2. To explain the design and working of a semiconductor laser
3. To provide necessary understanding of working principles of solar cells
4. To make students on how to choose suitable semiconductor materials for light emitting devices and photoconducting devices
5. To make the students identify the fabrication methods of integrated circuits

Unit-1 Review of semiconductor physics

Quantum mechanical concepts (Schrodinger time-independent wave equation, particle in 1D infinite well), Energy bands in solids, E-k diagram, Density of states, Fermi level (variation by carrier concentration and temperature); p-n junction, Metal-semiconductor junction (Ohmic and Schottky); Semiconductor materials of interest for optoelectronic devices, bandgap modification, heterostructures.

Learning Outcomes:

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

1. Understand the formation of band gap in semiconductors
2. explain the dependence of Fermi level in semiconductors on carrier concentration and temperature.
3. Know the applications of semiconductors in various fields.

Unit-2 Semiconductor Lasers

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Einstein coefficients, Population inversion, semiconducting laser, Gain guided semiconductor laser, and index guided semiconductor laser, application of Semiconductor Lasers.

Learning Outcomes:

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

1. Understand the principles of lasing action
2. Understand the production of laser in semiconducting materials.
3. Design a semiconductor laser.

Unit-3 Solar cells and Photovoltaic devices:

Charge carrier generation and recombination, p-n junction model and depletion capacitance, Current voltage characteristics in dark and Light, Device Physics of Solar Cells, Principle of solar energy conversion, Conversion efficiency, Type of solar cells in use: Dye Sensitized Solar Cells, Thin film solar cells.

Learning Outcomes:

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

1. Understand the carrier generation and recombination process in semiconductors.
2. Apply the principles of photoelectric effect in understanding current generation in solar cells.
3. Understand about the working principles of various solar cells.

Unit-4 Optoelectronic devices

Radiative recombination devices: Light-emitting diodes (LED), Organic Light Emitting Diodes (OLED) and its types.

Photoconducting devices: Photodetectors and photoconductors, Photoresistors, Phototransistors, p-n junction photodiodes, PIN photodiodes.

Learning Outcomes:

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

1. Design a semiconductor light-emitting diode
2. describe the working and design considerations for the LEDs
3. describe the working and design considerations for the photoconducting devices

Unit- 5 Integrated Circuits (IC's)

Classification of ICs, Fabrication of IC-Wafer production- Thermal oxidation - Masking- Lithography- etching- doping-metallization – Assembly and packaging- - Advantages and applications of IC's.

Learning Outcomes:

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

1. Know different types of Integrated Circuits
2. Explain the wafer fabrication methods
3. Understand the applications of ICs

Text books:

1. Physics of Semiconductor Devices, Simon M Sze, Kwok K.Ng, 4th edition, John Wiley & Sons, 2021.
2. Semiconductor Physics and Devices- Basic Principles , Donald A. Neamen, 4th Edition, Mc. Graw Hill.2003
3. Introduction to semiconducting materials and devices, M.S.Tyagi, John Wiley & Sons, 2008.
4. Opto electronics - An introduction (Third edition) - J Wilson and J F B Hawkes. (PHI, 1998)
5. Physics of Optoelectronic Devices- Shun Lien Cmua.Ng, John Wiley & Sons, 1995

Reference books:

6. Semiconductor Physics and Devices, Streetman and Banerjee, 6th Edition, Pearson Prentice Hall, 2010.
7. Semiconductor devices:Modelling and Technology), Nandita Dasgupta, Amitava Dasgupta, Princeton Hall of India (PHI), New Delhi, 2004.

Coursera:

https://www.coursera.org/learn/semiconductor-1#syllabus
https://www.coursera.org/learn/semiconductor-2?#syllabus

Course Outcomes

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

1. Describe the properties of materials and application of semiconductor electronics
2. Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices.
3. Demonstrate the switching and amplification application of the semiconductor devices.
4. Demonstrate the control applications using semiconductor devices.
5. Identify the fabrication methods of integrated circuits.
6. Classify and describe the semiconductor devices for special applications.

19ECE354: Remote Sensing and Geographic Information Systems

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Course objectives:

1. Familiarize about the concept of RS, its components, Electro Magnetic Radiation and energy interactions
2. Develop knowledge on remote sensing data characteristics and space programs
3. Obtain knowledge on evolution, components and concepts in GIS
4. Understand data concepts and analysis techniques in GIS along with its application areas
5. Demonstrate the knowledge of RS&GIS in implementing in various case studies

Module I: Number of hours(LTP) 9 0 0

Introduction Definitions of remote sensing and related terminology, Principles of remote sensing, components of remote sensing, Energy source and electromagnetic radiation, Energy interaction, Classification of Remote Sensing Systems

Learning Outcomes:

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

1. define various terminology used in Remote Sensing[L1]
2. Summarize the historical perspective of Remote Sensing[L2]
3. explain the principles and components of remote sensing[L2]
4. develop knowledge on Electro Magnetic Radiation[L3]
5. outline various energy interactions in related to Electro Magnetic Radiation[L2]

Module II: Number of hours(LTP) 9 0 0

Across track and along track scanning, Indian space programme - Research and development. Characteristics of remote Sensing data, Photogrammetry – Satellite data analysis – Visual image interpretation, Digital image processing – Image rectification, enhancement, transformation

Learning Outcomes:

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

1. classify systems in Remote Sensing and energy recording technologies[L2]
2. identify the historical perspective of Remote Sensing[L3]
3. outline the developments in Indian Space Program[L2]
4. interpret satellite data (remote sensing data) [L2]
5. Develop knowledge on process involved in digital image processing[L3]

Module III: Number of hours(LTP) 9 0 0

Introduction - Definitions of GIS - The Evolution of GIS, Components of GIS, Approaches to the study of GIS, Classes of maps, Plane and Geographic Coordinate systems, Map projection, Classification of map projections, Geo-referencing

Learning Outcomes:

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

1. Classify and explain different components of GIS[L2]
2. identify different application areas of GIS[L3]
3. define terms and concepts related to GIS[L1]
4. develop knowledge on map projections and their classifications[L3]
5. explain the process of geo-referencing[L2]

Module IV: Number of hours(LTP) 9 0 0

Spatial and non-spatial data, Vector and raster data structures, analysis, Database management, Applications of RSGIS in Natural Resources Management, Applications of RSGIS in Disaster Management.

Learning Outcomes:

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

1. Classify different data in GIS[L2]
2. compare vector and raster data structures[L2]
3. outline concepts of Database Management System[L2]
4. Identify usage of GIS in day-to-day activities[L3]

Module V: Number of hours(LTP) 9 0 0

Concepts of Machine learning, Case Study on identification of high incident locations using Machine Learning tools in ArcGIS

Learning Outcomes:

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

1. choose a case study of their interest [L3]
2. apply the knowledge of GIS in analyzing the case study[L3]

Text Books(s)

1. Lillesand, T.M. and Kiefer, R.W, Remote Sensing and Image Interpretation, 6/e, John Wiley and sons, New York, 2011
2. GolfriedKonechy, Geoinformation: Remote sensing, Photogrammetry and Geographical Information Systems, 1/e, CRC press, 2002

Reference Book(s)

1. Burrough, P.A. and McDonnell, R.A., Principles of Geographic Information Systems,3/e, Oxford University Press, New York, 2001.
2. Lintz, J. and Simonet, Remote sensing of Environment, Addison Wesley Publishing Company, New Jersey, 1977
3. NPTEL Web course on Remote Sensing: https://nptel.ac.in/courses/105108077/
4. NPTEL Web course on GIS in Civil Engineering: https://nptel.ac.in/courses/105102015/

Course Outcomes:

1. Familiarize about the concept of RS, its components, Electro Magnetic Radiation and energy interactions
2. Develop knowledge on remote sensing data characteristics and space programs
3. Obtain knowledge on evolution, components and concepts in GIS
4. Understand data concepts and analysis techniques in GIS along with its application areas
5. Demonstrate the knowledge of RS&GIS in implementing in various case studies

19EEI477: INDUSTRIAL AUTOMATION

L	T	P	C
2	1	0	3

To provide students with required knowledge in the field of automation and to introduce the advanced automation techniques like PLC, SCADA and DCS systems and Instrument protocols which are presently used in different Industries for Automation.

Course Objectives:

- To familiarize the role of automation in industries
- To explain the architecture and applications of PLC, SCADA and DCS
- To provide an understanding of instrumentation standard protocols
- To describe the concept and applications of DCS.
- To explore the importance and applications of automation in various modern industries.

UNIT I **8L**

Control Systems and Automation Principles: Evolution of instrumentation and control, role of automation in industries, benefits of automation, introduction to automation tools PLC, DCS, SCADA, hybrid DCS/PLC, automation strategy evolution, control system audit, performance criteria and safety systems.

Learning Outcomes:

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

- summarize the importance of instrumentation and control in industry (L2).
- describe various automation tools (L4).
- analyze the performance criteria of the system (L4).

UNIT II **9L**

Programmable logic Controllers (PLC): Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, PLC design, advanced applications of PLC and SCADA**:** PLC programming methods, PLC applications for batch process using SFC, analog control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Mod bus ASCII/RTU).

Learning Outcomes:

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

- explain the architecture of PLC and assemble it with SCADA/DCS (L2).
- distinguish between PLC & PC and PLC & DCS (L2).
- construct the ladder diagrams of PLC(L3).
- identify the advanced applications of PLC and SCADA(L1).
- list out PLC programming methods (L1).

UNIT III **8L**

Instrumentation Protocols: HART protocol introduction, frame structure, programming, implementation examples, benefits, advantages and limitations. Foundation field bus H1 introduction, structure, programming, FDS configuration, implementation examples, benefits, advantages and limitations, comparison with other field bus standards including device net, Profibus, control net, CAN, industrial Ethernet etc.

Learning Outcomes:

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

- explain the hart protocol and its programming (L2).
- list the advantages and limitations of HART protocol (L3).
- demonstrate the foundation field bus H1and its programming (L3).
- compare foundation field bus H1 with other field bus standards (L4).

UNIT IV **9L**

Distributed Digital Control Systems: DCS introduction, functions, advantages and limitations, DCS as an automation tool to support enterprise resources planning, DCS architecture of different makes, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. enhanced functions viz. advance process control, batch application, historical data management, OPC support, security and access control etc.

Learning Outcomes:

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

- describe distributed control system (L2).
- list the advantages and limitations of DCS (L3).
- formulate DCS as an automation tool for various functions (L5).
- illustrate DCS architecture of different makes (L3).

UNIT- V **8L**

Industrial Applications for Automation:–Power, water treatment, food and beverages, dairy, cement, steel, pharmaceuticals, automobile and building automation.

Learning Outcomes:

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

- analyze power plant industry (L4).
- develop water treatment and food &beverages plant using various automated tools (L3).
- explain the process of cement and steel plant automation (L3).
- adapt automated tools for automobile and building automation (L5).

Textbooks:

1. Popovik, Bhatkar, Distributed Computer Control for Industrial Automation, Marcel Dekkar Publications, 1990.
2. Webb and Reis, Programmable Logic Controllers: Principles and Applications, PHI, 5^{th} Edition.
3. S.K.Singh, Computer Aided Process Control, PHI, 2004.

References:

1. Gary Dunning, Introduction to Programmable Logic Controllers, Thomson Learning, 3^{rd} Edition.
2. N.E.Battikha, The Management of Control System: Justification and Technical Auditing, ISA, 1992.
3. Krishna Kant, Computer Based Process Control, PHI, 2^{nd} Edition.

Course Outcomes:

After completion of this course, the students will able to

- explain importance of automation in industries (L2).
- design and develop control systems for various real time industrial applications using PLC, SCADA and DCS (L5).
- apply different instrumentation protocols for industrial applications (L3).
- use DCS as an automation tool for various functions (L3).
- design and develop advanced Instrumentation systems in Industrial & Automation field (L3).

19EME349: Total Quality Management

L	T	P	C
2	1	0	3

This Course is to introduce the applications to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management. The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable them to identify the parameters that are improving/depriving the quality. By knowing about the quality ISO systems, the student will maintain processes/documentation properly so that the quality maintained by the organization gets recognized.

Course objectives:

1. The overall purpose of the course is to provide an understanding of the process of managing quality and managing services.
2. The principles of Quality, Quality Assurance, and Total Quality Management will provide an insight into the concepts of Excellence and Best Value and the contribution of quality to strategic management
3. Understand the usage of several techniques and quality management tools.
4. Identify the elements that are part of the quality measuring process in the industry.
5. Learn various Customer satisfaction measurement techniques

Module I: **Quality, Strategic Planning and Competitive Advantage** Number of hours(LTP) 9 0 0

Brief history, definitions of quality. Quality in manufacturing and service systems. Quality and price, quality and market share, quality and cost, quality & competitive advantages. ISO 9000, 14000.

Module II: **Managing and Organization for Quality** Number of hours(LTP) 9 0 0

Quality policy, quality objectives, leadership for quality, quality and organization culture, cross-functional teams, supplier/customers partnerships.

Module III: **Quality Control and Improvement Tools** Number of hours(LTP) 9 0 0

Cheek sheet, histogram, pareto chart, cause and effect diagram, scatter diagram, control chart, graph, affinity diagram, tree diagram, matrix diagram, process decision program chart, arrow diagram, acceptance sampling, process capability studies, zero defect program (POKA-YOKE)

Module IV: **Quality Circles** Number of hours(LTP) 9 0 0

Concept and total quality through bench marking, Japanese 5-S, quality management systems QS 9000, ISO 14000. Statistical process control: Control chart - X bar R, P, np and C Charts, benefits of control charts and applications (10 %)

Module V: **Customer Focus and Six sigma principles** Number of hours(LTP) 9 0 0

Customer satisfaction measurement techniques, customer relationship management techniques, Concept of Six Sigma, Six Sigma for manufacturing, Six Sigma for service, Understanding Six Sigma organization.

Text Books(s)

1. J.M. Juran, & F.M. Gryna, Quality Planning and Analysis, McGraw-Hill, 1993
2. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc.2003. (Indian reprint 2004).

3. Evans. J. R. & Lindsay. W, M “The Management and Control of Quality”, (5thEdition),SouthWestern (Thomson Learning), 2002
4. Geoff Tennant, Six Sigma: SPC and TQM in Manufacturing and Services, 1/e, Gower Publishing Ltd., 2001.

Reference Book(s)

1. J.Bank, Essences of Total Quality Management, Prentice Hall, 2007
2. Joel E. Ross - Text & Cases, Total Quality Management, St. Lucie Press, 1995
3. D.L. Goetsch & S. Davis, Introduction to Total Quality, Prentice- Hall, 2002.
4. R. Cavanagh, R. Neuman, P. Pande, what is Design for Six Sigma, 1/e, Tata McGraw- Hill, 2005.

Course Outcomes:

1. Understand the fundamental principles of Total Quality Management
2. Choose appropriate statistical techniques for managing and improving processes in Organisations
3. Develop skills on Quality control and improvement tools
4. Understand benefits of control charts and their applications
5. Analyse Customer relationship management techniques

19EME357: Supply Chain Management

L	T	P	C
2	1	0	3

The course under Operations and supply chain management has been designed to cover the basic concepts of operations management and supply chain management. The students will understand the role of logistics, drivers and metrics in supply chain and how to design the network. The students will understand the globalization and its risks and forecasting in supply chan. The students will understand collaborative planning and replenishment strategies and how to manage uncertainties in inventory. The students shall also be able to understand the role of information technology in inventory management and transportation in supply chain.

Course objectives:

1. To introduce operations management, role and responsibilities of operations manager.
2. To explain the importance of logistics and supply chain management and the relevant drivers and metrics.
3. To demonstrate the technique of forecasting to reduce uncertainty by identifying the risks in a global supply chain setting
4. To impart knowledge of collaborative planning, forecasting and replenishment methodologies to achieve better coordination in a supply chain.
5. To summarize the importance of technology in operations, logistics and supply chain management.

Module I: **Introduction to Operations Management** Number of hours(LTP) 9 0 0

History of operations management, types of manufacturing systems, roles and responsibilities of operations manager, Product operations and service operations, Current Trends in Operations Management

Module II: **Understanding the Logistics and Supply Chain** Number of hours(LTP) 9 0 0

Introduction to supply chain, supply chain links, role of logistics in supply chain, drivers and metrics in supply chain, designing the supply chain network, online sales and distribution network, factors influencing the network design.

Module III: **Impact of Uncertainty in Network** Number of hours(LTP) 9 0 0

Globalization and supply chain, risk management in global supply chain, demand forecasting in supply chain role of information technology in forecasting.

Module IV: **Coordination in Supply Chain** Number of hours(LTP) 9 0 0

Collaborative planning and replenishment strategies, CPFR, managing uncertainties in inventory.

Module V: **Impact of Replenishment Policies in Safety Inventory** Number of hours(LTP) 9 0 0

Role of information technology in inventory management, transportation in supply chain.

Text Books(s)

1. Sunil Chopra, Supply Chain Management, Pearson Publications, 2012.

Reference Book(s)

1. Sridhara Bhatt, Logistics and Supply Chain Management, Himalaya Publishers, 2011
2. D.K Agarwal, Logistics and Supply Chain Management, Macmillan Publishers, 2013.

Course Outcomes:

1. Understand the fundamental principles of Total Quality Management
2. Choose appropriate statistical techniques for managing and improving processes in Organisations
3. Develop skills on Quality control and improvement tools
4. Understand benefits of control charts and their applications
5. Analyse Customer relationship management techniques

19ECS442: BIG DATA

L	T	P	C
2	0	2	3

The course is designed which largely involves collecting data from different sources, manage it in a way that it becomes available to be consumed by analysts and finally deliver data products useful to the organization business. The process of converting large amounts of unstructured raw data, retrieved from different sources to a data product useful for organizations forms the core of Big Data Analytics.

Course objectives:

1. To introduce an in depth understanding of all the concepts related to Big Data and its uses
2. To provide an insight on the underlying technologies to handle Big Data and the Ecosystem of Hadoop.
3. To explore the layers of Big Data Stack and YARN Functionality.
4. To Understand the Architecture, benefits and Properties of Hive and Pig.
5. To provide learners with a deep and systematic knowledge on Spark.

Module I:	Module Name: Getting an overview of Big Data	Number of hours (LTP)	6	0	6

Big Data definition, History of Data Management, Structuring Big Data, Elements of Big-data, Big Data Analytics.

Exploring use of Big Data in Business Context: Use of Big Data in Social Networking, Use of Big Data in preventing Fraudulent Activities in Insurance Sector & in Retail Industry.

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

1. Learn various sources of data and forms of data generation. (L2)
2. Understand the evolution and elements of Big Data. (L2)
3. Explore different opportunities available in the career path. (L3)
4. Understand the role and importance of Big Data in various domains. (L2)

Module II:	**Handling Big Data**	Number of hours (LTP)	6	0	6

Distributed and parallel computing for Big Data, Introducing Hadoop, Cloud computing and Big Data, In-memory Computing Technology for Big Data.

Understanding Hadoop Ecosystem: Hadoop Ecosystem**,** Hadoop Distributed File System, MapReduce, Hadoop YARN, Introducing HBase, Combing HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

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

1. Identify the difference between distributed and parallel computing. (L3)
2. Learn the importance of Virtualization in Big Data. (L2)
3. Learn the details of Hadoop and Cloud Computing. (L2)

4. Learn the architecture and features of HDFS. (L2)

Module III: **Understanding Big Data Technology Foundations** Number of hours (LTP) 6 0 6

The MapReduce Framework, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, Role of HBase in Big Data Processing.

Exploring the Big Data Stack, Virtualization and Big Data, Virtualization approaches.

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

1. Understand Hadoop Ecosystem, MapReduce and HBase. (L2)
2. Apply the technique in optimizing MapReduce jobs. (L3)
3. Explore the layers of Big Data Stack. (L2)
4. Learn virtualization approaches in handling Big Data operations. (L2)

Module IV: HIVE and PIG Number of hours (LTP) 6 0 6

Exploring Hive: Introducing Hive, Getting Started with Hive, Hive Services, Data Types, Built- in Functions, Hive-DDL, Data Manipulation, Data Retrieval Queries, Using Joins.
Analysing Data with Pig: Introducing Pig, Running Pig, Getting started with Pig Latin, working `with operators in Pig, Debugging Pig, Working with Functions in pig, Error Handling in Pig.

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

1. Learn the working of Hive and query execution. (L2)
2. Learn the importance of Pig. (L2)
3. Choose the operators in Pig. (L2)

Module V: SPARK Number of hours (LTP) 6 0 6

Introduction, Spark Jobs and API, Spark 2.0 Architecture, Resilient Distributed Datasets: Internal Working, Creating RDDs, Transformations, Actions. Data Frames: Python to RDD Communications, speeding up PySpark with Data Frames, Creating Data Frames and Simple Data Frame Queries, Interoperating with RDDs, Querying with Data Frame.

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

1. Get an overview of Spark technology and Jobs Organization concept (L2)
2. Understand the schema less data structure available in PySpark (L3)
3. Get an overview of data frames that bridges the gap between Scala and Python in terms of efficiency. (L2)
4. Able to handle a real time Big Data Application. (L4)

Textbooks(s)

1. Big Data Black Book by Dt Editorial Services, Dreamtech Publications, 2016.

2. Learning PySpark by Tomasz Drabas, Denny Lee, Packt publishing, 2017.
3. Tom White, "Hadoop: The Definitive Guide", 3/e,4/e O'Reilly, 2015.

Reference Book(s)

1. Bill Franks Taming, The Big Data Tidal Wave, 1/e, Wiley, 2012.

2. Frank J. Ohlhorst, Big Data Analytics, 1/e, Wiley, 2012

Course Outcomes:

1. Demonstrate the big data concepts for real world data analysis (L1).
2. Develop Map Reduce concepts (L2).
3. Learn how Pig Latin is used for programming in Hadoop. (L3).
4. Illustrate Hadoop API for Map reduce framework (L4).
5. Develop basic programs of map reduce framework particularly driver code, mapper code, reducer code (L5).
6. Learn Apache Spark fundamentals, RDD, DataFrame.

Lab experiments for Bigdata

1	Installation of Hadoop Cluster – a. Stand Alone Mode, b. Pseudo Distributed Mode, c.Fully Distributed Mode
2	Perform file management task in Hadoop. a. Creating directory b. List the contents of a directory c. Upload and download a file d. See contents of a file e. Copy a file from source to destination f. Move file from source to destination.
3	Map reduce programming a. Wordcount program using Java b. Wordcount program using python
4	Databases,Tables,Views,Functions and Indexes
5	Write a program to perform matrix multiplication in hadoop with a matrix size of nxn where n >1000.
7	Given the following table schema Employee_table {ID: INT, Name: Varchar (10), Age: INT, Salary: INT} Loan_table {LoanID:INT, ID: INT, Loan_applied: Boolean, Loan_amt: INT) a. Create a database and the following tables in Hive. b. Insert records into the table c. write an SQL to retrieve the employee details who have applied for a loan.
8	Write a query to create a table which stores the employee records working in the same department together in the same sub-directory in HDFS. The schema for the table is given below:Emp_table: {id, name, dept, yoj}
9	Given +----+----------+-----+-----------+----------+ | ID	NAME	AGE	ADDRESS	SALARY | +----+----------+-----+-----------+----------+ +-----+---------------------+-------------+--------+ |OID	DATE	CUSTOMER_ID	AMOUNT | Create the following table in hive and insert transaction records into it. write an SQL query to find the customer details who have made an order?
10	Understanding Spark

19ECS444: Advances in Internet of Things

L	T	P	C
2	0	2	3

This course focus on the providing an overview of IOT, benefits of using it, how to built a product on different frameworks, platforms and various technologies used in IOT. This course give an in-depth analysis of architecture of IoT ,design patterns to be applied for various deployment components, use of Artificial Intelligence, Data science and machine learning algorithms in IOT and how to secure the IOT components over the network.

Course objectives:

1. Understand the framework , applications, future of IoT and various technologies used in developing IoT
2. Applying IoT Solutions to various deployments using design patterns.
3. Selecting the IoT Architecture based on the application and use of cloud in IoT
4. Expose the students to apply Artificial Intelligence, Data Science and Machine learning concepts on IoT data.
5. Understand the attacks and security measures to be taken when using IoT over network.

Module I: Module Name (if any) Number of hours(LTP) 6 0 6

MODULE 1:

IoT- Next Generation Automated World : Brief introduction to various technologies used in IoT, IoT revolution, benefits of IoT, real world applications of IoT, IoT and robotic work automation, what is the future of IoT.

IoT Frameworks: IoT value chain, IoT frameworks and platforms, Aws IoT, Watson IoT platform, IoT ecosystem, Elements for IoT implementation

Learning Outcomes:

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

1. Understand benefits of IoT in real world and future of IoT(L1)
2. Know Various Technologies used to create IoT applications (L2)
3. Create IoT applications using different Frameworks and platforms. (L3)

Module II: Module Name(if any) Number of hours(LTP) 6 0 6

MODULE 2:

Design Patterns for IoT

Various design patterns, design patterns for common IoT deployments, design patterns for edge deployment, provisioning, and orchestration, design patterns for node connections, design patterns for deployment strategies, design patterns for infrastructure, design patterns for security, challenges and solutions for designing architecture for IoT, case study: IoT lab that monitors parking, water quality, ambient, and environmental conditions.

Learning Outcomes:

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

1. Outlining the various design patterns used in IoT deployments (L2)
2. Differentiate between various design patterns (L2)
3. Understand the challenges for implementing Design patterns for each deployment component (L2)

Module III: Module Name(if any) Number of hours(LTP) 6 0 6

MODULE 3:

IoT Architecture Choices: four-layer architecture, seven-layer architecture, Hadoop, Role of the Cloud in IoT, case study : monitoring road occupancy patterns and mobility in Dordrecht smart city

Learning Outcomes:

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

1. Various architectures available to develop IoT applications (L2)
2. Differentiate between four layer and seven layer architecture(L2)
3. Implement IoT applications in cloud (L3)

Module IV: Module Name(if any) Number of hours(LTP) 6 0 6

MODULE 4:

Artificial Intelligence for IoT: AI and IoT: a logical combination, IoT and AI in the context of industry 4.0, case study : warning system to avoid flood sand allow disaster management in Colombian rivers

Data Analytics and Machine Learning for IoT: impact of data analytics and machine learning in IoT, machine learning models, case study: smart parking system in Montpellier to manage traffic jams

Learning Outcomes:

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

1. Learn Industry 4.0 concepts (L2)
2. Apply AI concepts on IoT devices and data (L4)
3. Understand how Machine learning and Data Analytics changes the IoT application in Industry 4.0 (L5)

Module V: Module Name(if any) Number of hours(LTP) 6 0 6

MODULE 5:

Security Challenges for IoT: botnets, mirai, spam emails, ransomware, medical IoT devices, man in the middle attack, remote vehicle access, weak passwords, ddos attack, ip spoofing, targeting cameras in IoT ecosystem, anatomy of an IoT cyber-attack, case study: smart water management system in spain

Learning Outcomes:

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

1. Identify different security challenges in IoT (L2)
2. Solutions to tackle various security attacks in IoT (L3)
3. Understand Real time scenarios of attacks and mitigating those attacks using Case study (L4)

Text Books(s)

1. Mayur Ramgir," Internet of Things- Architecture, Implementation, and Security", Pearson Education, 2019

Reference Book(s)

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", Springer,2011.
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.
3. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet of Things", Universities Press, 2015.

Course Outcomes:

1. Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.
2. Create a Real-time application by choosing appropriate design pattern
3. Describe the architecture IoT and the IoT technical fundamentals
4. Apply Machine Learning Algorithms for IoT data and Predict/ visualize output using Data Analytic tools
5. Identify the Vulnerability in connected networks

19ECS446: Game Programming

L	T	P	C
2	0	2	3

The main theme of the course on "Game Programming" is to provide an opportunity to obtain knowledge skills on foundations of basic needs of the graphic systems through different transformations and projections, understand the simulation and animation mechanisms, game engine architectures and support systems, Resources and file management systems, interface environments and then learn to build the logic of 2D and 3D gaming using different game programming tools such as DirectX, OpenGL, Python, Unity, Java 2D and 3D, C#, JavaScript and/or any other functional programming tool. At the end of this course, the team of student is able to develop 2D and/or 3D game using any of the game programming tools in an interactive environments for the development of Puzzle, AI based games by considering single, two-player or multi-player game agents.

Course objectives:

1. Understand the game engine architecture and geometric modelling
2. Understand the game development platforms and frameworks
3. Use many software development tools for best practices
4. Apply game logic and interface design, layout and event management
5. Work on teams to develop 2D and 3D games using current game programming tools

Module I: The Graphics System for Game Programming (Textbooks 1 and 2) Number of hours(LTP) 6 0 6

Details of module I: The Foundation, Transformations, Quaternion's, Geometry for 3D Engines, Ray Tracing, Lightening and Shading, Camera And Projections, Culling And Clipping, Character Animation, Physics-Based Simulation, Scene Graphs.

Learning Outcomes:

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

1. understand the foundations and transformations of Game Programming
2. understand Geometry modelling, lightening and shading for game programming
3. represent camera and projections as well as culling and clipping
4. understand character animation and physical simulation for gaming
5. understand and represent Scene graphs.

Module II: Game Engine Design (Textbook 3) Number of hours(LTP) 6 0 6

Details of module II: Game Engine Architecture- Introduction, Tools, Software Engineering for Games, Parallelism and Concurrent Programming, Engine Support Systems, Resources and File Systems, Game Loop And Real-Time Simulation, Human Interface Devices, Collision And Rigid Body Dynamics, Game Profiling.

Learning Outcomes:

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

1. understand the Game engine architecture and Engine Support systems
2. represent Resources and File Systems
3. understand Game Loop and Real-Time Animation
4. understand Human Interface Devices and dynamics
5. understand Game Profiling

Module III: Game Programming (Textbook 4) Number of hours(LTP) 6 0 6

Details of module III: Application Layer, Game Logic, Game Views, Managing Memory, Controlling The Main Loop, Loading And Caching Game Data, User Interface Management, Game Event Management.

Learning Outcomes:

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

1. understand game running fundamentals
2. understand core game technologies

3. understand loading and caching game data
4. understand user interface management
5. apply game event managmenet

Module IV: Game Platforms and Frameworks Number of hours(LTP) 6 0 6

Details of module IV: 2D And 3D Game Development Using Flash, DirectX, Java, Python, Game Engines – DX Studio, Unity.

Learning Outcomes:

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

1. understand various game platforms and frameworks
2. understand 2D and 3D game design and development
3. apply 2D and 3D game development using various tools and technologies
4. understand game engines using DX studio and Unity

Module V: Game Development Number of hours(LTP) 6 0 6

Details of module V: Developing 2D And 3D Interactive Games Using DirectX Or Python – Isometric And Tile Based Games, Puzzle Games, Single Player Games, Multi Player Games.

Learning Outcomes:

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

1. understand 2D and 3D interactive games
2. develop 2D and 3D Interactive games using various tools
3. build different puzzle games
4. develop AI based games
5. develop player based games

Text Books(s)

1. Eric Lengyel, “Mathematics For 3D Game Programming And Computer Graphics”, 3rd Edition, Course Technology PTR, 2012.
2. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach To Real-Time Computer Graphics” 2nd Edition, Morgan Kaufmann, 2007
3. Jason Gregory, “Game Engine Architecture”, CRC Press / A K Peters, 2009.
4. Mike Mc Shaffrfy and David Rez Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2013.
5. James R Parker, Game Development using Python, MERCURY LEARNING AND INFORMATION, New Delhi, 2019

Reference Book(s)

1. Ernest Adams And Andrew Rollings, “Fundamentals Of Game Design”, 2nd Edition Prentice Hall / New Riders, 2009
2. Steve Rabin, Introduction to Game Development, CENGAGE Technology, 2009.
3. David M Bourg & Glenn Seemann, AI for Game Developers, O'Reilly Publishers, 2004.
4. Casey Hardman, Game Programming with Unity and C#, A Complete Beginners Guide, Apress , 2020
5. Roger E Pedersen - Game Design Foundations, Worldware Publishing Inc. 2003
6. https://store.unity.com/
7. https://www.yoyogames.com/

Course Outcomes:

1. Understand the graphics systems for game programming
2. Understand the Game design architecture, tools and Interface environments
3. Design game programming using different layers and interface environments
4. Apply game platforms and frameworks
5. Develop 2D and 3D interactive games using various functional programming tools

19ECS448: Secure Software Engineering

L	T	P	C
2	0	2	3

Please type Course introduction paragraph here

This Course will help the students to get familiar with the security threats which arise during software development process and also helps to understand security services which needs to be adopted at each phase of Software Development Life Cycle

Course objectives:

1. Understand the security threats related to Software Development
2. Elicit, analyze, and specify security requirements through SRS
3. Design and Plan software solutions to security problems using various paradigms
4. Develop and apply testing strategies for Secure software applications
5. Understand the security risks related to Software Project Management

Module I: **Security Issues in Software Development** Number of hours(LTP) 6 0 6

Introduction to Software Engineering – SDLC

Software Assurance and Software Security, Threats to Software Security, Sources of Software Insecurity, The Benefits of Detecting Software Security Defects Early, Managing Secure Software Development

Defining Properties of Secure Software, Security Properties of Software Assertion and Specification of Desired Security Properties

Learning Outcomes:

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

1. Understand the threats to Software Security
2. Illustrate the sources of Software Insecurity
3. Understand the benefits of Early Software Detection
4. Define the Security Properties of Software
5. Illustrate the assertion of Desired Security Software's

Module II: **Requirements Engineering for Secure Software** Number of hours(LTP) 6 0 6

Introduction to Requirements Engineering, Quality Requirements, Misuse and Abuse Cases, The SQUARE Process Model, SQUARE Sample Outputs, Requirements Elicitation, Requirements Prioritization

Learning Outcomes:

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

1. Analyse the Misuse and Abuse cases
2. Understand the different Process Models
3. Determine the Requirement elicitation
4. Categorize the Requirement Properties
5. Determine the Security precautions to be taken during Requirements Phase

Module III: **Secure Software Architecture and Design** Number of hours(LTP) 6 0 6

Introduction, Software Security Practices for Architecture and Design: Architectural Risk Analysis, Software Security Knowledge for Architecture and Design: Security Principles, Security Guidelines, and Attack Patterns

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

1. Analyse the best Security Practices for Software Design
2. Analyse the risks related to the design phase
3. Understand the Security principles and guidelines
4. Categorize the different types of Attack patterns
5. Determine the architectural risks related to Design phase

Module IV: **Secure Coding and Testing** Number of hours(LTP) 6 0 6

Introduction, Code Analysis, Coding Practices, Software Security Testing, Security Testing Considerations Throughout the SDLC

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

1. Comprehensive Understanding the basic coding practices and faults
2. Determine the security precautions taken during coding phase
3. Understand the testing considerations required through SDLC
4. Categorize the priorities required during SDLC phase
5. Identify the best security practices required during Coding and testing phase

Module V: **Governance, and Managing for More Secure Software** Number of hours(LTP) 6 0 6

Introduction, Governance and Security, Adopting an Enterprise Software Security Framework, How Much Security Is Enough, Security and Project Management, Maturity of Practice.

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

1. Analyse the fundamental software risks during software development
2. Determine the security provisions needed at different points of production
3. Understand the Security issues in Design Phase of Software Development
4. Determine the level of security at each phase of Software Development
5. Identify the best practices required for software management

Text Books(s)

1. Julia H Allen, Sean J Barnum, Robert J Ellison, Gary McGraw, Nancy R Mead, Software Security Engineering: A Guide for Project Managers, Addison Wesley, 2008.

Reference Book(s)

1. Developing Secure Software: Jason Grembi, Cengage Learning.
2. Software Securtiy: Richard Sinn, Cengage Learning.

Course Outcomes:

1. Evaluate secure software engineering problems, including the specification, design, implementation, and testing of software systems
2. Analyse the Threats in Software Development phase
3. Determine the Security provisions and policies required in each phase of SDLC
4. Understand the precautions needed at each phase of SDLC to avoid threats
5. Comprehensive Understanding of security risks and project management

19ECS492: Project Phase II

L	T	P	C
0	0	12	6

The findings of Project Phase I is further carried out on the problem with the goal of contributing towards industry ready experience in design, development, testing, and maintenance of software and managing employees.
The students are expected to show their progress in periodic reviews under the guidance of project supervisor.
At the end of the final semester, he is expected to submit either project report.
The project can be done as a group consisting maximum of four persons.

GSS115: Gandhi for the 21st Century

L	**T**	**P**	**C**
0	0	0	1

The course will provide an overall understanding of Gandhi's life, his political contributions, and his basic philosophical thoughts. It also discusses how Gandhi influenced the entire world to think about non-violent resistance as a political strategy to bring and establish world peace

Course objectives:

1. To provide the basic knowledge of Gandhi's life, thought and works
2. To analyse the political contributions of Gandhi towards India's independence
3. To examine the significance of Gandhian principles in the contemporary scenario
4. To educate the students about the necessity of world peace and sustainable development
5. To provide understanding about the life of eminent world leaders who were influenced by Gandhi

Module I:

Introduction to the course: Gandhi's Early Childhood-Beginning of Satyagraha in South Africa-Entry to Indian Politics-Major Movements

Module II:

Gandhi's Political Philosophy: Eleven Vows and their significance, Gandhi's Constructive Programmes and their significance, Sarvodayaand Satyagraha

Module III:

Gandhian Way of Management: Management lessons from Gandhi, his views on education and its significance, Gandhian Economics and Sustainability

Module IV:

Gandhi and his contemporaries-Gandhi and Tagore, Ambedkar, Subhash Chandra Bose, Muhammed Ali Jinnah, Gandhi Mandela, and Martin Luther King Jr.

Module V:

Gandhi and Ecology: Ideas from Hind Swaraj-Environmental movements and Gandhian Environmentalism-World Peace and Gandhi-Conflict resolution and Gandhian principles.

Journal(s)

1. Gandhimarg, Gandhi Peace Foundation, New Delhi.
2. GITAM Journal of Gandhian Studies, GITAM University, Visakhapatnam.

Reference Book(s)

1. Allen, Douglas. (2019). Gandhi after 9/11: Creative Non-violence andSustainability. New Delhi: Oxford University Press.
2. Chandra, B. (2009). History of Modern India. New Delhi: Orient Blackswan.
3. Gandhi, M K. (1941). Constructive Programme. Ahmadabad: Navjivan Publishing House
4. Gandhi, M. K. (1948). The Story of My Experiments with Truth. Ahmadabad: NavjivanPublishing House.
5. Gandhi, M K. (1968). Satyagraha in South Africa. Ahmadabad: Navjivan Publishing House.
6. Hardiman, David. (2004). Gandhi in His Times and Ours: The Global Legacy of His Ideas.New York: Columbia University Press.

Course Outcomes:

1. Understand the life and works of Gandhi
2. Understand and appreciate the political contributions of Gandhi
3. Analyse the contemporary issues and connect it with Gandhian solutions
4. Analyse the issues related to world peace and to think about possible alternatives
5. Understand and appreciate the role of eminent world leaders towards non-violent social and political transformation.