



SYLLABUS

of

B. Tech Computer Science and Engineering with Specialization in

Artificial Intelligence and Machine Learning (AI&ML)

Data Science (DS)

Internet of Things (IoT)

Cyber Security (CS)

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

A University Committed to Excellence

Department of Computer Science and Engineering (CSE)
Common Structure for CSE Specializations (AI&ML, DS, IoT, CS)
(Effective from the academic year 2020-21 admitted batch)

Semester I

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA101	Engineering Mathematics I (Calculus and Algebra)	BS	3	0	0	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/National Sports 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		

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	Common with CSE
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	3	0	3	0	4.5	Common to CSE/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	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	Common with CSE
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		

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	Common with CSE
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	Common with CSE
5.	19ECS231	Object Oriented Programming Through Java	PC	2	0	3	0	3.5	Common with CSE
6.	19ECS203	Data Communications	PC	2	0	0	0	2	Common with CSE
7.	19ECS221	Computer Engineering Workshop	PC	0	0	4	0	2	Common with CSE
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		

Semester IV

S.No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EMA212	Engineering Mathematics IV (Differential equations)	BS	3	0	0	0	3	AI&ML
	19EMA206	Engineering Mathematics IV (Number Theory and its Applications)	BS	3	0	0	0	3	CS
	19EMA214/ 19EMA216	Engineering Mathematics IV (Descriptive Statistics/ Applied Statistics)	BS	3	0	0	0	3	DS/IoT
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	Common with CSE
4.	19ECS204	Operating Systems	PC	3	0	0	0	3	Common with CSE
5.	19ECS232	Computer Networks	PC	3	0	2	0	4	Common with CSE
6.	19EAI232	Introduction to Artificial Intelligence and its Applications	PC	3	0	2	0	4	Common to AI&ML/ CS/ DS
	19EIO232	Sensor Technology and Instrumentation	PC	3	0	2	0	4	IoT
7.	19EMC282/ 19EMC281	Environmental Sciences / Constitution of India	MC	3	0	0	0	0	Common to all
8.	19ECS292	Comprehensive Skill Development III	PW	0	0	0	6	1	Common to all
Total							21		

Semester V

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECS333	Database Management Systems	PC	3	0	2	0	4	Common with CSE
2.	19EAI331	Artificial Neural Networks	PC	2	0	2	0	3	AI&ML/DS
	19ECS305	Cryptography and Network Security	PC	3	0	0	0	3	CSE /CS
	19EIO331	Interfacing through Microprocessors & Microcontrollers	PC	2	0	2	0	3	IoT
3.	19ECS234	Design and Analysis of Algorithms	PC	3	0	2	0	4	Common with CSE
4.	19ECS3XX/ 19EAI3XX/ 19ECF3XX/ 19EDS3XX/ 19EIO3XX	Program Elective I	PE	2	0	2	0	3	Program Specific
5.	19EOE3XX	Open Elective I	OE	3	0	0	0	3	Common to all
6.	19EID3XX	Interdisciplinary Elective I	ID	2	0	2	0	3	
7.	19ECS391	Comprehensive Skill Development IV	PW	0	0	0	6	1	Common to all
Total							21		

Semester VI

S.No .	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EAI332	Automata Theory and Compiler Design	PC	4	0	3	0	5.5	Common for AI&ML/ CS/ DS/ IoT
2	19EAI334	OOSE based Application Development	PC	3	0	3	0	4.5	Common for AI&ML/ CS/ DS/ IoT
3	19EAI336	Machine Learning and its Applications	PC	3	0	2	0	4	AI&ML
	19ECF332	Ethical Hacking	PC	3	0	2	0	4	CS
	19EDS332	Data Visualization And Exploration with R	PC	3	0	2	0	4	DS
	19EIO332	Wireless Sensor Networks	PC	3	0	2	0	4	IoT
4	19ECS3XX/ 19EAI3XX/ 19ECF3XX/ 19EDS3XX/ 19EIO3XX	Program Elective II	PE	2	0	2	0	3	Program Specific
5	19EOE3XX	Open Elective II	OE	3	0	0	0	3	Common to all
6	19EHS302	Engineering Economics and Management	HS	3	0	0	0	3	Common with CSE
7	19EMC382	Engineering Ethics	MC	3	0	0	0	0	Mandatory Course
8	19ECS392	Comprehensive Skill Development V	PW	0	0	0	6	1	Department Specific
9	19EHS304	Universal Human Values: Understanding Harmony	HS	2	1	0	0	3	
Total							27		

Semester VII

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EAI431	Deep Learning	PC	3	0	2	0	4	Common to AI&ML/DS
	19ECF431	Digital Forensics	PC	3	0	2	0	4	CS
	19EIO431	Embedded Systems and its Applications	PC	3	0	2	0	4	IoT
2	19EAI433	Big Data Analytics	PC	3	0	2	0	4	Common to AI&ML/DS
	19ECF433	Mobile Application Security	PC	3	0	2	0	4	CS
	19EIO433	Cloud Based IoT	PC	3	0	2	0	4	IoT
3	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective III	PE	2	0	2	0	3	Program Specific
4	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective IV	PE	2	0	2	0	3	Program Specific
5	19EHS403	HS-II(Organizational Behavior)	HS	3	0	0	0	3	
6	19ECS497	Project Phase I	PW	0	0	2	0	1	Common with CSE
7	19ECS493	Internship	PW	0	0	0	0	1	Common with CSE
8	19ECS495	Comprehensive Skill Development VI	PW	0	0	0	6	1	Department Specific
Total							20		

Semester VIII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EID4XX	Interdisciplinary Elective II	ID	2	0	2	0	3	
2.	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective V	PE	2	0	2	0	3	Program Specific
3.	19ECS492	Project Phase II	PW	0	0	12	0	6	Common with CSE
4.	GSS115	Gandhi for the 21 st Century	HS					1	Online Course
Total							13		

Total Number of Credits distribution

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19.5/ 20.5	23/22	20.5	21	21	27	20	13	162

Category wise and Credits distribution

Category	Code	Courses	Credits GITAM	Credits suggested by AICTE
Humanities & Social Sciences	HS	Communicative English	15	12
		HS1 and HS2 (elective)		
		Gandhi for the 21 st Century		
		Comprehensive Skill Development I		
		Comprehensive Skill 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
Interdisciplinary Electives	ID	ID1, ID2	6	
Program Electives	PE	PE1 – PE5	15	18
Program Core	PC	PC1 – PC17	61	48
Project	PW	Venture Discovery	14	15
		Internship		
		Project Phase I		
		Project Phase II		
		Comprehensive Skill Development III		
		Comprehensive Skill Development IV		
		Comprehensive Skill Development V		
		Comprehensive Skill Development VI		
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, ME and CE
2.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	3	Common with 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	Common with 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/ 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 Applications/ Numerical Methods/ Differential Equations)	BS	3	0	0	3	Offered for CS/ CSE / AI&ML
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/ AI&ML/ CS/ DS/ IoT/ 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/ AI&ML/ CS/ DS/ IoT/ EEE
2.	19ECY133	Chemistry of materials	BS	3	0	3	4.5	Offered for AE, CE and ME
3.	19ECY135	Chemistry for Biotechnology	BS	3	0	3	4.5	Offered for BT

OPEN ELECTIVES

Open Elective I

S.No.	Course Code	Course Title	Category	L	T	P	C
1	19EOE301	Japanese for Beginners	OE	3	0	0	3
2	19EOE303	French for Beginners	OE	3	0	0	3
3	19EOE305	Biotechnology and Society	OE	3	0	0	3
4	19EOE307	Contemporary Relevance of Indian Epics	OE	3	0	0	3
5	19EOE309	Indian National Movement	OE	3	0	0	3
6	19EOE313	Personality Development	OE	3	0	0	3
7	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
8	19MOE303	Introduction to International Business	OE	3	0	0	3
9	19EOE319	Introduction to Music	OE	3	0	0	3
10	19EOE321	Environment and Ecology	OE	3	0	0	3
11	19EOE323	Indian History	OE	3	0	0	3
12	19EOE327	Professional Communication	OE	3	0	0	3
13	GEL244	English for Higher Education	OE	3	0	0	3
14	19EOE224	Virtual Reality	OE	1	0	4	3

Open Elective II

S.No.	Course Code	Course Title	Category	L	T	P	C
1	19EOE302	German for Beginners	OE	3	0	0	3
2	19EOE304	Chinese for Beginners	OE	3	0	0	3
3	19EOE306	Analytical Essay Writing	OE	3	0	0	3
4	19EOE308	Indian Economy	OE	3	0	0	3
5	19EOE310	Public Administration	OE	3	0	0	3
6	19EOE312	Environmental Management	OE	3	0	0	3
7	19EOE327	Professional Communication	OE	3	0	0	3
8	19MOE301	Basics of Finance	OE	3	0	0	3
9	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
10	19EOE313	Personality Development	OE	3	0	0	3
11	19MOE305	Basics of Marketing	OE	3	0	0	3
12	GEL345	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	AI&ML	19ECS343	Advanced Data Structures for Machine Learning	PE	2	0	2	3
2	Cyber Security	19ECF341/ 19ECS345 19ECF343	Operating System Security/ Advanced Computer Networks/ Mobile Application Security	PE	2	0	2	3
3	Data Science	19EDS341/ 19EDS343/ 19EDS345	Data Visualization and Exploration with R/ E-Commerce / Soft Computing	PE	2	0	2	3
4	IoT	19ECS362/ 19EIO341	Cloud Computing/ Software Defined Networks	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	AI&ML	19ECS342/ 19EDS345	Data Warehousing and Data Mining/ Soft Computing	PE	2	0	2	3
2	Cyber Security	19ECF341/ 19ECF343/ 19ECF345	Web Application Security/ Malware Analysis and Reverse Engineering/ Security for Cyber Physical Systems	PE	2	0	2	3
3	Data Science	19EDS342/ 19EDS344	Data Analytics with Tableau/ Operation Research	PE	2	0	2	3
4	IoT	19EIO342/ 19EIO344	IoT Architecture and protocols/ Energy Management for IoT devices	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	AI&ML	19EAI441	Web Mining	PE	2	0	2	3
2	Cyber Security	19ECF441/ 19ECF443/ 19ECF445	Cloud Security/ IoT Security/ Android Security Internals	PE	2	0	2	3
3	Data Science	19ECS362/ 19EDS441/ 19ECS459	Cloud Computing/ Health Analytics/ Block Chain Technology	PE	2	0	2	3
4	IoT	19EIO441/ 19EIO443	IoT for Industries/ IoT Technologies and Applications	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	AI&ML	19ECS443/ 19EAI445	Natural Language Processing/ Digital Image Processing	PE	2	0	2	3
2	Cyber Security	19ECF447/ 19ECF449/ 19ECS459	Intrusion Detection and Prevention Systems/ Threat Intelligence/ Block Chain Technology	PE	2	0	2	3
3	Data Science	19ECS441/ 19ECS443	Information Retrieval Systems/ Natural Language Processing	PE	2	0	2	3
4	IoT	19ECS344/ 19EIO441 19EAI331	Machine Learning/ Edge Computing/ Artificial Neural Networks	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	AI&ML	19EAI442/ 19EAI444	Computer Vision/ Quantum Computing for Computer Science	PE	2	0	2	3
2	Cyber Security	19ECS344/ 19EAI444/ 19ECF446/ 19ECF448	Machine Learning/ Quantum Computing for Computer Science / Cyber Law and IT Protection/ Fundamentals of IOS Security	PE	2	0	2	3
3	Data Science	19EDS442/ 19EAI444/ 19ECF444	Social Media Analytics/ Quantum Computing for Computer Science/ Financial Analytics	PE	2	0	2	3
4	IoT	19ECF443/ 19EIO444	IoT Security/ Communication and Network Technologies in IoT	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	0	2	3
2		19EEI371	Sensors and Signal Conditioning	ID	2	0	2	3
3	Basic Science Courses	19ECY371	Applications of Chemistry in Electronics	ID	2	0	2	3
4	Management Courses	19EHS405	Operations Research	ID	3	0	0	3
5		19EME371	Quantitative Techniques for Management	ID	3	0	0	3
6		19ECE371	Disaster Management	ID	3	0	0	3

Interdisciplinary Elective II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EEC475	Microcontrollers and Interfacing	ID	2	0	2	3
2		19EEI471	Robotics & Automation	ID	2	0	2	3
3		19EEC473	Fundamentals of Digital Signal Processing	ID	2	0	2	3
4		19EBT473	Introduction To Bioinformatics	ID	2	0	2	3
5	Basic Science Courses	19EPH471	Quantum Computing	ID	2	0	2	3
6	Management Courses	19EME456	Optimization Techniques	ID	3	0	0	3

Semester I

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA101	Engineering Mathematics I (Calculus and Algebra)	BS	3	0	0	0	3	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2	0	3	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics / Engineering Chemistry	BS/BS	3	0	3	0	4.5	Common to all
4.	19EID131	Problem Solving and Programming	ES	3	1	3	0	5.5	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES/ES	0/1	0	3	0	1.5/2.5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/National Cadet Corps/National Sports 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:

- To familiarize the students with the theory of matrices and quadratic forms.
- To explain the series expansions using mean value theorems.
- To teach basic concepts of partial derivatives.
- To explain the evaluation of double integrals and its applications.
- To demonstrate the evaluation and applications of triple integrals.

UNIT I: Matrices

10 L

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

Learning Outcomes:

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

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

UNIT II: Mean Value Theorems

6 L

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

Learning Outcomes:

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

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

UNIT III: Multivariable Calculus

8 L

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

Learning Outcomes:

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

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

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

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

Learning Outcomes:

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

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

UNIT V: Multiple Integrals-II**8 L**

Evaluation of triple integrals, change of variables (cartesian, cylindrical and spherical polar co-ordinates), volume as triple integral.

Learning Outcomes:

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

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

Text Book(s):

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

References:

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

Course Outcomes:

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

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

GEL131: COMMUNICATIVE ENGLISH
(Common to all)

L T P C
2 0 2 3

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

Course Objectives:

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

UNIT I

8L

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

Learning Outcomes:

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

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

UNIT II

10L

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

Learning Outcomes:

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

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

UNIT III

8L

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

Learning Outcomes:

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

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

UNIT IV

10L

Listening: Listening for labelling-maps, graphs, tables, illustrations, Speaking: Aided group presentation using charts, graphs etc. Reading: Reading for identification of facts and opinions, Writing: Information

transfer (writing a brief report based on information from graph/chart/table), Grammar & Vocabulary: Subject-verb agreement; language for comparison and contrast; Antonyms.

Learning Outcomes:

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

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

UNIT V

8L

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

Learning Outcomes:

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

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

Reference Book(s):

1. Arosteguy, K.O. and Bright, A. and Rinard, B.J. and Poe, M”, A Student's Guide to Academic and Professional Writing in Education”, UK, Teachers College Press,2019.
2. Raymond Murphy, “English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English, Cambridge University Press,2019.

- 3 Peter Watkins,” Teaching and Developing Reading Skills”, UK, CUP, 2018.
- 4 Deeptha Achar et al., “Basic of Academic Writing” (1and 2) parts New Delhi: Orient BlackSwan, (2012& 2013).
- 5 Kumar S and Lata P, “Communication Skills”, New Delhi Oxford University Press, 2015.

Course Outcomes

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

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

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

L T P C
3 0 3 4.5

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

Course Objectives

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

UNIT I: Basics of Electromagnetics

9 L

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

Magnetostatic field: Biot–Savarts' law, divergence and curl of magnetic fields, Faraday's and Ampere's laws in integral and differential form, displacement current, continuity equation, Maxwell's equations.

Learning outcomes:

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

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

UNIT II: Fiber Optics

7 L

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

Learning outcomes:

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

- apply the principle of propagation of light in optical fibers(L3)
- explain the working and classification of optical fibers(L2)

- analyze propagation of light through optical fibers based on the concept of modes (L4)
- explain the working and classification of optical fibers(L2)
- analyze propagation of light through optical fibers based on the concept of modes (L4)
- summarize applications of optical fibers in medical, communication and other fields(L2)

UNIT III: Dielectric and Magnetic Materials

10 L

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

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

Learning Outcomes:

After completing this unit, the students will be able to

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

UNIT IV: Semiconductor physics

8 L

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

Learning outcomes:

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

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

UNITV: Semiconductor devices

8 L

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

Learning Outcomes:

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

- explain the drift and diffusion currents and formation of junction layer (L2)

- state Einstein's relations(L1)
- explain Hall effect and its applications(L3)
- illustrate and interpret the V-I characteristics of a p-n junction diode(L2)
- describe applications of p-n junction diodes in photodiodes, LEDs and solar cells (L3).

Text Book(s)

1. David J. Griffiths, "Introduction to Electrodynamics", 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, "Solid State Physics", 8/e, New Age International, 2018.
4. S.M. Sze, "Semiconductor Devices-Physics and Technology", Wiley, 2008.

Engineering Physics Laboratory

List of Experiments

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

References

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

Course Outcomes

After completion of this unit the student will be able to

- utilize four probe set up and measure resistance(L3)
- determine the susceptibility of a paramagnetic substance(L5)
- understand the characteristics of photodiode, p-n junction diode and solar cell (L2).
- demonstrate the importance of dielectric material in storage of electric field energy in the capacitors(L2)
- assess the intensity of the magnetic field of circular coil carrying current with varying distance(L5)
- evaluate the acceptance angle of an optical fiber and numerical aperture and loss (L5).
- determine hysteresis losses by B-H curve and measure magnetic parameters using hysteresis loop (L5).
- identify the type of semiconductor i.e., n-type or p-type using Hall effect(L3)
- determine the band gap of a given semiconductor(L5)

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

L T P C
3 0 3 4.5

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

Course Objectives

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

Module 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)

Module II

8L

Battery Technology

Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Lecclanche cell, Modern batteries-zinc-air, lithium cells-LiMnO₂ cell-challenges of battery technology. Fuel cells Introduction-classification of fuel cells-hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell.

Learning outcomes:

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

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

Module III**8L****Renewable Sources of Energy Introduction- sources of renewable energy**

Solar energy–Introduction-Physical and Chemical properties of Silicon- Production of Solar Grade Silicon from Quartz-Doping of Silicon-p and n type semiconductors- PV cell / solar cell- Manufacturing of Photovoltaic Cells using Chemical Vapor Deposition Technique-applications of solar energy.

Learning outcomes:

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

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

Module 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, Electro plating of chromium, gold, etc. Electroless plating of copper, nickel.

Learning outcomes:

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

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

Module V**8L****Polymers, Nanomaterials and Molecular Machines & Switches:**

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

Nanomaterials: Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and nanowires. Chemical synthesis of nanomaterials: sol-gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM).

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

Learning outcomes:

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

- explain the concept so far tificial molecular machines and molecular switches. (L2)
- identify different types of polymers.(L3)
- distinguish between thermoplastic and thermo setting resins.(L4)
- compare nanoclusters and nanowires.(L4)

Text Book(s):

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

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

Course Objectives

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

List of Experiments

1. Determination of Mohr's salt by potentiometric method
2. Determination of strength of an acid by pH metric method
3. Determination of conductance by conductometric method
4. Determination of viscosity of a liquid
5. Determination of surface tension of a liquid
6. Determination of sulphuric acid in lead-acid storage cell
7. Determination of chromium (VI) in potassium di chromate
8. Determination of copper in a copper ore
9. Determination of Zinc by EDTA method.
10. Estimation of active chlorine content in Bleaching powder
11. Preparation of Phenol-Formal de hyderesin
12. Preparation of Urea-Formal d dehyderes in
13. Thin layer chromatography
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 Bhasin and SudhaRani Laboratory Manual on Engineering,
3. Chemistry, 3/e, Dhanpat Rai Publishing Company, 2007.

Course Outcomes:

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

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

19EID131:PROBLEM SOLVING AND PROGRAMMING

(Common to all)

L T P C
3 1 3 5.5

This course focuses on problem solving using visual programming and flowchart tools. Python being simple and easy to learn syntax, it is used as an introductory coding platform to translate flow charts into programs. The course introduces fundamental programming concepts. Python language is used to present concepts including control structures, functions, data structures followed by important Python packages that will be useful in data analysis.

Course Objectives:

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

UNIT I: Computational Thinking and Visual Programming Concepts

10 L+6P

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

Learning Outcomes

After completion of this unit the student will be able to

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

UNIT II: Algorithms and Flowchart design through Raptor

10L+6P

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

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

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

Learning outcomes:

After completion of this unit the student will be able to

- select flowchart symbols for solving problems. (L1)

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

UNIT III: Introduction to Python

10L+6P

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

Learning outcomes:

After completion of this unit the student will be able to

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

UNIT IV: Data Structures and Idiomatic Programming in Python

10L+6P

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

Learning outcomes:

After completion of this unit the student will be able to

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

UNITV: Packages

10L+6P

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

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

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

User defined packages, define test cases and perform unit testing

Learning outcomes:

After completion of this unit the student will be able to

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

Problem Solving and Programming 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 ($0 \leq \text{YYYY} \leq 9999$, $1 \leq \text{MM} \leq 12$, $1 \leq \text{DD} \leq 31$) 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. ($0 \leq \text{HH} \leq 23$, $0 \leq \text{MM} \leq 59$, $0 \leq \text{SS} \leq 59$)
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)

19EME121: WORKSHOP
(Common to all)

L T P C
0 0 3 1.5

The objective of this course is to expose students, common tools in engineering. This course enables the students to gain hands on experience and skills necessary to perform basic operations such as carpentry, sheet metal working and fitting. It also familiarizes the students with basic electrical house wiring concepts.

Course Objectives

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

Wood Working:

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

- a) Half – Lap joint.
- b) Mortise and Tenon joint.
- c) Corner Dovetail joint or Bridle joint.

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working,
Developments of following sheet metal job from GI sheets

- a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:

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

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

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

- a) Parallel and series b) Two-way switch
- c) Godown lighting d) Tube light
- e) Three phase motor f) Soldering of wires

Course Outcomes:

After completion of this lab the student will be able to

- Summarize various carpentry operation required to create a product in real time applications. (L2)
- Develop different parts with metal sheet in real time applications. (L3)
- demonstrate fitting operations in various applications. (L3)
- perform soldering and brazing operations. (L3)
- select different types of electric circuits in practical applications (L3)

19EME131: ENGINEERING GRAPHICS (Common to all)

L T P C
1 0 3 2.5

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

Course Objectives

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

Manual Drawing:

7 L

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

- a) Conic sections - general method only,
- b) Cycloid, epicycloids and hypocycloid
- c) Involute

2L

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

2L

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

1L

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

1L

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

1L

Computer Aided Drafting:

6L

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

1L

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

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple and compound solids. **2L**

Text Book(s):

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

References:

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

Course Outcomes:

After completion of this unit the student will be able to

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

19EMC181A : NATIONAL SERVICE SCHEME (NSS)

L T P C
0 0 2 0

National Service scheme is a public service program encouraged by Ministry of Youth Affairs 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 various NSS Functionaries.

UNIT II

2Hours

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

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 media in the N.S.S activities.

UNIT IV

4hours

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

UNIT V

10hours

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

Text Book(s):

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

19EMC181B: NATIONAL CADET CORPS

L T P C
0 0 2 0

UNIT I

5 hours

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

UNIT II

5 hours

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

UNIT III

5 hours

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

UNIT IV

5 hours

Social awareness and community development
:Basics of social service, weaker sections of our society and their needs, social/ rural development projects – menrega , sgsy , nsap etc, ngos : role and contribution, contribution of youth towards social welfare, family planning, drug abuse and trafficking, civil responsibilities, causes and prevention of hiv/ aids role of youth, counter terrorism, corruption, social evils – dowry / female foeticide / child abuse and trafficking, rti and rte, traffic control organization and anti drunken driving, provision of protection of children from sexual harassment act 2012.

UNIT V

5 hours

Health and Hygiene: Structure and functioning of the human body, hygiene and sanitation (personal and food hygiene), physical and mental health, infectious and contagious diseases and its prevention, basic of home nursing and first aid in common medical emergencies, wounds and fractures, introduction to yoga and exercises. **Adventure training:** Para sailing, slithering, rock climbing, cycling / trekking, environment awareness and conservation natural resources conservation and management, water conservation and rain water harvesting, waste management, pollution control, water, air, noise and soil, energyconservation, 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,** Surya namaskaras, Tad asan, Nataraj asan, Vriksh asan, Padahasthasan, Ardhashakrasan, Trikonasan, Bramari pranayama.
- **Yoga for allround fitness,** Bhadrasan, Vajrasan, ArdhaUstrasana, Nadishuddhi pranayama, Navasan, Janusirasan, Paschimotthanasan, Shashankasan, Vakrasan, Bhujangasan, Kapalabhati..
- **Meditative Postures:** Sukhasan, ArdhaPadmasan, Padmasan and Siddhasan, Meditation
- **Yoga Practice:** Makarasan, Sethubandhasan, Pavanmuktasan, Sarvangasan, Matsyasan, Halasan.

Text Book(s):

1. Swami Muktibodhanda Saraswathi Shay G.S., Hatha yoga Pradipika, Bihar School of yoga publications, Munger, 2000.
2. Hatha Yoga Pradeepika of Svatmarama, MDNY Publication, 2013
3. Svatmarama, Swami, The Hatha yoga Pradipika/ the original Sanskrit [by] Svatmarama; an English translation [by] Brian Dana Akers. Woodstock, NY:YogaVidya.com, 2002.

References:

1. Bharati, Swami Veda Reddy Venkata: Philosophy of Hatha Yoga (Englis), Himalayan, Pensylvania, Hatha Ratnavali.
2. Swami Satyananda Saraswathi - Asana, Pranayama, Mudra & Bandha. Bihar School of Yoga, Munger
3. B.KS.Iyenger - The Illustrated Light on Yoga. Harper Collins, New Delhi.

Course Outcomes:

After completion of this course the student will be able to

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

VDC111: VENTURE DISCOVERY

L	T	P	C
0	0	4	2

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

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

COURSE OBJECTIVES

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

UNIT I

(6 sessions)

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

UNIT II

6 sessions)

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

UNIT III

(6 sessions)

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

UNIT IV

(6 sessions)

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

UNIT V

(6 sessions)

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

Assessment methods

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

Transferrable and Employability Skills

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

Learning and teaching activities

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

Teaching and learning resources

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

Prescribed Modules:

Access to NU-IDEA online modules will be provided.

Referential text books and journal papers:

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

Suggested journals:

Vikalpa, Indian Institute of Management, Ahmedabad

Journal of General Management, Mercury House Business Publications, Limited

Harvard Business Review, Harvard Business School Publishing Co. USA

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

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

Semester II

S. No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	0	3	Common with CSE
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	3	0	3	0	4.5	Common to CSE/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	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	Common with CSE
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, testing of hypothesis for small and large samples in engineering applications.

Course Objectives:

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

UNIT I: Data Science and Probability

10 L

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

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

Learning Outcomes:

After completion of this unit the student will be able to

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

UNIT II: Random Variable and Probability Distributions

8 L

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

Learning Outcomes:

After completion of this unit the student will be able to

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

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

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

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

Learning Outcomes:

After completion of this unit the student will be able to

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

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

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

Learning Outcomes:

After completion of this unit the student will be able to

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

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

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

Learning Outcomes:

After completion of this unit the student will be able to

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

Text Book(s):

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

References:

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

Course Outcomes:

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

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

19EID134: AI TOOLS

(Common to all)

L T P C
2 0 2 3

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

Course objectives:

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

Module I:

9 L

Introduction to Artificial intelligence: Basics of AL 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

Module II:

9 L

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
- Identify types of machine learning

Module III:

9 L

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:
- Implement the methods in processing an image:

Module IV:

9 L

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 Chatbot:
- Describe natural language processing and concepts for converting speech to different forms

Module V:

9 L

BOT Technologies: Chatbots: Introduction to 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, Best practices for chatbot development. NLP components. NLP wrapper to chatbots. Audio bots and Music bots. 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
- Correlate Artificial Intelligence to advanced applications

Text Books(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.

Reference Book(s)

1. Aurélien Giron. Hands on Machine Learning with Scikit-Learn and TensorFlow concepts, Tools, and Techniques to Build Intelligent Systems, Published by O'Reilly Media, 2017
2. Build an AI Assistant with wolfram alpha and Wikipedia in python. <https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe>.
3. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv Computer Vision Projects with Python-Publishing (2016).
4. Curated datasets on kaggle <https://www.kaggle.com/datasets>.

Course Outcomes:

- Able to grasp the concepts of artificial intelligence, machine learning, natural language processing, image processing
- Recognize various domains in which AI can be applied
- Implement the methods in processing an image:
- Implement simple chatbots
- identify smart applications:

For Laboratory courses: List of Experiments

1. Supervise - Perform Data Labelling for various images using object recognition
2. Teachable Machine Brain.JS In Browser Object Recognition through
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 Open CV
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

19EID234: LIFE SCIENCES FOR ENGINEERS

(Common to all)

L T P C

2 0 2 3

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

Course Objectives

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

UNIT I

10 L

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

Learning Outcomes:

After completing this unit, the student will be able to

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

UNIT II

12 L

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

Learning Outcomes:

After completing this unit, the student will be able to

- outline the importance of water (L2).

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

UNIT III

12 L

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

Learning Outcomes:

After completing this unit, the student will be able to

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

UNIT IV

12 L

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

Learning Outcomes:

After completing this unit, the student will be able to

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

UNIT V

10 L

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

Learning Outcomes:

After completing this unit, the student will be able to

- outline the principles of recombinant DNA technology (L2).

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

Lab Experiments (Virtual or Field Experiments)

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

Text Book(s):

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

Reference Books:

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

Course Outcomes

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

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

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

L T P C
3 1 3 5.5

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

Course Objectives

- To familiarize the basic DC and AC networks used in electrical and electronic circuits.
- To explain the concepts of electrical machines and their characteristics.
- To introduce the importance of transformers in transmission and distribution of electric power.
- To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors(MOSFETs).
- To expose basic concepts and applications of Operational Amplifier and configurations.

UNIT I

10L

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

Learning Outcomes:

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

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

UNIT II

10L

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

Learning Outcomes:

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

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

UNIT III**12L**

Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination of efficiency. **Three Phase Induction**

Motors: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.

Learning Outcomes:

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

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

UNIT IV**12L**

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

Learning Outcomes:

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

- describe the device structure and physical operation of a diode(L1)
- discuss V-I characteristics of diodes(L2)
- explain the use of diode as switch and in electronic circuits(L2)
- describe the construction and operation of n-channel and p-channel MOSFETs(L1)

- explain the use of MOSFET as an amplifier and bidirectional switch(L2)

UNIT V

10L

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

Learning Outcomes:

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

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

Basic Electrical and Electronics Engineering Laboratory

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

Text Book(s):

1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1/e, McGraw Hill Education (India) Private Limited, 2017.

2. B. L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1/e, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2014.

References:

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

Course Outcomes

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

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

19ECS134: DATA STRUCTURES WITH PYTHON

L T P C
2 0 3 3.5

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

Course Objectives

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

UNIT I

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: Sequential Search, binary search.

Sorting: Insertion sort, selection sort, 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: array implementation, linked list implementation and applications, Priority Queue, Double-Ended Queues.

Learning Outcomes:

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

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

UNIT IV**10L**

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)
- explain different tree traversals and applications(L2)
- analyze the complexity of operations on binary search trees(L4)

UNIT V**10L**

Graphs: ADT, data structure for graphs, properties of graphs, types of graphs, graph representations, graph traversals, directed acyclic graph, shortest path 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. Michel T.Goodrich, RobertoTamassia, MichelH. Goldwasser, **Data Structures & Algorithms in Python**, Willey March, 2013. ISBN:978-1-118-29027-9.
2. RanceD.Necaise, **DataStructures & Algorithms using Python**, John Willey & Sons, India. 2011, ISBN 9788126562169

References:

1. Wesly J.Chun, Core Python Programming, 2/e, Prentice 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 distance 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)

19EHS122: COMPREHENSIVE SKILL DEVELOPMENT I

L T P A C

0 0 0 6 1

Course Objectives:

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

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

Part-1

A. Verbal and Soft Skills

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

B. Quantitative Aptitude and Reasoning

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

Part-2

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

Visual Studio code – Configuring, integrating Git for assignment submission

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

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

Problem Solving with C: Memory, C Syntax, Conditions and Loops, Functions and Recursion, Arrays, Techniques for manipulating Strings, Searching, Sorting, Stacks and Queues, Structures.

Course Outcomes:

On completion of the course, student will be able to

- effectively communicate through verbal/oral communication and improve the listening skills. (L3)
- write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self-motivation and practicing creative thinking. (L6)
- understand the problems and develop his competitive coding skills. (L2)
- apply the skills in various domains and will be able to solve complex problems faced by the industry(L3).
- function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality. (L4)

**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.

Module I: Mathematical Logic 10 L

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)

Module II: Recurrence Relations 8 L

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)

Module III: Group Theory 8 L

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)

Module IV: Graph Theory

8 L

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) Text 3

Module V: Trees

6 L

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 Books(s)

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997. Dkfjd
2. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2012.

Reference Book(s)

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:

- 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)

L	T	P	C
2	0	2	3

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

Course objectives:

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

Module I:

8 L

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

Learning Outcomes:

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

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

Module 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 completion of 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)

Module III:

10 L

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

Learning Outcomes:

After completion of 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)

Module IV:

10 L

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

Learning Outcomes:

After completion of 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)

Module 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 completion of 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 Books(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. 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, theorems and properties of Boolean algebra.
- Familiarize the student with techniques for minimizing expressions.
- Demonstrate the design of combinational and sequential logic circuits.

Module I: Binary Systems:

8 L

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)

Module II: Boolean Algebra and Logic Circuits:

8 L

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:

- Solve expressions in the canonical and standard forms (L3)
- Construct logic circuits with logic gates (L3)
- Construct any Boolean function using Universal gates (L3)
- Summarize the properties of Boolean algebra (L2)

Module III: Gate-Level Minimization:

8 L

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

Learning Outcomes:

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

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

Module IV: Combinational Logic

9 L

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)

Module V: Sequential Circuits

9 L

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

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.

Reference Book(s):

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 McGrawHill, 2007.

19ECS231: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(Common to all branches / for AB 2020-21 etc)

L	T	P	C
2	0	3	3.5

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

Course objectives:

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

Module I: Fundamentals ,Data types , Operators, Control Structures 6L 9P

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)

Module II: Introduction to Classes, Objects And Methods 6L 9P

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

Parsing, Auto boxing and Unboxing. I/O: Command-Line Arguments, Scanner and BufferedReader Classes

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

Learning

Outcomes:

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

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

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Module III: Arrays and Strings

6L 9P

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, to String(), Character extraction, string comparison, searching strings, modifying, data conversion, changing the case, joining, split(). String Buffer class: constructors, length(), capacity(), ensure Capacity(), set Length(), 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)

Module IV: Inheritance and Interfaces

6L 9P

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)**

Module V: Packages and Exception Handling

6L 9P

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)

Text Books(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.

Reference Book(s)

1. Y. Daniel Liang , 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.

Course 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 attributes of OOP to reap its benefits(L3).
- demonstrate the ease of handling various scenarios of program execution without abrupt interruption(L2).

For Laboratory courses: List of Experiments:

1. Develop a program to demonstrate the use of labelled break and continue statements.
2. Develop a program to demonstrate the use of for each loop.
3. Develop a program to sort an array in ascending and descending order.
4. Develop a program to create a student class and display his details
5. Develop a program to create an array of objects for employee class.
6. Develop a program that will take a string from a command line argument and check whether it is a palindrome or not.
7. Write a program for finding area of different geometric shapes (Circle, Rectangle and Cube) using method overloading.
8. Write a Program to generate Fibonacci Series by using Constructor to initialize the Data Members.
9. Develop a program to demonstrate constructor overloading.
10. Develop a program to accept a sentence and display the words in it.
11. Design a vehicle class hierarchy in Java, and develop a program to demonstrate Polymorphism.
12. Develop a program to demonstrate multiple inheritance through interface.

13. Write a program to find the roots of a quadratic equation using interface and packages.

- Declare an interface in package Quad1
- Declare another package Quad2 and implement the interface

14. Develop a program to demonstrate exception handling by using THROW, MULTIPLE CATCH & FINALLY statements.

15. Write a program to throw a user defined exception for employee details

- If an employee name is a number, a name exception must be thrown. 91
- If an employee age is greater than 50, an age exception must be thrown

Case Study:

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

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

19ECS203: Data Communications

L	T	P	C
2	0	0	2

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

Course objectives:

- Introduce the basic concepts of data communication and layered models
- Familiarize the concepts of Data Transmission and various characteristics of transmission media
- Study the analog and digital signal encoding techniques
- Expose the basic error control and flow control techniques.
- To get acquainted with static channel allocation using multiplexing techniques

Module I: Data communication, Data networking and the Internet 9 L
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 the basic concepts of data communications (L2).
- Discuss the nature and evolution of internet technology(L2)
- Infer the necessity of layered protocol architecture (L2)
- Analyse the functionalities of the OSI and TCP/IP models (L4).
- Summarize the characteristics of OSI and TCP/IP models(L2)

Module II: Data transmission 9 L
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:

- Discuss about the concepts and terminology of Data Transmission (L2).
- Describe Analog transmission, Digital transmission (L2)
- Summarize various Transmission impairments(L2)
- Explain the concept of Channel capacity under given considerations(L2)
- Compare guided and unguided media(L2)

Module III: Signal encoding techniques 9 L
Digital data to digital signals, digital data to analog signals, analog data to digital signals, analog data to analog signal.

Learning Outcomes:

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

- How to represent digital data by using digital signals (L3)
- Able to learn how to convert analog signal to digital data (L3)
- Ability to know converting digital data to a bandpass analog signal (L2)
- Ability to know Converting a low pass analog signal to a bandpass analog signal (L3)
- Compare different digital modulation techniques (L3)

Module IV: Digital Data Communication Techniques

9 L

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 datalink control (HDLC) protocol.

Learning Outcomes:

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

- learn the Asynchronous and Synchronous transmission (L3)
- detect error position and error correction (L4)
- learn the main functions of the data link layer (L2)
- Analyse the data link control and media access control (L2)
- learn different protocols (L4)

Module V: Multiplexing

9 L

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:

- describe the need for multiplexing(L2)
- illustrate the working of FDM and TDM techniques(L2)
- summarize the characteristics of Frequency Division Multiplexing(L2)
- explain the difference between Synchronous TDM and Statistical TDM techniques(L2)
- compare the performance of multiplexing techniques under different conditions(L3)

Text Books(s)

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

Reference Book(s)

2. Fred Harshall, Data Communications, Computer Networks and Open systems,4/e, Pearson Education, 2005.
3. 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

- Explain and summarize the purpose of OSI and TCP/IP network architectures (L2)
- Compare the properties of Data transmission and various transmission Media(L2)
- Describe the analog and digital signal encoding techniques
- Analyse error and flow control techniques
- Explain different multiplexing techniques and their characteristics

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 the 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).

Module I: PC Hardware and Software

6 P

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.

Task 2: Every student should individually install MS Windows on their personal computer. The lab instructor should assist and verify the installation, and the teachers follow it up with a viva.

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.

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

Learning Outcomes:

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

- assemble and disassemble various components of PC [L2]

- identify the names, distinguishing features, and units for measuring different kinds of Components and storage devices [L1]
- identify the names and distinguishing features of different kinds of input and output devices [L1]
- install system software's like windows and Linux [L3]
- perform various basic commands and operations on files in Linux [L3]

Module II: Hardware and Software Troubleshooting

9 P

Task 5: Hardware Troubleshooting: Students must be given a PC that 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.

Task 6: Software Troubleshooting: Students must 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.

Learning Outcomes:

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

- Indicate the names and functions of hardware ports and the parts of the motherboard [L1]
- understand the process of reviewing, diagnosing and identifying operational or technical problems within the system [L2]
- resolve physical and/or logical problems and issues within computing hardware [L3]
- Perform the process of scanning, identifying, diagnosing and resolving problems, errors and bugs in software [L3]
- resolve the issues due to incorrect installation or restoring software after corruption or file deletion caused by a virus [L3]

Module III: Internet and World Wide Web

9 P

Task 7: Orientation and Connectivity Boot Camp: Students should connect 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.

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.

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.

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

Learning Outcomes:

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

- demonstrate the setting up of new dial-up connections [L2]
- illustrate the process of creation and accessing the emails [L2]
- explain the different types of web browsers [L2]
- select the appropriate search engine for a specific application [L1]
- install freeware antivirus software to the system [L3]

Module IV: Excel

9 P

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

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

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

Learning Outcomes:

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

- Identify the names and functions of the Excel interface components. [L1]
- Enter and edit data, Format data and cells. [L1]
- Use formulas, including the use of built-in functions, and relative and absolute references. [L3]
- Create and modify charts. [L3]
- Preview and print worksheets. [L2]

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

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

Learning Outcomes:

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

- Identify the names and functions of the PowerPoint interface. [L1]
- Create and manipulate simple slide shows with outlines and notes. [L3]
- Create slide presentations that include text, graphics, animation, and transitions. [L3]
- Use design layouts and templates for presentations. [L3]
- Create a PowerPoint presentations. [L3]

Text Books(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.

Reference Book(s)

1. Dinesh Maidasani, Computer Fundamentals, MS Office and Internet & Web Technology, Firewall Media, 2005.
2. Hardware and Software of Personal Computers by Sanjay K. Bose.

Course Outcomes:

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

- Identify various hardware components of a Personal Computer(L3)
- Install Operating System(L3)
- Troubleshoot hardware and software(L3)
- Work with Internet and Search engines(L4)

- Make use of Excel and PowerPoint(L3)

19EMC281: CONSTITUTION OF INDIA

	L	T	P	C
	3	0	0	0
Module I: Introduction to Indian Constitution			10	L
Constitutional history, constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.				
Module II: Rights and Duties			8	L
Citizenship, fundamental rights and directive principles, fundamental duties.				
Module III Union Government			8	L
President and vice president, election, removal and powers, prime minister and council of ministers, parliament, supreme court, union, state relations, emergency provisions.				
Module IV: State and Local Governments			8	L
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.				
Module V: Other Constitutional and Statutory Bodies			8	L
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 Books(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

Reference Book(s)

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

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.

Module I: **Introduction to environment and natural resources**

10 L

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 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)

Module II: **Ecosystems and biodiversity: Structure components of ecosystem**

9 L

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 100 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, manwildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ conservation of biodiversity.

Learning Outcomes:

After 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)

Module III: Environmental pollution and control

8 L

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 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)

Module IV: Social issues and global environment problems and efforts

9 L

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 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)

Module V: Human population and environment legislation

6 L

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 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 Books(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

Reference Book(s)

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. Eccleston, 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:

- 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

Course Outcomes:

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

Part-1**3 Hours per week****A. Verbal and Soft Skills:**

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

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

B. Quantitative Aptitude and Reasoning

Puzzles, Numbers, Arithmetic, Data Interpretation.

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

1.	Numbers [Number System, Divisibility rules, Remainders, LCM & HCF]	3
2.	Numerical Computation and Estimation-1 [i. Chain Rule ii. Ratio Proportions iii. Partnerships & Averages iv. Percentages v. Profit-Loss, and discounts vi. Mixtures]	6
3.	Data Interpretation [Pie diagrams, Line Graph, Bar Graph, Tabular forms, and Case lets]	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, Representation of graphs, Breadth First Search, Depth First Search, Dynamic Programming.

Scheme of Evaluation

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

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

Late Work

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

References:-

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

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

19EMA212: ENGINEERING MATHEMATICS-IV
Differential Equations

L	T	P	C
3	0	0	3

This course is designed for engineering students to impart the knowledge on differential equations, both ordinary and partial, which are widely used in the modelling and analysis of a wide range of physical phenomena and has got applications across all branches of engineering. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course objectives:

- To familiarize the students with the basic concepts of linear differential equations and their applications.
- To explain the evaluations of linear homogeneous and non-homogeneous differential equations.
- To teach the applications of higher order differential equations..
- To explain the concepts of first order partial differential equations.
- To teach the applications of higher order partial differential equations.

Module I:

10 L

Differential Equations of First Order and Its Applications : Exact differential equations, Integrating factors, rules to find an integrating factor, Definition of linear differential equation of any order, Solving first order linear differential equation, Bernoulli's equation, Applications: Newton's law of cooling, Rate of decay of radio-active materials.

Learning Outcomes:

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

- distinguish between linear and non linear differential equations (L4).
- solve exact differential equations (L3).
- apply the concept of first order ordinary differential equations to solve real world problems (L3).

Module II:

8 L

Linear Differential Equations of Higher Order :Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

Learning Outcomes:

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

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

Module III:

8 L

Equations Reducible to Linear Differential Equations and Applications

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

Learning Outcomes:

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

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

Module IV:

8 L

Partial Differential Equations: First order partial differential equations, solutions of first order linear PDEs, Charpit's method, solutions to homogenous and non-homogenous linear partial differential equations

Learning Outcomes:

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

- apply a range of techniques to find solutions of PDEs (L3)
- identify the basic properties of PDEs (L3)

Module V:

10 L

Partial Differential Equations– Higher order: Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.

Learning Outcomes:

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

- apply a range of techniques to find solutions of higher order PDEs (L3)
- analyze physical situations using higher partial ordinary differential equations (L4)

Text Books(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.

Reference Book(s)

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
3. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

Course Outcomes:

- apply the concept of first order ordinary differential equations to solve real world problems (L3).
- evaluate linear homogeneous and non homogeneous differential equations (L3)
- apply the concept of higher order ordinary differential equations to solve real world problems (L3).
- apply the concept of first order partial differential equations to solve real world problems (L3).
- apply the concept of higher order partial differential equations to solve real world problems (L3).

19EMA206: ENGINEERING MATHEMATICS-IV
NUMBER THEORY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

This course is designed to give an introduction to the deep theory of the integers, with focus on the properties of prime numbers, and integer or rational solutions to equations.

Course objectives:

- The course provides an introduction to basic number theory, where the focus is on computational aspects with applications in cryptography.
- To gain knowledge about the mathematics of the cryptographic algorithms.
- To get an insight into the working of different existing cryptographic algorithms.
- To learn how to use cryptographic algorithms in security.

Module I:

8 L

Basic Concepts in Number Theory: Divisibility, Greatest Common Divisors, Euclidean Algorithm, Factorization of integers, Congruence, Modular arithmetic, Quadratic residues, Fermat's theorem, Cauchy's theorem, Chinese Remainder theorem, Primality testing algorithm, Euclid's algorithm for integers, Quadratic residues, Legendre symbol, Jacobi symbol

Learning Outcomes:

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

- develop the basics of number theory (L3)
- perceive the congruence modulo, modular arithmetic and quadratic residues (L5)

Module II:

6 L

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Learning Outcomes:

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

- discover the concepts of different modes of symmetric ciphers (L4)

Module III:

10 L

Block Ciphers: Traditional Block Cipher Structures, Fiestal Cipher, Data Encryption Standard, Advanced Encryption Standard, Block Cipher Operation, Stream Ciphers, RC4

Pseudo Random Number Generators: Principles of Pseudo random number generation.

Pseudo Random Number Generators, Randomness and Pseudo randomness.

Learning Outcomes:

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

- determine the classical encryption techniques (L5)
- determine AES, DES (L5)

Module IV:

10 L

Public Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm. Diffie-Hellman Key Exchange Algorithm, Elliptic Curve Cryptosystem, Probabilistic encryption.

Learning Outcomes:

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

- estimate the importance of Public Key Cryptography (L5)
- apply RSA algorithm and Elliptic Curve Cryptography (L3)

Module V:

10 L

Cryptographic Hash Function Applications of Cryptographic hash Functions. , Hash Functions, Message Authentication Codes, Message Digest, Digital Signatures, Introduction to DSA

Learning Outcomes:

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

- apply cryptographic hash function for Message Authentication Code (L3)
- choose cryptographic hash functions for Digital Signatures (L5)

Text Books(s)

1. Neal Koblitz, A Course in Number Theory and Cryptography: Springer- Verlag, New York Inc. May 2001.
2. William Stallings, Cryptography and Network security: Principles and Practice, Pearson Education, 2002.
3. Stinson D, Cryptography: Theory and Practice, 3/e, Chapman & Hall/CRC, 2012

Reference Book(s)

1. W. Trappe and L. C. Washington, Introduction to Cryptography with Coding Theory, 2/e, Pearson Education 2007.
2. Douglas R. Stinson, Cryptography: Theory and Practice, CRC Press.
3. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
4. Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery John Wiley, An Introduction to the Theory of Numbers, 5/e, 2015.

Course Outcomes:

- develop fundamental mathematical concepts of number theory (L3)
- determine the classical encryption techniques (L5)
- construct public key encryption, key establishment protocols and digital signatures (L3)

19EMA214: ENGINEERING MATHEMATICS-IV (DESCRIPTIVE STATISTICS)

L	T	P	C
3	0	0	3

This course is an introductory to descriptive statistics for undergraduate students in engineering sciences. Statistical methods are important tools which provide the engineer with both descriptive and analytical methods for dealing with the variability in observed data. It introduces students to cognitive learning in statistics; and develops skills on analyzing the data by using different tests and designing the experiments with several factors.

Course objectives:

- To summarize the data and to obtain its salient features from the vast mass of original data.
- To describe the basic measures of statistics including measures of location, dispersion and linear regression.
- To analyze data pertaining to attributes and to interpret the results.
- To Interpret summery features of data.
- To understand the concepts of Large Samples and Small Samples

Module I:

8 L

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives.

Learning Outcomes:

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

- organize, manage and present the given data. (L3)
- analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- understand the difference between the levels of measurement: nominal, ordinal, interval, and ratio.
- identify the general elements that characterize a study.
- understand the fundamentals of experimental design.

Module II:

8 L

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.

Learning Outcomes:

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

- analyze statistical data using measures of central tendency, dispersion and location.
- understand the differences between each measure of center.
- identify the symbols and know the formulas for sample and population means.
- determine the values in a data set that are outliers.
- identify the values to be removed from a data set for an n – percent trimmed mean.
- calculate the range and inter-quartile range
- calculate the standard deviation for a population and a sample, and understand its meaning.

Module III:

8 L

Bivariate Data Analysis: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression

Learning Outcomes:

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

- understand the concept of bivariate data, correlation and the use of scatter plots to display bivariate data
- understand when the terms “positive,” “negative” “strong,” and “perfect” apply to correlation between two variables in a scatter plot graph
- calculate and interpret the correlation between two variables then fitting of regression line.
- calculate the simple linear regression equation for a set of data
- calculate residuals and understand the least-squares property and its relation to the regression equation

Module IV:

8 L

Curve Fitting & Attributes: Principle of least squares and fitting of polynomials and exponential curves. Theory of attributes: Independence and association of attributes, consistency of data, measures of association and contingency, Yule’s coefficient of colligation.

Learning Outcomes:

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

- to find the probabilities of events, to fit various mathematical curves (linear and non- linear).
- to observed data by using principle of least squares and forecasting values of unknown values of the variable.
- know the association between the attributes
- know the ‘Conditions for the consistency’ and criteria for the independence of data based on attributes
- knowledge of other types of data reflecting quality characteristics including concepts of independence and association.

Module V:

10 L

Testing of Hypothesis : Formulation and procedure testing of hypothesis

Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems. Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ^2 - test for goodness of fit, χ^2 - test for independence of attributes.

Learning Outcomes:

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

- apply parametric tests in different real life data.
- know the difference between sample proportions and sample means based on large sample.
- understand the differences between the F-and the Student’s t-distributions.
- understand the features of experiments that allow Goodness-of-Fit tests to be used.
- run a Test of Independence to determine whether two variables are independent or not.

Text Books(s)

1. Feller, W, An Introduction to Probability theory and application, Wiley,2014.
2. Goon A.M., Gupta M.K. and Dasgupta B, Fundamentals of Statistics, Vol.I & II, 8th Edition. The World Press, Kolkata,2002.

3. Gupta, S.C. and Kapoor, V.K, Fundamental of Mathematical Statistics, 11th Edition, Sultan Chand & Sons, 2007

Reference Book(s)

1. Statistics with Applications, (7th Edition.), Pearson Education, Asia. 1. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical
2. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edition., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New D.
4. S. Ross, A First Course in Probability, Pearson Education India, 2002.

Course Outcomes:

- analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- analyze statistical data using measures of central tendency, dispersion and location.
- calculate and interpret the correlation between two variables then fitting of regression line.
- know the 'Conditions for the consistency' and criteria for the independence of data based on attributes.
- understand the differences between the F-and the Student's t-distributions.

19EMA216: ENGINEERING MATHEMATICS-IV (APPLIED STATISTICS)

L	T	P	C
3	0	0	3

This course is an introductory to applied statistics for undergraduate students in engineering sciences. Statistical methods are important tools which provide the engineer with both descriptive and analytical methods for dealing with the variability in observed data.

Course objectives:

- To acquaint the students with some important but useful concepts on topics in sampling theory, ANOVA and time series analysis
- To train and develop in depth understanding of the key technologies in data science and analytics: applied statistics, data mining, data visualization techniques, and forecasting methods
- To provide opportunities of higher studies in the area of Applied statistics and data science.
- To impart knowledge on various theoretical and practical aspects of statistics and data science.
- To practice problem analysis and decision-making.
- This course will give exposure to four applied fields of statistics viz. Sampling Theory, Design of experiments, Time Series, Index Numbers, and Demographic methods

Module I:

8 L

Sampling Theory: Principle steps in a sample survey, Censuses versus sample survey, sampling and Non-sampling errors. Types of sampling - subjective, probability and mixed sampling methods. Simple Random Sampling, Stratified random sampling, Systematic sampling, Advantages and Disadvantages of above methods of sampling.

Learning Outcomes:

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

- know the basic knowledge of complete enumeration and sample, sampling frame, sampling distribution,
- know the basic knowledge of sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling etc.,
- introduced to various statistical sampling schemes such as simple, stratified and systematic sampling
- an idea of conducting the sample surveys and selecting appropriate sampling techniques,
- knowledge about comparing various sampling techniques.

Module II:

10 L

Analysis of Variance: One way & Two way classifications.

Design of Experiments: Principles of experimentation in Designs, analysis of completely randomised design (CRD), Randomised block design (RBD) and Latin square design (LSD) including one missing observation.

Learning Outcomes:

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

- understand what between-group and within-group variability consist of and represent
- understand the purpose of conducting analytical comparisons
- understand the process of designing an experiments

- make use of the basics of the Design of Experiments such as randomization and blocking.
- identify common and important types of experimental designs with respective advantages and disadvantage

Module III:

10 L

Time series: -Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares, moving average methods. Growth curves and their fitting with reference to modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

Learning Outcomes:

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

- time series data, its applications to various fields and components of time series,
- fitting and plotting of various growth curves such as modified exponential, Gompertz and logistic curve,
- fitting of trend by Moving Average method
- measure the Seasonal Indices by Ratio-to-Trend ,
- measure the Ratio-to-Moving Average and Link Relative methods

Module IV:

10 L

Index Numbers: Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.

Learning Outcomes:

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

- formulate and application of index numbers.
- solve the problems and the construction of index numbers.
- appreciate, formulate solutions, analyze use of index numbers and time series to real world problems.
- Know the concepts of time reversal test, factor reversal test and circular test.
- verify the various tests for good index numbers, chain base and consumer price index number

Module V:

8 L

Vital statistics: Introduction, definition and uses of vital statistics. Sources of vital statistics ,registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate ,total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and abridged life tables.

Learning Outcomes:

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

- Learn the distinction between Vital Statistics and Demography.
- Learn the measurement of Population
- Learn the Distinction between Rate and Ratio.
- Learn the Basic measures of Mortality.
- Learn the Concept of Life Tables, their construction and uses.
- Learn the Basic measures of Fertility & Population Growth.

Text Books(s)

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol.I& II, 8th Edition. The World Press, Kolkata.
2. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
3. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency.
4. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey Designs .Wiley Eastern

Reference Book(s)

1. B.L.Agarwal: Basic Statistics. New Age publications.
2. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.

Course Outcomes:

- know the basic knowledge of sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling etc.,
- make use of the basics of the Design of Experiments such as randomization and blocking
- measure the Ratio-to-Moving Average and Link Relative methods
- know the concepts of time reversal test, factor reversal test and circular test.
- know the Concept of Life Tables, their construction and uses.

19EID232: INTERNET OF THINGS

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)

Text Book(s):

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

References

1. Arshdeep Bahga, 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)

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).

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 behaviour of computer hardware architecture and application of the design concepts. The basic concepts of this course can have a view as to how a computer system works. This course enables the students to learn the basics of hardware components from basic gates to memory and I/O devices and instruction set architectures.

Course objectives:

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

Module I: Register Transfer and Micro operations:

8 L

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)

Module II: Basic Computer Organization and Design:

10 L

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)

Module III: Central Processing Unit

10 L

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:

- Illustrate different types of addressing modes(L2)
- Understand the concepts of pipelining and parallel processing(L2)
- Solve and practice computer arithmetic algorithms(L3)

Module IV: Input-Output Organization

8 L

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)

Module V: Memory Organization

8 L

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 Books(s)

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

Reference Book(s)

1. Carl Hamacher, Zvonko Vranesic, 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:

- 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.

Module I: Introduction and Operating System Structures

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)
- analyse and list out different system calls (L4)

Module II: Process Management and CPU Scheduling

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)
- analyse scheduling algorithms with different examples (L4)

Module III: Process Synchronization and Deadlock

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)
- analyse deadlock prevention and avoidance policies(L4)
- apply different methods to recover from deadlock(L3)

Module IV: Memory Management , Virtual memory and File Concepts 8 L

Memory Management: Swapping, contiguous memory allocation, paging, segmentation, structure of page 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)
- analyse various techniques of allocating memory to processes, analyse different file concepts and access methods. (L4)
- compare different page replacement algorithms(L2)

Module V: I/O systems, Mass-storage structure , Protection and Linux System 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)
- analyse system protection techniques(L4)
- evaluate disk scheduling algorithms(L5)

Text Books(s)

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

Reference Book(s)

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. Dhamdhare, Operating systems- A Concept based Approach,2/e, McGraw Hill, 2010.

Course Outcomes:

- illustrate the basic and overall view of operating system (L2)
- analyse 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.

Module I: Computer networks and the Internet

9 L

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)

Module II: Application Layer

9 L

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)

Module III: Transport Layer

9 L

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 de-multiplexing 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)

Module IV: The Network Layer

9 L

Introduction, Virtual Circuit and Datagram Networks, Inside Router, The Internet Protocol (IP),

Routing Algorithms–The Link State (LS) Routing Algorithm, The Distance Vector (DV) Routing Algorithm, Hierarchical Routing

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)

Module V:

9 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)

Text Books(s)

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

Reference Book(s)

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:

- 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)

For Laboratory courses: List of Experiments:

1. Write a report that includes a diagram showing the topology, type of connection devices, and speed of the wired and wireless LAN in your organization. Also find out the MAC and IP addresses and the subnet mask of your computer.
2. Find the default subnet address based on given mask and IP address (Class A, Class B)
3. 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 favourite search engine. Wait till the page loads and stop capture. List out the type and number of each type of packets captured.
4. 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.

5. 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.
6. 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.
7. 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.
8. 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.
9. 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.

19EAI232: Introduction to Artificial Intelligence and its Applications

L	T	P	C
3	0	2	4

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 logics.

Module I:

9 L

Introduction: What is AI?, Foundations and History of AI, the state of Art of AI, Risks, Benefits and Applications of AI.

Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

Learning Outcomes:

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

- define Artificial Intelligence (L1)
- how agents work in environments (L1)
- recall uninformed search techniques (L1)
- illustrate the working of informed search techniques (L2)
- apply heuristics in real time problem (L3)

Module II:

9 L

Search in Complex Environments: Local Search and Optimization Problems, Local Search in Continuous Spaces, Search in Partially Observable Environments.

Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the Art Game Programs, Alternative Approaches.

Learning Outcomes:

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

- explain how games improve intellectual abilities of humans (L1)
- choose optimal decisions in games (L1)
- illustrate alpha-beta pruning (L2)
- compare stochastic and partially observable games (L2)
- distinguish imperfect and perfect real time decisions (L4)

Module III:

9 L

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Local Agents: Knowledge-based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving.

Learning Outcomes:

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

- define constraint satisfaction problems (L1)
- illustrate inference in constraint satisfaction problems (L2)
- contrast backtracking search and local search for constraint satisfaction problems (L2)
- explain knowledge - based agent (L2)
- apply propositional logic for real time problems (L3)

Module IV:

9 L

First-Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic.

Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Learning Outcomes:

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

- define knowledge-based agents (L1)
- how to represent real world facts in propositional and first-order logic (L1)
- explain the wumpus world problem-solving process (L2)
- infer proofs in propositional and first-order logic (L2)
- contrast forward chaining and backward chaining (L2)

Module V:

9 L

Applications: Introduction, Categories of Applications of AI (Text Book 2)

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The Theory of Learning, Linear Regression and Classification, Unsupervised Learning and Transfer Learning.

Expert Systems: Introduction, Need and Justification of Expert System, Knowledge Representation, Knowledge Acquisition and Variation, Utilization and Functionality (Text Book 2)

Learning Outcomes:

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

- define expert systems (L1)
- outline machine learning (L2)
- experiment with classifications techniques (L3)
- make use of Knowledge representation (L3)
- justify the need of expert system (L5)

Text Books(s)

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Publications, 2020
2. Dr.Nilakshi Jain, Artificial Intelligence : Making a System Intelligent, Wiley Publications,1st Edition,2019

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 (L2)
- illustrate various real world applications of expert systems (L2)

For Laboratory courses: List of Experiments:

1. Revisit/Refresh the Study of Python and/or PROLOG
2. Write a program to control the VACUUM Cleaner moves (Intelligent systems design process)
3. Write a program to solve Monkey & Banana Problem. ii) Write a program to solve Water-Jug problem (Implementing the Production for real world problems.)
4. Write a program to solve 8-puzzle problem ii) Write a program to solve Short path problem/Travelling Sales man Problem (Understanding various search algorithms BFS, DFS, A* and AO* algorithms)
5. Write a program to implement TIC – TAC - TOE game (Understanding Alpha – Beta pruning)
6. Write a program to implement Cross- Word puzzle (Understanding Constraint specific problem)
7. Write a program to solve Robot traversal problem (Understanding Means End Analysis)
8. Write a program to implement Hangman game
9. Write a program to understand Prepositional logic using KANREN, SYMPY, pyDatalog packages in Python
10. Write a program to understand Inferential logic using KANREN, SYMPY, pyDatalog packages in python

11. Write a program to design an expert system using PyPi package (Understanding Expert system design process)
12. Write a program to implement a binary classification using Decision Tree (Understanding Decision Tree)
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 Chatbot application
16. Write a program to implement logistic regression

19EIO232: Sensor Technology and Instrumentation

L	T	P	C
3	0	2	4

Environmental parameters are necessary in several domains, such as home automation, industrial automation, medical aids, mobile healthcare, elderly assistance, intelligent energy management and smart grids, automotive, traffic management, and many others. At present, it is a clear trend to integrate new components and expand the features of the older ones to make the whole assembly smarter. Smart sensors are sensors with integrated electronics that can perform one or more of the logic functions, two-way communication, make decisions. Physically, it consists of transduction element, signal conditioning electronics and controller/processor that support some intelligence in a single package. Applications of Sensors and Internet of Things include smart agriculture, transportation, environment monitoring, healthcare, and smart wearable. This course covers fundamental principles of sensor technology and instrumentation applicable for the current trends of Artificial Intelligence and Internet of Things.

Course objectives:

- To Introduce the Principles and Performance characteristics of Sensors.
- To Discuss principles and working of Resistive, Capacitive and Inductive sensors.
- To Identify different types of Magnetic and optical sensors.
- To create awareness about application areas of Advanced Sensors
- To Compare Traditional and Virtual Instruments to use in IoT Applications.

Module I: Sensor Fundamentals

9 L

Types of sensors, Characteristics of sensors- static characteristics, dynamic characteristics, sensor selection. Applications of sensors in IoT

Learning Outcomes:

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

- Explain the principle behind the sensor.
- Classify The Sensor types.
- Select the sensor for an Application in IoT.
- Describe Static Characteristics of Sensors.
- Describe Dynamic Characteristics of Sensors.
-

Module II: Resistive, Inductive and Capacitive sensors

9 L

Resistive sensors-Potentiometers, Strain gauge, RTD, Thermistor, Inductive sensors - LVDT, Synchro, Capacitive sensors – Variable area, Variable permittivity, distance between the plates, capacitive microphone.

Learning Outcomes:

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

- Explain the principles behind Resistive sensors.
- Describe Inductive sensors and their applications.
- Describe the Principle and applications of Synchro.
- Classify Capacitive sensors.
- Explain the principle behind Microphone

Module III: Magnetic and Optical Sensors

9 L

Magnetostrictive sensor, Hall effect sensor, Piezo-electric sensor, photo detectors, photo diode, phototransistor, photomultiplier, photo emissive cell.

Learning Outcomes:

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

- Explain the principles behind Magnetostrictive sensors.
- Describe Hall effect sensors and their applications
- Summarize Principles and applications of Piezo -electric sensors.
- Explain the principles of Photoelectric sensors
- Identify different types of Photoelectric sensor used in IoT.

Module IV: Advancements in Sensor Technology

9 L

Smart sensors, micro electro mechanical system (MEMS), Nanosensors, Thinfilm sensors, Biosensors.

Learning Outcomes:

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

- Summarize different advanced sensors in IoT applications.
- Explain the principles of MEMS systems
- Describe Smart sensors and their applications.
- Identify sensors used in Biomedical applications.
- Explain the principles and types of Nanosensors.

Module V: Introduction to Virtual Instrumentation

9 L

Virtual Instrumentation – Block diagram and Architecture of Virtual Instruments, Virtual Instruments versus Traditional Instruments, VI programming techniques-sub VI, loops, structures, charts, arrays, clusters, graphs, file I/O, DAQ in VI

Learning Outcomes:

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

- Describe the Architecture of Virtual Instrumentation.
- Compare Virtual Instruments and Traditional Instruments.
- Summarize Programming techniques used in VI.
- Explain the principles of DAQ in VI.
- Use of VI techniques in IoT.

Text Books(s)

1. D. Patranabis, Sensors and Transducers, PHI Learning Pvt Ltd, Second edition, 2013
2. LabVIEW based advanced Instrumentation System, PSumathi, Springer Science Elsevier 2007.

Reference Book(s)

1. A K Sawhney, “ A course on Electrical and Electronic Measurements and Instrumentation”, Danpat Rai & Co. , 2015
2. Lab view for everyone, Lisa K.Wells and Jeffrey Travis, Prentice Hall, NewJersey, 1997.

Course Outcomes:

- Explain the principles, performance characteristics and Application of Sensors.
- Describe the principles and types of Resistive, Capacitive, and Inductive sensors.
- Summarize Principles and applications of Magnetic and Optical sensors.
- Explain advancements in Sensors Technology and their application areas.
- Apply Virtual instrumentation in IoT technologies.

For Laboratory courses: List of Experiments:

1. Characteristics of First Order System
2. Characteristics of Second Order System
3. Static characteristics of Thermocouple
4. Dynamic characteristics of Thermocouple
5. Characteristics of LVDT
6. Level measurement using capacitive sensor
7. Characteristics of RTD
8. Characteristics of Strain gauge
9. Design the signal conditioning circuit for RTD
10. To study the performance of Biosensor (Pulse sensor)
11. Arithmetic and Logic operations using LabVIEW
12. Sub-VI using LabVIEW
13. Performing array and cluster operations using LabVIEW
14. DAQ using LabVIEW
15. Digital signal processing using LabVIEW
16. Controller design using LabVIEW

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

Course Outcomes:

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

Part-1

3 Hours per week

A. Verbal and Soft Skills:

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

Unit	Module/ Topics	Hrs
1.	Vocabulary Builder	4
2.	Reading Comprehension	4
3.	Fill-in-the-Blanks	3
4.	General Usage	4
	Total	15

B. Quantitative Aptitude and Reasoning

Puzzles, Arithmetic, Geometry, Mensuration

Unit	Module/ Topics	Hrs
1.	Puzzles	5
2.	Arithmetic	2
3.	Geometry	3
4.	Mensuration	5
	Total	15

Part-2**3 Hours per week****Coding** : Medium Level problem solving techniques:

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

Scheme of Evaluation

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

Type of Assessment	Marks
At least 5 problems in each topic	15
Assignments	15
Content writing	10
Quizzes	10
Total	50

Late Work

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

References:-

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

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