

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A'Grade)

Coimbatore - 641032.

B.E. COMPUTER SCIENCE AND ENGINEERING



Common to all B.E. / B.Tech. Degree Programmes

(CHOICE BASED CREDIT SYSTEM)

Curriculum & Syllabus

2022-2023

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.



Chairman, Board Of Studies

**Chairman - BoS
CSE - HiCET**



Dean-Academics

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VISION AND MISSION OF THE DEPARTMENT

VISION

To provide an excellence for individuals to develop technologically superior, socially conscious and nationally responsible citizens.

MISSION

DM1: To develop competent Computer Science and Engineering professionals with knowledge in current technology.

DM2: To mould them to attain excellent leadership qualities there by making them excel in their careers.

DM3: To inspire and nurture students to come out with innovation and creativity solutions meeting the societal needs.



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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

	Graduate attributes	Descriptions
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	An ability to apply, design and develop principles of software engineering, networking and database concepts for computer-based systems in solving engineering problems.
PSO2	An ability to understand, design and code engineering problems using programming skills.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To acquire knowledge in the latest technologies and innovations and an ability to identify, analyze and solve problems in computer engineering.

PEO2: To be capable of modeling, designing, implementing and verifying a computing system to meet specified requirements for the benefit of society.

PEO3: To possess critical thinking, communication skills, teamwork, leadership skills and ethical behavior necessary to function productively and professionally.



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DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (UG)

REGULATION-2022

For the students admitted during the academic year 2022-2023 and onwards

SEMESTER I (Credit : 19)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
2	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
3	22CY1151	Chemistry for Circuit Engineers	BSC	2	0	2	3	4	50	50	100
4	22CS1151 / 22CS1152	Problem solving using C Programming / Object Oriented Programming using Python	ESC/ICC-1	2	0	2	3	4	50	50	100
5	22IT1152	Introduction to Web Application Development	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6	22HE1071	Universal Human Values	AEC	2	0	0	2	3	40	60	100
7	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
8	22MC1091/ 22MC1092	அறிவியல் தமிழ்/ Indian Constitution	MC	2	0	0	0	2	100	0	100
TOTAL				16	1	8	19	26	480	320	800

SEMESTER II (Credits – 22)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA2103	Differential Equations & Linear Algebra	BSC	3	1	0	4	4	40	60	100
2	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
THEORY WITH LAB COMPONENT											
3	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
4	22PH2151	Physics For Circuit Engineering Programme	BSC	2	0	2	3	4	50	50	100
5	22IT2251 / 22CS2253	Python programming and Practices / Java Fundamentals	PCC/ICC- 2	2	0	2	3	4	50	50	100
6	22IT2253	Dynamic Web Design	PCC	2	0	1	2	3	50	50	100
PRACTICAL											
7	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8	22HE2071	Design Thinking	AEC	1	0	2	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE-1	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2091/ 22MC2092	தமிழர்மரபு/ <i>Heritage of Tamils</i>	MC	2	0	0	0	2	100	0	100
11	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
TOTAL				18	1	12	22	29	630	370	1000

For the students admitted during the academic year 2021-2022 and onwards
SEMESTER III

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3104	Discrete Mathematics and Graph Theory	BS	3	1	0	4	40	60	100
2	21CS3201	Data Structures	PC	3	0	0	3	40	60	100
3	21CS3202	Database Management Systems	PC	3	0	0	3	40	60	100
4	21CS3203	Computer Architecture	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
5	21CS3251	Digital Principles and System Design/ICC3	PC	3	0	2	4	50	50	100
PRACTICAL										
6	21CS3001	Data Structures Laboratory	PC	0	0	3	1.5	60	40	100
7	21CS3002	Database Management Systems Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY										
8	21MC3191	Indian Constitution	MC	2	0	0	0	100	0	0
9	21HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total Credits				20	1	8	20	530	370	900

SEMESTER IV

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS4201	Java Programming/ICC4	PC	3	0	0	3	40	60	100
2	21CS4202	Software Engineering	PC	3	1	0	4	40	60	100
3	21CS4203R	Operating Systems	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4	21MA4151	Probability, Statistics and Queuing Theory	BS	3	0	2	4	50	50	100
5	21CS4251	Design and Analysis of Algorithms	PC	3	0	2	4	50	50	100
PRACTICAL										
6	21CS4001	Java Programming Laboratory/ICC5	PC	0	0	3	1.5	60	40	100
7	21CS4002R	Operating Systems Laboratory	PC	0	0	3	1.5	60	40	100

MANDATORY										
8	21MC4191	Essence of Indian Traditional Knowledge/ Value Education	MC	2	0	0	0	100	0	100
9	21HE4072	Career Guidance Level – IV: Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total Credits				20	1	10	21	540	360	800

**For the students admitted during the academic year 2020-2021 and onwards
SEMESTER V**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CS5201	Theory of Computing	PC	3	1	0	4	25	75	100
2	19CS5202	Computer Networks	PC	3	0	0	3	25	75	100
3	19CS5203	Data mining	PC	3	0	0	3	25	75	100
4	19EC5231	Principles of Microprocessors and Micro Controllers	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19CS5252/ 19CS5251	Object Oriented Analysis and Design / Introduction to Design Thinking	PC	2	0	2	3	50	50	100
6	19CS53**	Professional Elective I	PE	2	0	2	3	50	50	100
PRACTICAL										
7	19CS5001	Engineering Clinic	PC	0	0	3	1.5	50	50	100
8	19EC5031	Principles of Microprocessors and Micro Controllers Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
Total Credits				18	1	10	24	500	500	1000

SEMESTER VI

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CS6181	Principles of Management	HS	3	0	0	3	25	75	100
2	19CS6201	Artificial Intelligence / ICC7	PC	3	1	0	4	25	75	100
4	19**6401	Open Elective I	OE	3	0	0	3	25	75	100
5	19CS63**	Professional Elective II	PE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
6	19CS6251R	Compiler Design	PC	2	0	3	3.5	50	50	100
7	19CS6252	Mobile Computing and Application Development	PC	2	0	2	3	50	50	100
PRACTICAL										
7	19IT6003	Project Based Learning	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19CS6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
9	19HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
10	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
Total Credits				19	1	6	24	425	575	1000

LIST OF PROFESSIONAL ELECTIVES

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	19CS5351	Internet and Web Technology	PE	2	0	2	3	50	50	100
2	19CS5352	Advanced Java Programming	PE	2	0	2	3	50	50	100
3	19CS5353	Fundamentals of Open Source Software	PE	2	0	2	3	50	50	100
4	19CS5354	R Programming	PE	2	0	2	3	50	50	100
5	19CS5355	Computer Graphics and Multimedia	PE	2	0	2	3	50	50	100

PROFESSIONAL ELECTIVE II

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19CS6301	Business Intelligence – Data Warehousing and Analytics	PE	3	0	0	3	25	75	100
2	19CS6302	Embedded Systems	PE	3	0	0	3	25	75	100
3	19CS6304	Big Data Analytics and Tools	PE	3	0	0	3	25	75	100
4	19CS6305	Soft Computing	PE	3	0	0	3	25	75	100
5	19CS6307	Responsive Web Design And Development	PE	3	0	0	3	25	75	100
6	19IT6308	Web Development - I	PE	3	0	0	3	25	75	100

OPEN ELECTIVE

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
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OPEN ELECTIVE - I

1	19CS6401	Introduction to Java Programming	OE	3	0	0	3	25	75	100
2	19CS6402	Green Computing	OE	3	0	0	3	25	75	100

Following is the Industry Core Courses (ICC) which will be offered as Choice Based Course in the following semesters

ICC. No.	Sem. No	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	22CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	22CS2253	Java Fundamentals	2	0	2	3	50	50	100
ICC3	III	21CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	21CS4204	Data Visualization	3	0	0	3	40	60	100
ICC5	IV	21CS4003	Data Visualization Laboratory	0	0	3	1.5	60	40	100
ICC6	V	19CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	19CS6253	Predictive Modeling	3	0	2	4	50	50	100
ICC8	VI	19CS6306	Development of Machine Learning Models	3	0	0	3	25	75	100
ICC9	VII	19CS7306	AI Analyst	3	0	0	3	25	75	100

For the students admitted during the academic year 2020-2021 and onwards

PROFESSIONAL ELECTIVE III

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19CS7301	Multi-core Architecture and Programming	PE	3	0	0	3	25	75	100
2	19CS7302	Cyber Forensics	PE	3	0	0	3	25	75	100
3	19CS7303	Wireless Sensor Networks	PE	3	0	0	3	25	75	100
4	19CS7304	C# and .Net Programming	PE	3	0	0	3	25	75	100
5	19CS7305	Software Testing	PE	3	0	0	3	25	75	100
6	19IT7003	Professional Readiness for innovation, employability and entrepreneurship	PE	3	0	0	3	50	50	100

SEMESTER VII – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CS7201	Cryptography and Network Security	PC	3	0	0	3	25	75	100
2	19CS7202	Cloud Computing	PC	3	0	0	3	25	75	100
3	19**7401	Open Elective II	OE	3	0	0	3	25	75	100
4	19IT7003	Professional Readiness for Innovation, Employability and Entrepreneurship	PE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19CS7251	Machine Learning Techniques	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19CS7001	Cloud Computing Laboratory	PC	0	0	3	1.5	50	50	100
7	19CS7002	Security Laboratory	PC	0	0	3	1.5	50	50	100
8	19CS7901	Project Phase I	EEC	0	0	4	2	50	50	100
Total Credits				14	0	12	20	300	500	800

SEMESTER VIII – 14 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CS83**	Professional Elective IV	PE	3	0	0	3	25	75	100
2	19CS83**	Professional Elective V	PE	3	0	0	3	25	75	100
PRACTICAL										
3	19CS8901	Project Phase II	EEC	0	0	16	8	100	100	200
Total Credits				6	0	16	14	150	250	400

PROFESSIONAL ELECTIVE IV

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19CS8301	Digital Image Processing	PE	3	0	0	3	25	75	100
2	19CS8302	High Speed Networks	PE	3	0	0	3	25	75	100
3	19CS8303	Information Security	PE	3	0	0	3	25	75	100
4	19CS8304	Human Computer Interaction	PE	3	0	0	3	25	75	100
5	19CS8305	Responsive Web Design	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19CS8306	Information Retrieval Techniques	PE	3	0	0	3	25	75	100
2	19CS8307	User Interface Design	PE	3	0	0	3	25	75	100
3	19CS8308	Visualization Techniques	PE	3	0	0	3	25	75	100
4	19CS8309	Deep Learning	PE	3	0	0	3	25	75	100
5	19CS8310	Block Chain Technology	PE	3	0	0	3	25	75	100

OPEN ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
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OPEN ELECTIVE - I

1	19CS6401	Introduction to Java Programming	OE	3	0	0	3	25	75	100
2	19CS6402	Green Computing	OE	3	0	0	3	25	75	100

OPEN ELECTIVE - II

1	19CS7401	Foundation Skills in Information Technology (NASSCOM)	OE	3	0	0	3	25	75	100
2	19CS7402	Multimedia Systems	OE	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19	22	25	23	22	24	20	10	165



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SYLLABUS



Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MA1101	MATRICES AND CALCULUS (Common to all Branches)	3	1	0	4
Course Objective	<p>The learner should be able to</p> <ol style="list-style-type: none"> 1. Construct the characteristic polynomial of a matrix and use it to identify eigenvalues and Eigenvectors 2. Impart the knowledge of sequences and series. 3. Analyse and discuss the maxima and minima of the functions of several variables. 4. Evaluate the multiple integrals and apply in solving problems. 5. Apply vector differential operator for vector function and theorems to solve engineering problems. 					
Unit	Description					Instructional Hours
I	Matrices Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.					12
II	Single Variate Calculus Rolle's Theorem–Lagrange's Mean Value Theorem–Maxima and Minima–Taylor's and Maclaurin's Series.					12
III	Functions of Several Variables Partial derivatives–Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers.					12
IV	Integral Calculus Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.					12
V	Vector Calculus Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.					12
Total Instructional Hours					60	
Course Outcome	<p>At the end of the course, the learner will be able to</p> <p>CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.</p> <p>CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.</p> <p>CO3: Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.</p> <p>CO4: Evaluate multiple integral and its applications in finding area, volume.</p> <p>CO5: Apply the concept of vector calculus in two and three dimensional spaces.</p>					
TEXTBOOKS:						
T1: G.B. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 9 th Edition Addison Wesley Publishing Company, 2016.						
T2: Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2019.						
T3: K.P. Uma and S. Padma, "Engineering Mathematics I (Matrices and Calculus)", Pearson Ltd, 2022.						
REFERENCEBOOKS:						
R1- Jerrold E. Marsden, Anthony Tromba, "Vector Calculus", W.H. Freeman, 2003						
R2- Strauss M.J, G.L. Bradley and K.J. Smith, "Multivariable calculus", Prentice Hall, 2002.						
R3- Veerarajan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.						


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	2	0	2	3
Course Objective	<p>The student should be able</p> <ol style="list-style-type: none"> To improve the communicative proficiency of learners. To help learners use language effectively in professional writing. To advance the skills of maintaining the suitable one of communication. To introduce the professional life skills. To impart official communication etiquette. 					
Unit	Description					Instructional Hours
I	Language Proficiency: Types of Sentences, Functional Units, Framing question. Writing: process description, Writing Checklist. Vocabulary – words on environment. Practical Component: Listening- Watching short videos and answer the questions, Speaking- Self introduction ,formal & semi-formal					7+2
II	Language Proficiency: Tenses, Adjectives and adverbs. Writing: Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension. Vocabulary – words on entertainment. Practical Component: Listening- Comprehensions based on TED talks Speaking- Narrating a short story or an event happened in their life					7+2
III	Language Proficiency: Prepositions, phrasal verbs. Writing: Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. Vocabulary – words on tools. Practical Component: Listening- Listentosongsandanswerthequestions Speaking- Justaminute					5+4
IV	Language Proficiency: Subject verb concord, Prefixes & suffixes. Writing: Preparing agenda &minutes, writing an event report. Vocabulary – words on engineering process. Practical Component: Listening- Comprehensions based on Talk of orators or interview shows Speaking- Presentation on a general topic with ppt.					5+4
V	Language Proficiency: Modal Auxiliaries, Active & passive voice, Writing: Project report (proposal & progress) ,sequencing of sentences Vocabulary –words on engineering material Practical Component: Listening- Listening- Comprehensions based on Nat Geo/Discovery channel videos Speaking- Preparing posters and presenting as a team.					6+3
Total Instructional Hours						45
Course Outcome	After completion of the course the learner will be able CO1:To communicate in a professional forum CO2:To speak or write a content in the proficient language CO3: To maintain and use appropriate one of the communication. CO4:To read ,write and present in a professional way. CO5:To follow the etiquettes in formal communication.					
TEXTBOOKS: T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press,2016.T2- Raymond Murphy, "Essential English Grammar". Cambridge UniversityPress,2019. REFERENCEBOOKS: R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice". Oxford University Press, 2009. R2-RaymondMurphy, "English GrammarinUse"-4 th editionCambridgeUniversityPress,2004. R3-KamaleshSadanana"AFoundationCoursefortheSpeakersofTamil-Part-I&II".Orient Blackswan,2010.						

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Programme /Sem	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech/ I	22CY1151	Chemistry for Circuit Engineering (ECE, EEE, EIE, BME, CSE, IT, AIML)	2	0	2	3
Course Objective	<p>The learner should be able to</p> <ol style="list-style-type: none"> 1. Acquire knowledge on the concepts of chemistry involved in day today life. 2. Identify the water related problems and water treatment techniques. 3. Enhance the fundamental knowledge on electrochemistry and the mechanism of corrosion and its control. 4. Gain knowledge on the nuclear energy source and batteries. 5. Extend the knowledge on the concepts of spectroscopy and its applications. 					
Unit	Description					Instructional Hours
I	CHEMISTRY IN EVERYDAY LIFE Chemicals in food – Food colors – Artificial sweeteners – Food preservatives. Soaps and Detergents – Soaps – Types of Soap – Detergents – Types of detergents. Drugs – Classification of drugs - Therapeutic Action of Different Classes of Drugs. Chemicals in Cosmetics – Creams – Talcum powders- Deodorants – Perfumes. Plastics – Thermoplastics- Preparation, properties and uses of PVC, Teflon and Thermosetting plastics - Preparation, properties and uses of Polyester and Polyurethane.					6
II	WATER TECHNOLOGY Impurities in Water, Hardness of Water, Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion- -Softening Methods (Zeolite & Ion-Exchange Methods)- Desalination of Brackish Water - Reverse Osmosis, Potable water and treatment. Estimation of total, permanent and temporary hardness of water by EDTA. Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method.					6+9
III	ELECTROCHEMISTRY AND CORROSION Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods. Conductometric titration of strong acid vs strong base (HClvsNaOH). Estimation of Ferrous iron by Potentiometry.					6+6
IV	ENERGY SOURCES AND STORAGE DEVICES Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium ion battery- fuel cell H ₂ -O ₂ fuel cell applications.					6
V	SPECTROSCOPY Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) - applications – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – Estimation of nickel by atomic absorption spectroscopy.					6
Total Instructional Hours						45
Course Outcome	At the end of the course, the learner will be able to CO1: List out the chemicals used in food, soaps and detergents, drugs, cosmetics and plastics CO2: Differentiate hard and soft water and solve the related problems on-water purification in domestic as well as in industries. CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities CO5: List out the applications of spectroscopic techniques in various engineering fields.					
TEXT BOOKS						
T1 - P.C.Jain& Monica Jain. "Engineering Chemistry" Dhanpat Rai Pub. Co., New Delhi (2018).						
T2 -O.G.Palanna. "Engineering chemistry" McGraw Hill Education India (2017).						
REFERENCES						
R1 - Shikha Agarwal "Engineering Chemistry -Fundamentals and Applications, Cambridge University Press, Delhi, 2019						
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand& Co. Ltd., New Delhi (2018).						

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Programme / Semester	Course Code	Name of the Course	L	T	P	C
B.E. / I	22CS1151	PROBLEM SOLVING USING C PROGRAMMING	2	0	2	3
Course Objective	<p>The learner should be able to</p> <ol style="list-style-type: none"> To develop simple algorithms for arithmetic and logical problems. To understand and implement the fundamental concepts in a program. To enable how to implement conditional branching, iteration and recursion. To understand how to decompose a problem into functions and synthesize a complete program and to enable them to use arrays, pointers, strings and structures in solving problems. To understand the use files to perform read and write operations 					
Unit	Description					Instruct ional Hours
I	<p>INTRODUCTION TO COMPUTERS</p> <p>Computer Systems – Computing Environments – Computer Language – Creating and Running programs – Computer Numbering System – Storing Integers and Real Numbers – Algorithms - Flowchart.</p>					7
II	<p>INTRODUCTION TO C LANGUAGE</p> <p>Character set - C Tokens, Identifiers and Keywords - Constants, Variables - Data types – Text Input / Output – Operators - Expressions – Precedence and Associativity – Evaluating Expressions – Type Conversions. <i>Illustrative program: 1) Josh went to the market to buy N apples. He found two shops, shop A and B, where apples were being sold in lots. He can buy any number of the complete lot(s) but not loose apples. He is confused with the price and wants you to figure out the minimum cost to buy exactly N apples. Write an algorithm for Josh to calculate the minimum cost to buy exactly N apples.</i></p> <p>Input Format:</p> <ul style="list-style-type: none"> The first line of the input consists of an integer – N, representing the total number of apples that Josh wants to buy. The second line consists of two space-separated positive integers – M1 and P1, representing the number of apples in a lot and the lot's price at shop A, respectively. The third line consists of two space-separated positive integers-M2 and P2, representing the number of apples in a lot and lot's price at shop B, respectively. <p>Output Format:</p> <p>Print a positive integer representing the minimum price at which Josh can buy the apples.</p> <p>2) Chaman planned to choose a four-digit lucky number for his car. His lucky numbers are 3,5 and 7. Help him find the number, whose sum is divisible by 3 or 5 or 7. Provide a valid car number, fails to provide a valid input then display that number is not a valid car number. Note: The input other than 4 digit positive number [includes negative and 0] is considered as invalid.</p>					6+4
III	<p>DECISION MAKING, ARRAYS, STRINGS AND POINTERS</p> <p>Two-way selection – Multi-way selection – Concept of a Loop – Pre-test and Post-test Loops – Initialization and Updating – Controlled Loops – Other Statements Related to Looping – Looping Application - Arrays - Strings - Pointers – Pointer Applications – Processor Commands. <i>Illustrative program: 1) You are playing an online game. In the game, a list of N numbers is given. The player has to arrange the numbers so that all the odd numbers of the list come after the even numbers. Write an algorithm to arrange the given list such that all the odd numbers of the list come after the even numbers.</i></p> <p>Input</p> <ul style="list-style-type: none"> The first line of the input consists of an integer number, representing the size of the list(N). The second line of the input consists of N space-separated integers representing the values of the list <p>Output</p> <p>Print N space-separated integers such that all the odd numbers of the list come after the even</p>					6+4

	<p>numbers</p> <p>2) Given an integer matrix of size $N \times N$. Traverse it in a spiral form.</p> <p>Input: The first line contains N, which represents the number of rows and columns of a matrix. The next N lines contain N values, each representing the values of the matrix.</p> <p>Output: A single line containing integers with space, representing the desired traversal. Constraints: $0 < N < 500$</p> <p>3) A digital machine generates binary data which consists of a string of 0s and 1s. A maximum signal M, in the data, consists of the maximum number of either 1s or 0s appearing consecutively in the data but M can't be at the beginning or end of the string. Design a way to find the length of the maximum signal.</p> <p>Input The first line of the input consists of an integer N, representing the length of the binary string. The second line consists of a string of length N consisting of 0s and 1s only.</p> <p>Output Print an integer representing the length of the maximum signal.</p> <p>4) Given a string S (input consisting) of '*' and '#'. The length of the string is variable. The task is to find the minimum number of '*' or '#' to make it a valid string. The string is considered valid if the number of '*' and '#' are equal. The '*' and '#' can be at any position in the string.</p> <p>Note : The output will be a positive or negative integer based on number of '*' and '#' in the input string. (*>#): positive integer (#>*): negative integer (#=*): 0</p>	
IV	<p>FUNCTIONS, STRUCTURES AND UNION</p> <p>Designing Structured Programs – Functions in C – User defined functions – Inter-Function Communication – Standard Function – Passing Arrays to Functions – Passing Pointers to Function – Recursion – Passing an array to a function – typedef – Enumerated types - Structure – Union – Programming Application. <i>Illustrative program: 1) The Caesar cipher is a type of substitution cipher in which each alphabet in the plaintext or messages is shifted by a number of places down the alphabet. For example, with a shift of 1, P would be replaced by Q, Q would become R, and so on. To pass an encrypted message from one person to another, it is first necessary that both parties have the 'Key' for the cipher, so that the sender may encrypt and the receiver may decrypt it. Key is the number of OFFSET to shift the cipher alphabet. Key can have basic shifts from 1 to 25 positions as there are 26 total alphabets. As we are designing custom Caesar Cipher, in addition to alphabets, we are considering numeric digits from 0 to 9. Digits can also be shifted by key places. For Example, if a given plain text contains any digit with values 5 and key =2, then 5 will be replaced by 7, "-" (minus sign) will remain as it is. Key value less than 0 should result into "INVALID INPUT". Write a function CustomCaesarCipher(int key, String message) which will accept plaintext and key as input parameters and returns its cipher text as output.</i></p> <p>Enter your PlainText: All the best Enter the Key: 1 The encrypted Text is: BmmuifCftu</p>	5+4
V	<p>BINARY INPUT / OUTPUT</p> <p>Defining and Opening a file, closing a file - input/output operations on files - error handling during I/O operations - random access to files - Text versus Binary Streams – Standard Library Functions for Files – Converting File type. <i>Illustrative program: 1) Write a C Program to merge contents of two files into a third file. 2) Write a program in C to delete a specific line from a file.</i></p>	6+3
Total Instructional Hours		30+15
Course Outcome	<p>At the end of the course, the learner will be able to</p> <p>CO1: Develop simple algorithms for arithmetic and logical problems. CO2: Test and execute the programs and correct syntax and logical errors. CO3: Implement conditional branching, iteration and recursion. CO4: Decompose a problem into functions and synthesize a complete program and use arrays, pointers, strings and structures to formulate algorithms and programs.</p>	

CO5: Use files to perform read and write operations.

TEXT BOOKS:

T1: Behrouz A. Forouzan, Richard F. Gilberg, J. Jaya, S. Shankar, I. Jasmine Selvakumari Jeya, M. Ramya Devi, "Computer Programming in C", Cengage Learning, 2022.

T2: Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd edition, 2017.

REFERENCE BOOKS:

R1: Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th edition, 2014.

R2: R. S. Bichkar, "Programming with C", Universities Press, 2nd edition 2012.

R3: Yashvant Kanetkar, "Exploring C", BPB Publishers, 2nd edition, 2003.

R4: W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd edition, 1988



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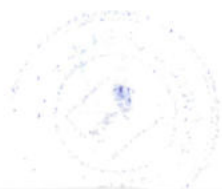
Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22CS1152	OBJECT ORIENTED PROGRAMMING USING PYTHON (Common to CSE, IT, ECE and AI&ML)	2	0	2	3
Course Objective	<p>The learner should be able</p> <ol style="list-style-type: none"> To read and write simple Python programs. To develop Python programs with conditionals and loops. To define Python functions and call them. To understand OOP concepts and write programs using classes and objects. To do input/output with files in Python. 					
Unit	Description					Instructional Hours
I	INTRODUCTION TO PYTHON What is Python - Advantages and Disadvantages, Benefits and Limitation- Downloading and Python-installation-Python Versions-Running Python Scripts, Executing scripts with python launcher-Using interpreter interactively- Using variables-String types: normal, raw and Unicode-String operations and functions- Math operator and functions.Illustrative program: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range. Towers of Hanoi.					7+2
II	DATA TYPES, STATEMENTS, CONTROL FLOW Data Types(List,Tuple,string,dictionary,set)-Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if - else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass. Illustrative programs:Find the square root of a number, To find the given number is Prime or not, Write a Python program which accepts a sequence of comma-separated numbers from user, generate a list and find the sum and average of the numbers.					5+4
III	PYTHON FUNCTIONS Introduction to functions-Global and local variable in python-Decorators in python-Python lambda functions-Exception handling in python. Illustrative programs:Square root, GCD,exponentiation, linear search, binary search, Write a menu driven program to perform the following task:a) A function Sum_DigN() to find the sum of the digits of a given number, b) A recursive function Sum_DigR() to find the same.					5+4
IV	PYTHON OOPS Introduction to oops concept-Python class and objects-Constructor in python-Inheritance-Types of inheritance-Encapsulation in python-Polymorphism in python. Illustrative programs:Write a Python program using class for the calculation of telephone bill. The charges for the calls are fixed as follows: Unit Call Cost/unit Below 100 calls No Charge, only rental amount Rs. 250 100-150 calls Rs. 1.00 151-300 calls Rs. 2.50 301-600 calls Rs. 4.50 Above 600 Rs. 6.00					5+4
V	FILES, PACKAGES File handling in python-Open a file in python-How to read from a file in python-writing to file in python-Python numpy-Python pandas. Illustrative programs:How to display the contents of text file in reverse order? Write the code for the same, not exceeding 10 lines of code, Creating Modules and Packages for arithmetic Operations.					5+4
Total Instructional Hours						45
Course Outcome	At the end of the course, the learner will be able to CO1: Understanding the basic concepts to read, write and execute simple python programs. CO2: Apply the conditional and looping concepts for solving problems. CO3: Apply functions to decompose larger complex programs. CO4: Understanding the OOPS concepts and writing programs using classes and objects CO5: Understand to read and write data from/to files in Python Programs.					
TEXT BOOKS:						
T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2. Network Theory Ltd., 2011.						
REFERENCE BOOKS:						
R1: Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.						
R2: Timothy A. Budd. —Exploring Python , Mc-Graw Hill Education (India) Private Ltd., 2015.						
R3: Robert Sedgewick, Kevin Wayne, Robert Dondero. —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016						

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Programme	Course Code	Name of the Course	L	T	P	C
B TECH	22IT1152	Introduction to Web Application Development	2	0	2	3
Course Objective	<ol style="list-style-type: none"> 1. To discuss the essence of software development methods 2. To gain knowledge about basic HTML Tags. 3. To create static websites using HTML. 4. To impart knowledge about Cascading Style sheet. 5. To design a front end web application using HTML and CSS 					
Unit	Description					Instructional Hours
I	Unit-1 Software Development Life Cycle Software Development Model -Waterfall Model- Incremental Process Models- Evolutionary Process Models- Spiral Model-Agile Software Development –Agile process-Agility principles-Introduction Github.					5
II	Unit-2 Hyper Text Markup Language-1 Web Essentials: Clients, Servers, Basic Terminologies-HTML Basic Tags – Elements - Attributes - Basic Formatting, Fonts and Colors-Hyperlink-Images- Tables - cell spanning, cell spacing- Table contents, Border. List –ordered List-Unordered List-Definition List. Illustrative problems: Designing a web page using HTML basic tags, Developing web site with suitable contents and links, Designing web pages using lists and tables, Designing a web page using images and embed an image map in a web page					(6+4)
III	Unit-3 Hyper Text Markup Language-II Frames-HTML Forms - Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box–HTML 5 features. Illustrative problems: Designing the Login form with username, password and submit field, Designing a course registration form.					(6+4)
IV	Unit-4 Cascading Style Sheet-I Introduction - CSS Syntax -Type of CSS Selector-Simple Selectors, Universal Selector, ID Selector, Class selector and Pseudo Classes – Style Specification Formats-Inline Style-Embedded Style sheet-External Style sheet. Illustrative problems: Developing a web application using internal, external and embedded style sheet, Applying style specification in HTML page using CSS.					(6+4)
V	Unit-5 Cascading Style Sheet-II Font properties-List properties- Background properties-Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border- Padding, Margin-CSS Layout- Normal Flow Layout-Relative positioning-Float positioning-Absolute positioning. Illustrative problems: Developing an web application using CSS Positioning.					(6+4)
Total Instructional Hours						45
Course Outcome	<ol style="list-style-type: none"> 1. Basic understanding of development of software life cycle. 2. To understand basic HTML Tags. 3. Designing a simple web application using HTML. 					

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|--|--|--|
| | 4. Understanding about the usage of Cascading Style Sheet.
5. Creating a front end Web application using HTML and CSS | |
|--|--|--|

TEXT BOOKS:

- T1 – Roger S.Pressman, Bruce R. Maxim, Software engineering- A practitioner's Approach, McGraw-Hill International Edition, 8th edition (2015). ISBN: 9789353165710
T2- Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
T3- Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.

REFERENCE:

- R1 - Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
R2 - <https://www.w3schools.com/>
R3 - <https://www.tutorialspoint.com/>




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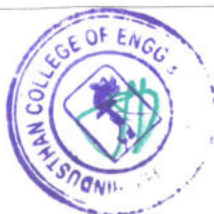
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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1071	UNIVERSAL HUMAN VALUES (COMMON TO ALL BRANCHES)	2	0	0	2
Course Objectives	<p>The students should be made</p> <ol style="list-style-type: none"> To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature. 					
Unit	Description					Instructional Hours
I	Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations					6
II	Harmony in the Human Being and Harmony in the Family Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health					6
III	Harmony in the Family and Society Harmony in the Family – the Basic Unit of Human Interaction.Values in Human to Human Relationship'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship'Respect' – as the Right Evaluation Understanding Harmony in the Society					6
IV	Harmony in the Nature / Existence Understanding Harmony in the Nature.Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasivespace Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order					6
V	Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession					6
Total Instructional Hours						30
Course Outcome	At the end of the course, the learner will be able CO1: To become more aware of holistic vision of life - themselves and their surroundings. CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions. CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior. CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions. CO5: To develop competence and capabilities for maintaining Health and Hygiene.					
Reference Books:						
R1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2 nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1						
R2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2 nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2						
R3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.						
R4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.						

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1072	ENTREPRENEURSHIP & INNOVATION	1	0	0	1
Course Objectives	<p>The student should be made</p> <ol style="list-style-type: none"> To acquire the knowledge and skills needed to manage the development of innovation. To recognize and evaluate potential opportunities to monetize these innovations. To plan specific and detailed method to exploit these opportunities. To acquire the resources necessary to implement these plans. To make students understand organizational performance and its importance. 					
Module	Description					
1	Entrepreneurial Thinking					
2	Innovation Management					
3	Design Thinking					
4	Opportunity Spotting/ Opportunity Evaluation					
5	Industry and Market Research					
6	Innovation Strategy and Business Models					
7	Financial Forecasting					
8	Business Plans/ Business Model Canvas					
9	Entrepreneurial Finance					
10	Pitching to Resources Providers / Pitch Deck					
11	Negotiating Deals					
12	New Venture Creation					
13	Lean Start-ups					
14	Entrepreneurial Ecosystem					
15	Velocity Venture					
TOTAL INSTRUCTIONAL HOURS						15
Course Outcome	<p>At the end of the course, the learner will be able to</p> <p>CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.</p> <p>CO2: Understand the processes by which innovation is fostered, managed, and commercialized.</p> <p>CO3: Remember effectively and efficiently the potential of new business opportunities.</p> <p>CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..</p> <p>CO5: Develop a business model for a new venture, including revenue, Margins, operations, Working capital, and investment</p>					
TEXTBOOKS						
T1: Arya Kumar "Entrepreneurship - Creating and leading an Entrepreneurial Organization", Pearson, Second Edition (2012).						
T2: Emrah Yavuz "Design Thinking Methodology", Artbiztech, First Edition (2016).						
REFERENCEBOOKS						
R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).						
R2: Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017).						
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).						
WEBRESOURCES						
W1: https://blof.forgeforward.in/tagged/startup-lessons						
W2: https://blof.forgeforward.in/tagged/entrepreneurship						
W3: https://blof.forgeforward.in/tagged/minimum-viable-product						
W4: https://blof.forgeforward.in/tagged/minimum-viable-product						
W5: https://blof.forgeforward.in/tagged/innovation						

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Programme/ Sem	CourseCode	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MC1091	INDIAN CONSTITUTION	2	0	0	0
Course Objectives	The student should be made to 1. Sensitization towards self, family (relationship), society and nature 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals 3. Strengthening of self-reflection 4. Development of commitment and courage to act					
Unit	Description					Instructional Hours
I	BASIC FEATURES AND FUNDAMENTAL PRINCIPLES Meaning of the constitution law and constitutionalism–Historical perspective of the constitution of India– salient features and characteristic of the constitution of India.					6
II	FUNDAMENTAL RIGHTS Scheme of the fundamental rights–fundamental duties and its legislative status–The directive principles of state policy–its importance and implementation–Federal structure and distribution of legislative and financial powers between the union and states.					6
III	PARLIAMENTARY FORM OF GOVERNMENT The constitution powers and the status of the president in India.– Amendment of the constitutional Powers and procedures–The historical perspective of the constitutional amendment of India–Emergency provisions: National emergency, President rule, Financial emergency.					6
IV	LOCAL GOVERNANCE Local self-government-Rural Local Government-Panchayath Raj, Elections of Panchayat-State Election Commission-Urban Local Government-Amendment Act, Urban Local Government Structures in India					6
V	INDIAN SOCIETY Constitutional Remedies for citizens–Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.					6
Total Instructional Hours						30
Course Outcome	At the end of the course, the learner will be able to CO1: Understand the functions of the Indian government. CO2: Understand and abide the rules of the Indian Constitution					
TEXTBOOKS: T1: Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi, 1997. T2: Agarwal RC., "Indian Political System", S.Chand and Company, New Delhi, 1997. T3: Maciver and Page, "Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi. T4: Sharma K.L., "Social Stratification in India: Issues and Themes ", Jawaharlal Nehru University, New Delhi, 1997.						
REFERENCEBOOKS: R1- Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi. R2- Gahai U R. "Indian Political System ", New Academic Publishing House, Jalaendhar. R3- Sharma R N., "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.						


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திட்டம்/ செம்	பாடநெறி குறியீடு	பாடத்தின் பெயர்	L	T	P	C
பி.இ/ க	22MC1091	அறிவியல் தமிழ் (முதலாம் ஆண்டு பி.இ பொது பாடப்பிரிவு)	2	0	0	0
பாடத்தின் நோக்கம்	கற்றவர் இயல் வேண்டும் <ol style="list-style-type: none"> சங்க காலத்தில் தொழில்துறை பற்றிய அறிவைப் பெறுதல். சங்க காலத்தில் வீட்டின் பொருள் ,சிற்பங்கள் மற்றும் கோவில்கள் வடிவமைப்பு பற்றி கூட்டு கற்றல் வரலாறு மற்றும் தொல்லியல் சான்றுகளின் ஆதாரமாக உலோகவியல் ஆய்வுகளில் அறிவை வளர்த்துக் கொள்ளுங்கள். வேளாண்மை மற்றும் வேளாண் செயலாக்கத்தில் பயன்படுத்தப்படும் பண்டைய நுட்பங்களைப் பற்றிய அறிவைப் பெறுதல். தமிழ் மொழியின் மென்பொருள் பற்றி அறிதல் 					
அலகு	விளக்கம்					பயிற்சி நேரம்
I	நெசவு மற்றும் பாணைத் தொழில்நுட்பம் சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம்- கருப்பு சிவப்பு பாண்டங்கள் -பாண்டங்களில் கீறல் குறியீடுகள்					3
II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் சங்க இலக்கியத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு -சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும்- சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிப்பாடுத் தளங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோச்செனிக் கட்டிடக் கலை.					3
III	உற்பத்தி தொழில்நுட்பம் கப்பல் கட்டும் கலை- உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருகுதல் எஃகு - வரலாற்றுசாலை சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள் , கண்ணாடிமணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் -					3

	தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	
IV	வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்க பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	3
V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ் அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணைய கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	3
மொத்த பயிற்றுவிக்கும் நேரம்		15
பாடத்தின் முடிவு	பாடநெறியின் முடிவில் கற்றவர் கற்றபின் பா மு ₁ : பண்டைய தொழில்நுட்பத்தை அடையாளம் கொள்ள தெரியும் பா மு ₂ : சங்க கால கட்டுமானப் பொருட்கள்- சிற்ப வகைகளை வேறுபடுத்த முடியும் பா மு ₃ : வரலாறு மற்றும் தொல்லியல் சான்றுகளின் ஆதாரமாக உலோகவியல் ஆய்வுகளில் பட்டியலிட்டு அடையாளம் காண முடியும் பா மு ₄ : விவசாயம் மற்றும் வேளாண் செயலாக்கத்தில் பயன்படுத்தப்படும் பழங்கால நுட்பங்களைப் பற்றி விளக்கத்துடன் நிரூபிக்க முடியும் பா மு ₅ : தமிழ் மொழியின் புதிய மென்பொருள் பற்றி உருவாக்கக் கூடிய திறன் மேம்படுத்துதல்.	
உரை புத்தகங்கள்		
உ1- தமிழக வரலாறு - மக்களும் பண்பாடும் - கே .கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)		
உ2- எஸ்.கே. சிங், இடைக்கால இந்தியாவின் வரலாறு. புது தில்லி: ஆக்சிஸ் பக்ஸ் பிரைவேட் லிமிடெட், 2013.		
குறிப்புகள்		
கு1- கணித்தமிழ் -முனைவர் இல. சுந்தரம் .(விகடன் பிரசுரம்)		
கு2- கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு.		

ஆய்வு வாரிய தலைவர்

டீன் கல்வியாளர் / முதல்வர்



Dean (Academics)
HICET

SEMESTER II

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22MA2103	DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA (AIML,CSE,IT)	3	1	0	4

The student should be able

- Course Objective**
- 1 Describe some methods to solve different types of first order differential equations.
 - 2 Understand the various approach to find general solution of the ordinary differential equations
 - 3 Evaluate the various types of Partial differential equations and methods to find solution.
 - 4 Extend the knowledge of vector spaces
 - 5 Extend the knowledge of inner product spaces

Unit	Description	Instructional Hours
	ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER	
I	Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation.	12
	LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER	
II	Second order linear differential equations with constant with RHS of the form e^{ax} , x^n , $\sin ax$, $\cos ax$ - Cauchy's linear equations- Method of variation of parameters.	12
	PARTIAL DIFFERENTIAL EQUATIONS	
III	Formation of partial differential equations by eliminating arbitrary constants and functions - Solution of first order partial differential equations of the form $f(p,q)=0$, Clairaut's equation - Lagrange's equation.	12
	VECTOR SPACES	
IV	Definition and examples of vector spaces, subspaces of a vector space and the quotient space, Linearly dependence and linearly independence of a set of vectors, Linear span.	12
	INNER PRODUCT SPACES	
V	Complex matrices - Conjugate of the matrix - Hermitian and Skew Hermitian matrices - Properties (without proof) - Unitary matrix - Properties (without proof) - Inner product spaces - Gram - Schmidt orthogonalization	12
	Total Instructional Hours	60

- Course Outcome**
- CO1 Apply few methods to solve different types of first order differential equations.
 - CO2 Evaluate the solutions of higher order ordinary differential equations and its properties.
 - CO3 Compute the solution of first order partial differential equations.
 - CO4 Infer the knowledge of vector space
 - CO5 Infer the knowledge of Inner product space space

TEXT BOOK:

- T1 Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2019
- T2 Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; Linear Algebra, Pearson 5th edition

REFERENCES:

- R1 Dennis Zill, Warren S. Wright, Michael R. Cullen, Advanced Engineering Mathematics, Jones & Bartlett Learning, 2011
- R2 Ian N. Sneddon, Elements of Partial Differential Equations, Courier Corporation, 2013.
- R3 David Lay, Steven Lay, Judi McDonald "Linear Algebra and Its Applications" 5th Edition, Pearson ,2019.



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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22PH2101	BASICS OF MATERIAL SCIENCE (Common to all branches except MCT)	2	0	0	2

The student should be able

- Course Objective**
- 1 Gain knowledge about Crystal systems and crystal structures
 - 2 Understand the knowledge about electrical properties of materials
 - 3 Enhance the fundamental knowledge in semiconducting materials.
 - 4 Gain knowledge about magnetic materials
 - 5 Acquire fundamental knowledge new engineering materials which is related to the engineering program

Unit	Description	Instructional Hours
	CRYSTAL PHYSICS	
I	Crystal systems - Bravais lattice - Lattice planes - Miller indices - Inter planar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
	ELECTRICAL PROPERTIES OF MATERIALS	
II	Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, expression - Widemann - Franz law - Success and failures - Fermi-Dirac statistics - Density of energy states .	6
	SEMICONDUCTING MATERIALS	
III	Introduction - Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Intrinsic semiconductor - electrical conductivity - band gap determination. - Extrinsic semiconductor - n type and p type semiconductor -Light Emitting Diode.	6
	MAGNETIC MATERIALS	
IV	Origin of magnetic moment - Bohr magnetron - comparison of Dia, Para and Ferro magnetism - Domain theory - Hysteresis - soft and hard magnetic materials - anti ferromagnetic materials - Ferrites and its applications.	6
	NEW ENGINEERING MATERIALS	
V	Metallic glasses: melt spinning process, Preparation and applications - shape memory alloys: phases, shape memory effect - Characteristics of SMA : Pseudoelastic effect, Super elasticity and Hysteresis. Applications of SMA. Nanomaterials preparation (bottom up and top down approaches) - various techniques - pulsed laser deposition - Chemical vapor deposition	6
	Total Instructional Hours	30
	CO1 Understand the Crystal systems and crystal structures in the field of Engineering	
	CO2 Illustrate the fundamental of electrical properties of materials	
Course Outcome	CO3 Discuss concept of acceptor or donor levels and the band gap of a semiconducting materials	
	CO4 Develop the technology of the magnetic materials and its applications in engineering field	
	CO5 Understand the advanced technology of new engineering materials in the field of Engineering	

TEXT BOOK:

- T1 Rajendran V, "Materials Science", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2 M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company Ltd., New

REFERENCES:

- R1 Charles Kittel "Introduction to Solid State Physics". Wiley., New Delhi 2017
R2 Dr. M.Arumugam "Materials Science " Anuradha publications., 2019


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22HE2151	EFFECTIVE TECHNICAL COMMUNICATION (Common to all Branches)	2	0	2	3

Course Objective	The student should be able
	1 To improve essential business communication skills.
	2 To enrich employability knowledge.
	3 To acquire the crucial organizing ability in official forum.
	4 To impart important business writings.
	5 To make effective presentation with essential etiquette.

Unit	Description	Instructional Hours
I	Language Proficiency: Types of sentences in English according to structure Writing: writing definitions, Describing product, work place and service (purpose, appearance, function) Vocabulary – words on nature Practical Component: Listening- Watching and interpreting advertisements/short films Speaking- Extempore speech	9
II	Language Proficiency: Direct and Indirect speech. Writing: Formal memos, Job application and resume preparation Vocabulary - words on offense and ethics Practical Component: Listening- Comprehensions based on telephonic conversation Speaking- Vote of thanks & welcome address	9
III	Language Proficiency: Homophones and Homonyms, Writing: Preparing a detail plan for an official visit, schedule and Itinerary, reading comprehension, Vocabulary- words on society Practical Component: Listening- Listening- paraphrasing the listened content Speaking- Group Discussion with preparation	9
IV	Language Proficiency: Idioms Writing: Report writing (marketing, investigating) Vocabulary-words involved in business Practical Component: Listening- Watching technical discussions and preparing MoM Speaking- On the spot Group Discussion	9
V	Language Proficiency: spotting errors Writing: making /interpreting chart, sequencing of sentences Vocabulary- words involved in finance Practical Component: Listening- Comprehensions based on announcements Speaking- Presentation on a technical topic with ppt.	9
Total Instructional Hours		45

Course Outcome	
CO1	To the business procedure and promotion skills.
CO2	To make oral and written presentation in corporate forum.
CO3	To schedule official events and participate in official discussions without reluctance.
CO4	To take an effective role and manage in an organizational sector.
CO5	To prepare and demonstrate a professional presentation

TEXT BOOK:

- T1 Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.
T2 Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.
T3

REFERENCES:

- R1 Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.
R2 Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3 Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.


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Dean - Academics

**Chairman - BoS
CSE - HICET**

**Dean (Academics)
HICET**

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22PH2151	PHYSICS FOR CIRCUIT ENGINEERING PROGRAMME (AIML, CSE, ECE, EEE, EIE, IT & BME)	2	0	2	3

The student should be able

- Course Objective**
- 1 Gain knowledge about laser, their applications, become conversant with principles of optical fiber and its applications
 - 2 Enhance his fundamental knowledge about properties of matter
 - 3 Understand the concept of wave optics
 - 4 Gain knowledge about quantum mechanics to explore the behavior of sub atomic particles
 - 5 Acquire fundamental knowledge of Ultrasonics and their applications.

Unit	Description	Instructional Hours
	LASER AND FIBER OPTICS	
I	Spontaneous emission and stimulated emission –Type of lasers – Nd:YAG laser - Laser Applications – Holography – Construction and reconstruction of images. Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index and modes) – Fiber optical communication link. Determination of Wavelength and particle size using Laser	6
	PROPERTIES OF MATTER	
II	Elasticity – Hooke's law – Poisson's ratio – Bending moment – Depression of a cantilever – Determination of Young's modulus of the material of the beam by Uniform bending theory and experiment. Twisting couple - torsion pendulum: theory and experiment Determination of Young's modulus by uniform bending method Determination of Rigidity modulus – Torsion pendulum	6
	WAVE OPTICS	
III	Interference of light – air wedge –Thickness of thin paper (Testing of thickness of surface) -Michelson interferometer - Diffraction of light –Fraunhofer diffraction at single slit – Diffraction grating - Plane Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. Determination of wavelength of mercury spectrum – spectrometer grating Determination of thickness of a thin wire – Air wedge method	6
	QUANTUM PHYSICS	
IV	Black body radiation –Compton effect: theory and experimental verification – wave particle duality –concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box.	6
	ULTRASONICS	
V	Production – Piezoelectric generator – Properties of Ultrasonic waves. Determination of velocity using acoustic grating – Cavitation. Industrial applications – Drilling and welding – Nondestructive testing (pulse echo system). Medical applications – Ultrasound Scanner – A – mode – B- mode and C –mode.	6
	Total Instructional Hours	30
	Total Lab Instructional Hours	30

Course Outcome	CO1	CO2	CO3	CO4	CO5
	Understand the advanced technology of LASER and optical communication in the field of engineering	Illustrate the fundamental properties of matter	Discuss the Oscillatory motions of particles	Understand the dual nature of matter and the Necessity of quantum mechanics.	Develop the Ultrasonics technology and its applications in NDT.

TEXT BOOK:

T1 Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

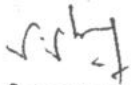
T2 Gaur R.K. and Gupta S.I., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCES:

R1 M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S.Chand and Company Ltd., New Delhi 2016

R2 Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2021

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HICET

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22IT2251	Python Programming and Practices (Common to IT, CSE & AIML)	2	0	2	3

The student should be able

- | | | |
|-------------------------|---|---|
| Course Objective | 1 | To know the basics of algorithmic problem solving |
| | 2 | To read and write simple Python programs |
| | 3 | To develop Python programs with conditionals and loops and to define Python functions and call them |
| | 4 | To use Python data structures — lists, tuples, dictionaries |
| | 5 | To do input/output with files in Python |

Unit	Description	Instructional Hours
	ALGORITHMIC PROBLEM SOLVING	
I	Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).	(5+2)
	DATA, STATEMENTS, CONTROL FLOW	
II	Data Types, Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass;	(6+4)
	FUNCTIONS, STRINGS	
III	Functions, parameters and arguments; Fruitful functions: return values, local and global scope, function composition, recursive functions. Strings: string slices, immutability, string functions and methods, string module.	(6+4)
	LISTS, TUPLES, DICTIONARIES	
IV	Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension.	(6+4)
	FILES, MODULES, PACKAGES	
V	Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, modules, packages	(6+2)
Total Instructional Hours		45

S.No

List of Experiments

- 1 Read NAME, REG NO, PHYSICS, CHEMISTRY, MATHS MARKS and calculate cutoff marks out of 200 print the cutoff marks of the student
- 2 Take two numbers of int data type, two numbers of float data type as input. Print the sum and difference of two int variable on a new line Print the sum and difference of two-float variable rounded to one decimal place on a new line.
- 3 Get two integer inputs from user as dividend named as x and y. Find out Greatest Common Divisor Between both of the above two dividends
- 4 Tony's Maths teacher ask him to solve an exponential problem but he don't know how to solve. Teacher gives two values as named base and exponent value ask tony to find the factor. Help him to do his task.
- 5 Read four inputs from the user named X1, X2, Y1, Y2 and compute to find a distance between two points.
- 6 Read the five different subject marks of the student, calculate total marks and print the total marks, grade.
- 7 Given the age input as N from the user and check whether user is eligible for voting or not using if condition and print Eligible or Not Eligible. Hint: The minimum age to vote is 18 years.
- 8 Write a program that reads a integer value as N from the user and then produces n lines of output The first line contains 1 star,the second line contains 2 stars and so on until the last line which

should have N stars.can you Write this using single loop? Hint: remember what the expression '+'*5 does.

9 A year is a leap year if it is divisible by 4, unless it is divisible by 100 and not by 400. Write a function that takes an integer value representing a year, and returns a Boolean result indicating whether or not the year is a leap year

10 sheela wants to convert time into minutes but she have no idea about it. Create a function named time() and get the input from the user as two integers hours, minutes and print the minutes as output. Help sheela to do this conversion

11 Get the two different matrix elements for (2x2) matrix. Perform addition operation and subtraction operation and print the result in matrix format using nested loop in python.

12 Read the input from the user for no of elements as N and then append it into the list. Write a python program to find the maximum element in the list.

13 Read the N no of elements from the user and append it into the list, perform linear search operations using python programming List operations

14 Read the List of Numbers from the user with N elements and perform Selection sorting operation using python programming.

15 Write a python program to take input as filename with extension, perform reading and writing operations in the file.

CO1 Develop algorithmic solutions to simple computational problems

CO2 Read, write, execute by hand simple Python programs

Course Outcome CO3 Structure simple Python programs for solving problems and Decompose a Python program into functions

CO4 Represent compound data using Python lists, tuples, dictionaries

CO5 Read and write data from/to files in Python Programs.

TEXT BOOK:

T1 Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.6.2, Shroff Publishers, First edition (2017).

T2 S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019

REFERENCES:

R1 Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

R2 Timothy A. Budd, —Exploring Python1, Mc-Graw Hill Education (India) Private Ltd., 2015.

R3 Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

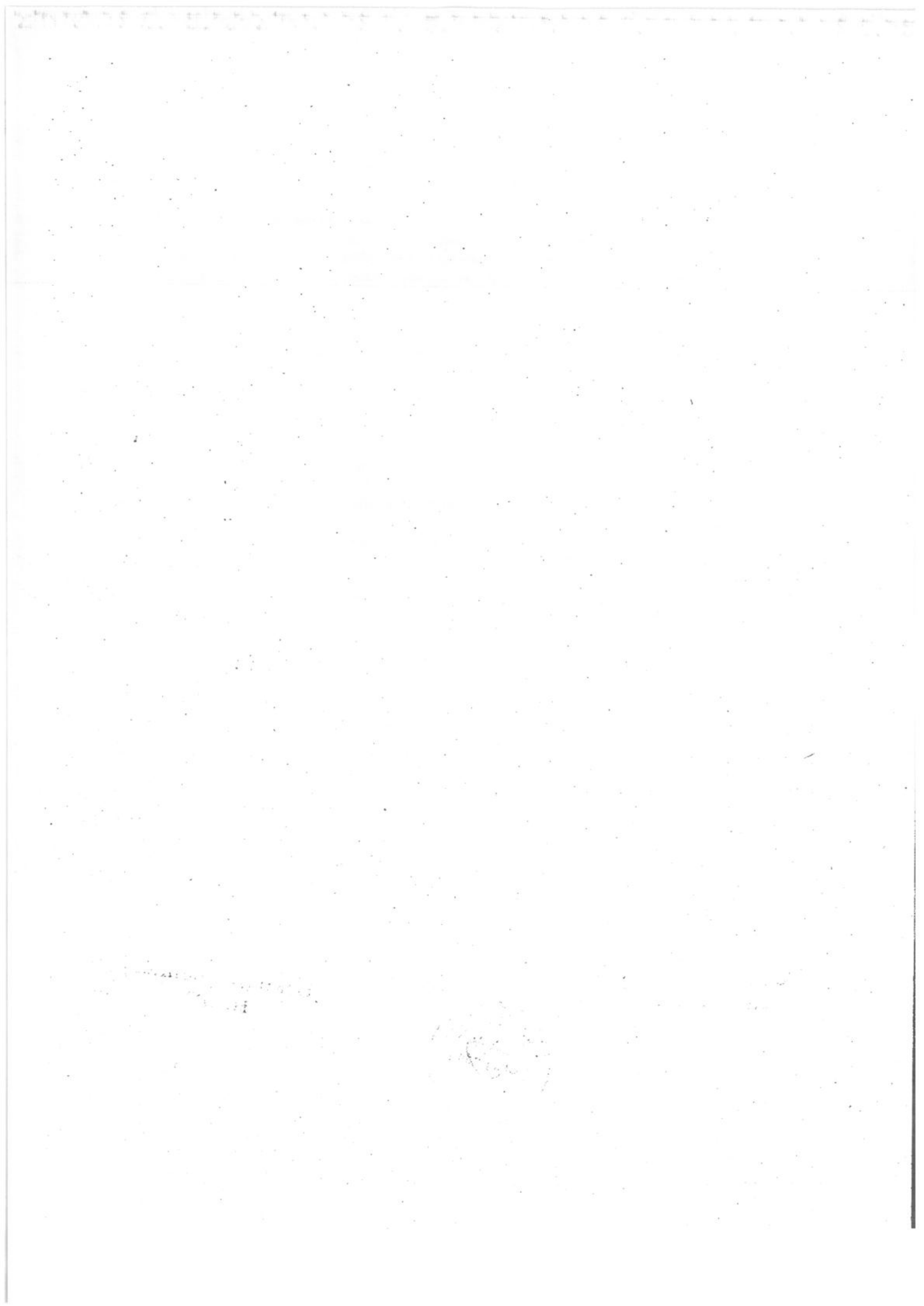
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**Chairman - BoS
CSE - HiCET**

Dean - Academics

**Dean (Academics)
HiCET**





Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22IT2253	DYNAMIC WEB DESIGN (Common to IT, CSE & AIML)	2	0	2	2

- The student should be able**
- Course Objective**
- 1 To get Introduction to Java Script
 - 2 To understand about Dialog box and functions in Java Script
 - 3 To learn about Control statements in Java script
 - 4 To study bout Arrays and objects in Java Script
 - 5 To have a knowledge in Event handling in JavaScript

Unit	Description	Instructional Hours
	INTRODUCTION TO JAVASCRIPT	
I	Introduction-History of JavaScript -Simple Program: Displaying a dynamic Line of Text in a Web Page - Modifying Our First Program Obtaining – Data Types-Identifiers - Operators. <i>Conversion of Celsius to Fahrenheit using JavaScript. Java Script to perform Arithmetic Operations-Calculation of diameter, circumference and area of the circle.</i>	7+2
	DIALOG BOX AND FUNCTIONS	
II	User Input with prompt Dialogs (alert, prompt, confirm) - Arithmetic operations using prompt (Detail) - Display Date and Time with Greeting - Functions-Function Expression - Arrow Function. <i>Input two Integers from user and displays the sum, product, difference and quotient of the two numbers using functions and alert box. Input three integers from user and display sum, average in alert dialog using functions.</i>	7+2
	CONTROL STATEMENTS	
III	If statement - if else statement-else - if statement-Switch statement-repetition statements - while repetition statement - do-while repetition statement -for repetition statement – break and continue statements. <i>Check for eligibility to drive a vehicle - Rate the student performance 5 to 1 using switch- loop that will iterate from 0 to 15. For each iteration, it will check if the current number is odd or even, and display a message to the screen.</i>	7+2
	ARRAYS AND OBJECT	
IV	Arrays - Declaring and Allocation Arrays - Array Methods - Built in Object - Math - String-Date – Boolean – documents – window - using cookies. <i>Random Image Generator Using Arrays - Display current Date and Time in a Web page.</i>	7+2
	EVENT HANDLING AND REGULAR EXPRESSION	
V	Document Object Model - Element Access in JavaScripts - Events and Event Handling - Basic Concepts of Event Handling - Events, Attributes, and Tag - Event Handler Attributes - Handling Events from Form Elements - Regular Expression. <i>Form validation - Design Job Skills web page-what happens for a failing applicant and a successful applicant.</i>	7+2
	Total Instructional Hours	45

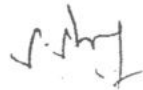
- Course Outcome**
- CO1 Design simple dynamic web pages
 - CO2 Develop a web page using prompt and using functions.
 - CO3 Creation of dynamic web page using Control Statements
 - CO4 Creating an interactive webpage using Arrays and Objects
 - CO5 Design a web page that handles Events.

TEXT BOOK:

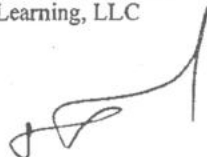
- T1 Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Fourth Edition, Pearson Education, 2006.
- T2 Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.

REFERENCES:

- R1 Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
- R2 John Dean "WEB PROGRAMMING with HTML, CSS, and JavaScript", Bartlett Learning, LLC 2019.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22ME2001	ENGINEERING PRACTICES (Common to all branches)	0	0	4	2

Course Objective To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

Unit Description of the Experiments
GROUP A (CIVIL AND MECHANICAL)

- 1 Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
- 2 Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction
- 3 Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction
- 4 Preparation of arc welding of Butt joints, Lap joints and Tee joints.
- 5 Practice on sheet metal Models- Trays and funnels
- 6 Hands-on-exercise in wood work, joints by sawing, planing and cutting.
- 7 Practice on simple step turning, taper turning and drilling.
- 8 Demonstration on Smithy operation.
- 9 Demonstration on Foundry operation.
- 10 Demonstration on Power tools.

GROUP B (ELECTRICAL ENGINEERING)

- 1 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2 Fluorescent lamp wiring.
- 3 Stair case wiring.
- 4 Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
- 5 Measurement of energy using single phase energy meter.
- 6 Soldering practice using general purpose PCB.
- 7 Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
- 8 Study of Energy Efficient Equipment's and Measuring Instruments.

Total Instructional Hours 45

Course Outcome
 CO1 Fabricate wooden components and pipe connections including plumbing works.
 CO2 Fabricate simple weld joints.
 CO3 Fabricate different electrical wiring circuits and understand the AC Circuits.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22HE2071	DESIGN THINKING	2	0	0	2

Course Objective	The student should be able
	1 To expose students to the design process
	2 To develop and test innovative ideas through a rapid iteration cycle.
	3 To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
	DESIGN ABILITY	
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	6
	DESIGNING TO WIN	
II	Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	5
	DESIGN TO PLEASE AND DESIGNING TOGETHER	
III	Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	6
	DESIGN EXPERTISE	
IV	Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	6
	DESIGN THINKING TOOLS AND METHODS	
V	Purposeful Use of Tools and Alignment with Process - Journey Mapping - Value Chain Analysis - Mind Mapping – Brainstorming - Design Thinking Application: Design Thinking Applied to Product Development	7
	Total Instructional Hours	30

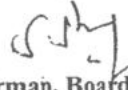
Course Outcome	CO1	CO2	CO3
	Develop a strong understanding of the Design Process	Learn to develop and test innovative ideas through a rapid iteration cycle.	Develop teamwork and leadership skills

TEXT BOOK:

T1 Nigel Cross, "Design Thinking", Kindle Edition

REFERENCES:

- R1 Tom Kelley, "Creative Confidence", 2013.
- R2 Tim Brown, "Change by Design", 2009


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22HE2072	SOFT SKILLS AND APTITUDE I	0	0	0	1

The student should be able

- Course Objective**
- 1 To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
 - 2 To enhance the students ability to deal with numerical and quantitative skills.
 - 3 To identify the core skills associated with critical thinking.
 - 4 To develop and integrate the use of English language skills

Unit	Description	Instructional Hours
I	Lessons on excellence Skill introspection, Skill acquisition, consistent practice	2
II	Logical Reasoning Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	Quantitative Aptitude Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
IV	Recruitment Essentials Resume Building - Impression Management	4
V	Verbal Ability Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement - Punctuations	4
Total Instructional Hours		30

Course Outcome	Description
CO1	Students will analyze interpersonal communication skills. public speaking skills.
CO2	Students will exemplify tautology, contradiction and contingency by logical thinking.
CO3	Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
CO4	Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity
CO5	Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar

REFERENCES:

- R1 Quantitative Aptitude – Dr. R S Agarwal
- R2 Speed Mathematics: Secret Skills for Quick Calculation - Bill Handley
- R3 Verbal and Non – Verbal Reasoning – Dr. R S Agarwal
- R4 Objective General English – S.P.Bakshi


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அலகு I மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி

இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்

விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:

3


இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.



1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. சுண்ணித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.


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Programme	Course code	Name of the course	L	T	P	C
B.TECH.	22MC2092	HERITAGE OF TAMIL	2	0	0	0

The student should be able

- Course Objective**
- 1 Introduce students to the great History of Tamil literature.
 - 2 Establish the heritage of various forms of Rock art and Sculpture art.
 - 3 To study and understand the various folk and Martial arts of Tamil culture
 - 4 Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature.
 - 5 To learn about the various influences or impacts of Tamil language in Indian culture.

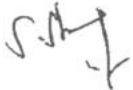
Unit	Description	Instructional Hours
	Language and Literature Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry _ Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
I	Heritage _ Rock Art Paintings to Modern Art – Sculpture Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handcrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
II	Folk and Martial Arts Therukoothu, Karagattam, Villupattu, Kaniyan koothu, Oyilattam, Leather puppetry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.	6
III	Thinai Concept of Tamils Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Export and Import during Sangam age – Overseas conquest of Cholas.	6
IV	Contribution of Tamils to Indian National Movement and Indian Culture Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books.	6
V		
	Total Instructional Hours	30
	CO1 Learn about the works pertaining to Sangam age	
	CO2 Aware of our Heritage in art from Stone sculpture to Modern Sculpture.	
Course Outcome	CO3 Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.	
	CO4 Appreciate the intricacies of Tamil literature that had existed in the past.	
	CO5 Understand the contribution of Tamil Literature to Indian Culture	

TEXTBOOKS:

- T1 Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
- T2 Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
- T3 Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

REFERENCES:

- R1 The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
- R2 Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- R3 Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.



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Programme BE	Course Code 21MA3104	Name of the Course DISCRETE MATHEMATICS AND GRAPH THEORY	L 3	T 1	P 0	C 4
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- Course Objectives**
1. Illustrate logical theory and proportional calculus techniques that will create logical thinking.
 2. Generate counting problems using mathematical induction, inclusion and exclusion principles.
 3. Examine the Boolean algebra which is used in the Boolean logics and circuits.
 4. Describe the basic knowledge of graph theory which is applied in Computer networks.
 5. Recognize the concepts of trees in computer engineering.

Unit	Description	Instructional Hours
I	MATHEMATICAL LOGIC Propositional logic - Tautology and Contradiction - Propositional equivalences - Normal forms - Principal normal forms - Theory of Inference.	12
II	COMBINATORICS Mathematical induction – Recurrence relations – Solving linear recurrence relations - generating functions – principle of inclusion and exclusion – applications.	12
III	LATTICES AND BOOLEAN ALGEBRA Lattices – Properties of lattices – Lattices as algebraic system – Sub lattices - some special lattices – Boolean algebra – Definition and simple properties.	12
IV	GRAPHS Graphs – introduction – types of graphs – matrix representation of graphs – paths, cycles connectivity – connectedness in undirected graphs – Euler and Hamiltonian graphs – connectedness in directed graphs.	12
V	TREES Trees – properties of trees –spanning tree – minimum spanning tree – Rooted and binary trees – properties of binary trees - spanning trees in a weighted graph.	12
Total Instructional Hours		60

- Course Outcome**
- CO1: Evaluate the notion of mathematical thinking, mathematical proofs, and algorithmic thinking and be able to apply them in problem solving.
- CO2: Solve problems using counting techniques and recurrence relations.
- CO3: Understand the knowledge about Lattices and Boolean Algebra.
- CO4: Apply the properties of graphs and related discrete structures in computer networks.
- CO5: Analyze the various types of trees and their properties.

TEXT BOOKS:

- T1 - Discrete Mathematics with proof-Eric Gossett-2nd Edition 2018.
- T2- Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, Delhi, 2016.

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REFERENCE BOOKS :

- R1 - T.Veerarajan, "Discrete Mathematics with Graph Theory and Combinatorics", Tata. McGraw-Hill Education, 15th reprint, 2012
R2 - Kenneth H.Rosen, "Discrete Mathematics and its Applications", seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2013.
R3 - Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications,2010.


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Programme BE	Course Code 21CS3201	Name of the Course DATA STRUCTURES	L 3	T 0	P 0	C 3
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- Course Objective**
1. Understand the fundamental concepts of Programming such as Pointers, Structures and union.
 2. Understand the concept of various linear data structures like list, stack and queue.
 3. Understand the various non-linear data structures like binary tree, binary search tree, AVL, splay tree and red black tree.
 4. Understand the concepts of Sorting, Searching and Hashing techniques
 5. Understand graph algorithms such as shortest path and minimum spanning tree

Unit	Description	Instructional Hours
	FUNDAMENTAL CONCEPTS OF PROGRAMMING	
I	Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.	7
	BASIC DATA STRUCTURES	
II	List ADT-Single Linked List-Doubly Linked List-Circular Linked List-Polynomial Addition. Stack ADT-Array Based Implementation-Linked List Implementation-Applications of Stack-Infix to Postfix Conversion, Postfix Evaluation, Matching Parentheses. Queue ADT- Array Based Implementation-Linked List Implementation-Double Ended Queue.	10
	TREES	
III	Tree ADT-Binary Tree-Tree Traversal Algorithms-Search Tree: Binary Search Tree-AVL Tree-Splay Tree-B+ trees-Red-Black Tree. Priority Queues- Binary Heap	9
	SORTING AND SEARCHING	
IV	Sorting Algorithms -Insertion Sort, Bubble Sort, Selection Sort, Radix sort– Shell Sort-Merge Sort-Quick Sort- Searching Algorithm : Linear Search-Binary Search. Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.	9
	GRAPHS	
V	Graph ADT- Representation of Graphs-Graph Traversals-Topological Sort- Shortest Paths- Dijkstra’s Algorithm-Network Flow Problem- Minimum Spanning Trees-Prims-Algorithm- Kruskal’s Algorithm- Applications of Depth-First Search-Biconnectivity-Euler Circuits. Introduction to NP-Completeness.	10
	Total Instructional Hours	45

- Course Outcome**
- CO1: Develop applications in C using pointers, structures and unions.
- CO2: Acquire knowledge the most common abstractions for data collections (e.g., stacks, queues, lists).
- CO3: Use non linear data structures such as trees to solve problems. .
- CO4: Apply Algorithms for solving problems like sorting and searching.
- CO5: Apply Graph algorithms to find the shortest path cost.

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TEXT BOOKS:

- T1: Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016.
- T2: Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 1997.

REFERENCE BOOKS:

- R1: Aaron M. Tenenbaum, Yeediyah Langsam, Moshe J. Augenstein, ‘Data structures using C’, Pearson Education, 2008.
- R2: Stephen G. Kochan, “Programming in C”, Fourth edition, Pearson Education, 2015.
- R3: Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008



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Programme BE	Course Code 21CS3202	Name of the Course DATABASE MANAGEMENT SYSTEMS	L 3	P 0	T 0	C 3
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- Course Objective**
1. To understand the role of data, files and databases in information systems and learn the fundamentals of data models
 2. To study SQL and relational database design
 3. To represent ER diagram for any customized applications
 4. To understand various normal forms
 5. To understand the fundamental concepts of transaction processing, concurrency control techniques and recovery procedures

Unit	Description	Instructional Hours
	INTRODUCTION TO DATABASE SYSTEMS	
I	Introduction to database system, Characteristics of the Database Approach, Advantages of using the DBMS Approach, History of Database Applications. Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages	8
	RELATIONAL DATABASE	
II	Structure of Relational Databases, Database Schema, Keys, Relational Query Languages, The Relational Algebra Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries Join, Views, Integrity Constraints, Triggers	10
	CONCEPTUAL DATA MODELING	
III	Using High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues, The Enhanced Entity-Relationship (EER) Model: Subclasses, Superclasses, and Inheritance, Specialization and Generalization.	9
	NORMALIZATION THEORY	
IV	Functional Dependencies, Normal Forms Based on Primary Keys, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form	9
	TRANSACTION MANAGEMENT	
V	Transactions: Transaction Concept, A Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity Recovery System: Failure Classification, Recovery Algorithm	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the functional components of DBMS and datamodels
 CO2: Able to write SQL queries
 CO3: Analyze a system and design ER diagram and Relational Schema
 CO4: Able to perform normalization and write queries using normalization criteria
 CO5: Illustrate the concepts for transaction processing, concurrency control and recovery procedures for RDBMS.

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TEXT BOOKS:

- T1: Ramez Elmasri and Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education,7th edition, 2013 (UNIT I, III & IV)
T2: Abraham Silberschatz, Henry F.Korth and S.Sudarshan, Database System Concepts, Mc Graw Hill, 7th edition, 2019. (UNIT II, V)

REFERENCE BOOKS:

- R1: Raghu Rama Krishnan, Database Management Systems, Tata Mcgraw Hill,6th edition,2010.
R2: Carlos Coronel and Steven Morris, Database System Design and Implementation, Cengage Learning, 11th edition, 2013.


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Programme BE	Course Code 21CS3203	Name of the Course COMPUTER ARCHITECTURE	L 3	P 0	T 0	C 3
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- Course Objective**
1. To conceptualize the basic structure and operations of a digital computer.
 2. To study the design of arithmetic and logic unit and implementation of fixed-point and floating-point arithmetic operations.
 3. To understand the basic design principles of Pipelining for CPU performance improvement.
 4. To develop a deeper understanding of parallel processors and multi-core processors.
 5. To familiarize the concepts of hierarchical memory system, cache memories, virtual memories, I/O Communication, Interrupts and Standard Interfaces.

Unit	Description	Instructional Hours
	BASIC STRUCTURE OF A COMPUTER SYSTEM	
I	Functional Units –Basic Operational Concepts-Performance – Instructions: Language of the Computer – Operations, Operands – Representing Instructions– Logical operations – Decision making – MIPS Addressing.	9
	ARITHMETIC FOR COMPUTERS	
II	Addition and Subtraction – Multiplication – Division – Floating Point- Floating Point Representation – Floating Point Operations – Subword Parallelism	8
	PROCESSOR AND CONTROL UNIT	
III	Basic MIPS implementation – Building Datapath – Control Implementation Scheme – Pipelining –Pipelined Datapath and Control – Handling Data hazards & Control hazards – Exceptions	10
	PARALLEL PROCESSORS	
IV	The Difficulty of Creating Parallel Processing Programs – Flynn’s Classification- SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing	9
	MEMORY AND I/O SYSTEMS	
V	Memory Hierarchy - Memory Technologies – Cache Memory – Measuring and Improving Cache Performance – Virtual Memory, TLB’s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus Structure – Bus Operation – Arbitration – Interface Circuits - USB	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the basics structure of computers, operations and instructions
 CO2: Practice the arithmetic operations performed by ALU.
 CO3: Design and analyze pipeline for consistent execution of instructions with hazards.
 CO4: Explain the structure of parallel processing architectures
 CO5: Demonstrate knowledge about state-of-the-art I/O, memory , Interrupts and Interfaces

TEXT BOOKS:

- T1: David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
 T2: Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, fifth Edition, Tata McGraw Hill, 2014

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REFERENCE BOOKS:

- R1: William Stallings, Computer Organization and Architecture – Designing for Performance, tenth Edition, Pearson Education, 2016.
- R2: John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2017 Paperback version.
- R3: John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Sixth Edition, 2019 Paperback version.



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Programme	Course Code	Name of the Course	L	T	P	C
BTECH	21CS3251	DIGITAL PRINCIPLES AND SYSTEM DESIGN (Common to CSE and IT)	3	0	2	4

- Course Objective**
1. To understand different methods used for the simplification of Boolean functions.
 2. To study combinational circuits.
 3. To learn synchronous sequential circuits.
 4. To understand asynchronous sequential circuits.
 5. To study the fundamentals of HDL.

Unit	Description	Instructional Hours
	MINIMIZATION TECHNIQUES Number systems: Decimal, Binary, Octal, Hexadecimal-Number-Base conversion-Complements of Numbers: 1's and 2's complements- Boolean algebra and laws-De-Morgan's Theorem-Principle of Duality-Minimization of Boolean expressions – Minterm – Maxterm – Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions (2variable, 3variable & 4-variable)- Tabulation method.	10
I	COMBINATIONAL CIRCUITS Circuits for arithmetic operations: adder: Half adder, Full adder, subtractor: Half subtractor, Full subtractor-BCD adder-Magnitude comparator-Encoders, Decoders-Multiplexers, Demultiplexers, Code converters: Binary to Gray, Gray to Binary <i>1. Experimental Design and implementation of Half Adder & Half Subtractor.</i> <i>2. Experimental Design and implementation of Binary to Gray and Gray to Binary Conversion.</i> <i>3. Experimental Design and implementation of Multiplexers and Demultiplexers</i>	9+6(P)
III	SYNCHRONOUS SEQUENTIAL CIRCUITS Flip flops: SR, JK, D, T - Design of synchronous sequential circuits: State diagram - State table – State minimization - State assignment. Shift registers: SISO, SIPO, PIPO, PISO – Counters: BCD, Up down counter. <i>Experimental Design and implementation of Synchronous and Asynchronous Counters</i>	9+4(P)
IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS Analysis and design of asynchronous sequential circuits-Reduction of state and flow tables– Race-free state assignment–Hazards.	9
V	HARDWARE DESCRIPTION LANGUAGE Introduction to Hardware Description Language (HDL)- HDL for combinational circuits- Half adder, Full adder, Multiplexer, De-multiplexer, HDL for Sequential Circuits- Flip flops, Synchronous and Asynchronous Counters, Registers. <i>1. Coding Combinational/Sequential circuits using HDL</i>	9+4(P)
Total Instructional Hours		60

TEXT BOOKS:

T1 Morris Mano M. and Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL", V Edition, Pearson Education, 2013. ISBN-13: 978-0-13-277420-8

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REFERENCE BOOKS :

R1-.S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design",FourthEdition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.ISBN: 978-93-259-6041-1

R2-.Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2013



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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS3001	DATA STRUCTURES LABORATORY	0	0	3	1.5

- Course Objective**
1. To learn the methodical way of solving problem.
 2. To comprehend the different methods of organizing large amount of data.
 3. To efficiently implement the different data structures.

S. No. Description Of the Experiments

Singly Linked List and Doubly Linked List

- 1
- a) Create and display Singly Linked List.
 - b) Given a singly linked list with head node root, write a function to split the linked list into k consecutive linked list "parts".
 - c) Find kth node from the end of linked list
 - d) Reverse a doubly linked list.
 - e) Merge two sorted singly Linked Lists without creating new nodes.

a) Implementation of Stack

Arun reads lot of story books and he keeps all the story books piled as a single stack. He wants to write a program to keep the order of the books in the pile. The program must implement the following functionalities.

- 2
- Add a book to the top of the pile when 1 is followed by the name of the book.
Remove a book from the top of the pile when -1 is given as the input (provided the pile has at least one book).
Print the name of the book on the top of the pile when 2 is given as the input (provided the pile has at least one book).
The program must exit when 0 is given as the input.

b) Implementation of Queue

Riyaz has a book of tickets and wants to store ticket numbers in a data structure. New tickets are added to the end of the booklet. Ticket at the top of the stack is issued to the customer. Implement the data structure should Riyaz use to represent the ticket booklet?

- 3
- a) Given an Infix expression convert it into its postfix Equivalent using stack data structure.
 - b) Write a program to implement deque using linked lists

Binary search tree and traversal

- 4
- a) Insertion, Deletion, Searching in a BST
 - b) Find kth smallest and kth largest element in a BST
- Check if a given sequence represents the in-order, pre-order and post-order traversal of a BST.

Write a program for AVL tree having functions for the following operations:

- 5
- a) Insert an element (no duplicates are allowed),
 - b) Delete an existing element,
 - c) Traverse the AVL (in-order, pre-order, and post-order)

Heaps using priority queue

- 6
- Geek hosted a contest and N students participated in it. The score of each student is given by an integer array arr. The task is to print the number of each student (indexes) in the order they appear in the scoreboard. A student with a maximum score appears first. If two people have the same score then higher indexed student appears first.

- 7
- Write a C program to Implement Hash Tables with Quadratic Probing.**

a) Merge Sort

- 8
- Write a function that takes two list, each of which is sorted in increasing order, and merges the two into one list, which is in descending order, and returns it. In other words, merge two sorted linked list from their end.

b) Quick Sort

Given an array arr[], its starting position low and its ending position high. Implement the partition() and quickSort() functions to sort the array.

- 9 **Implementation of the following graph traversal algorithms:**
a) **Depth first traversal**
b) **Breadth first traversal**

Minimum spanning tree using prim's and kruskal's algorithm.

- 10 Given a graph which consists of several edges connecting its nodes, find a subgraph of the given graph with the following properties: The subgraph contains all the nodes present in the original graph. The subgraph is of minimum overall weight (sum of all edges) among all such subgraphs. It is also required that there is exactly one, exclusive path between any two nodes of the subgraph. One specific node S is fixed as the starting point of finding the subgraph using Prim's Algorithm. Find the total weight or the sum of all edges in the subgraph.

Total Practical Hours: 45

Course Outcome	CO1: Apply good programming design methods for program development.
	CO2: Apply the different data structures for implementing solutions to practical problems.
	CO3: Develop recursive programs using trees and graphs.



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Programme BE	Course Code 21CS3002	Name of the Course DATABASE MANAGEMENT SYSTEMS LABORATORY	L 0	T 0	P 3	C 1.5
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- Course Objective**
1. To understand data definitions and data manipulation commands.
 2. To learn the use of nested and join queries
 3. To understand views and constraints
 4. To understand functions, procedures and procedural extensions of data bases
 5. To understand design and implementation of typical database applications

S. No.	Description of the Experiments
1	Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving tables
2	Data Control and Transaction Control statements
3	Database Querying – Simple queries, Nested queries, Sub queries and Joins
4	Integrity Constraints
5	Views, Sequences and Synonyms
6	Database Programming: Implicit and Explicit Cursors
7	Procedures and Functions
8	Triggers
9	Exception Handling
10	Development of mini-projects with front end of your choice.

Total Practical Hours: 45

Scenario 1

Example 1:

Table 1: Busdiv

Buscode	BusDesc
01	Super Delux
02	Delux
03	Super Fast
04	Normal

Table 2: Busroute

Route_id	Route_no	Buscode	Origin	Dest	Fare	Dist	Capacity
201	33	01	Chennai	Madurai	170	300	45
202	25	02	Trichy	Madurai	45	100	50
203	15	03	Nellai	Madurai	30	90	50
204	36	04	Chennai	Bangalore	150	250	55
205	40	01	Bangalore	Madurai	170	250	45
206	38	02	Madurai	Chennai	160	300	50
207	39	03	Hyderabad	Chennai	160	190	50
208	41	04	Chennai	Cochin	148	320	55
209	47	02	Chennai	Coimbatore	165	300	50
210	46	04	Coimbatore	Chennai	150	300	55

Table 3: Busdepot

Place_id	Place	Address	Station
01	Chennai	12, Beach Rd	Broadway
02	Madurai	17, Bye Pass Rd	Ellis Nagar

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03	Trichy	11, First Cross Road	Tollgate
04	Bangalore	15, Second St	Malleswaram
05	Hyderabad	115, Lakeview Rd	Charminar
06	Nellai	12, Temple Rd	Town

Table 4: Journey

J-Id	Date	Time	Route_id	Buscode
01	13-Jan-97	10:00:00	201	01
02	13-Jan-97	12:00:00	201	01
03	13-Jan-97	13:00:00	201	01
04	13-Apr-97	15:00:00	202	02
05	13-Apr-97	17:00:00	202	03
06	13-Apr-97	19:00:00	203	04

Table 5: Ticket

J-Id	Tick no	Dob	Doj	Time	Station	Origin	Dest	Adults	Child	Totfare	Route_id
01	001	10-Dec-96	13-Jan-97	10:00:00	Broadway	Chennai	Madurai	1	1	225	201
02	002	12-Dec-96	13-Jan-97	12:00:00	Broadway	Chennai	Madurai	2	0	90	202
03	003	01-Jan-97	13-Jan-97	13:00:00	Broadway	Chennai	Madurai	1	1	255	201
04	004	02-Feb-97	13-Apr-97	15:00:00	Tollgate	Trichy	Madurai	3	0	90	203
05	005	05-Mar-97	13-Apr-97	17:00:00	Tollgate	Trichy	Madurai	1	0	150	204
06	006	18-Mar-97	13-Apr-97	19:00:00	Town	Nellai	Madurai	1	1	90	202

Table 6: Ticketdetail

Tick no	Name	Sex	Age	Fare
001	Latha	F	24	170
001	Anand	M	10	85
002	Pradeep	M	30	45
002	Kuldeep	M	32	45
003	Rakesh	M	48	170
003	Brindha	F	08	85
004	Radhika	F	22	30
004	Juliat	F	21	30

Constraints

1.

Busdiv

Buscode(primary key)

Busdesc(Unique)

Busroute

Buscode(Foreign key)

Route_no(Unique)

2.

Journey

J_Id(primary key)

Day(Notnull)

Time(Notnull)

Ticket

J_Id(Foreign key)

Time(Notnull)

Origin(Notnull)

Dest(Notnull)

3.

Busroute

Route_id (primary key)

Journey

Route_id (Foreign key)

4.

Ticket

Tick_no (primary key)

Ticketdetail

Tick_no (Foreign key)

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Sex (Check constraint for accepting either M of F)

5.

Busdiv

Buscode (primary key)

Journey

Buscode (Foreign key)

Create the above tables by applying the constraints specified and populate the tables. Perform various DML, TCL commands (Select, Insert, Update, Delete, Commit, Rollback, Savepoint, Grant, Revoke). Perform various operation involving arithmetic operators, logical operators, comparison operators, character, number, date functions. Create a view jview from the Journey table such that it contains Day, Time and route_id as J_day, J_time, J_r_id as column headings. Update the jview such that the J_day is “20-jan-98” where J_r_id is 201. Select the contents of corresponding table that jview is based and check whether update has occurred. Perform various join operations on the tables Busdiv and Busroute.

Create a synonym passenger for ticketdetail table. Select contents of passenger. Create a synonym busdetails for busroute table. Drop the passenger synonym. Create an index on route_id column of busroute table. Drop the index. Create a sequence ticket where minimum value is 1 and maximum value is 20 with an increment of 2 and starting with 1. Insert the sequence ticket into the tick_no column of ticket table. Alter the sequence such that the maximum value is 15. List only the sequences created by you. List only the views created by you. List all the indexes created by you. Drop all the database objects created by you. Create a procedure that will increment the selected records totfare in the ticket table by 100 update the table. Create a trigger that ensures no changes to the records on specified days.

Scenario 2:

Table 1: Emp

EmpNo	Ename	Job	MGR	HireDate	Sal	Comm	Deptno
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

Table 2: Dept

DeptNo	Dname	Loc
10	Accounting	New York
20	Research	Dallas
30	Sales	Chicago
40	Operations	Boston

Table 3: Salgrade

Grade	LoSal	HiSal
1	700	1200

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2	1201	1400
3	1401	2000
4	2001	3000
5	3001	9999

Create the above tables by applying the necessary constraints and populate the tables. Perform various DML, TCL commands (Select, Insert, Update, Delete, Commit, Rollback, Savepoint, Grant, Revoke). Perform various operation involving arithmetic operators, logical operators, comparison operators, character, number, date functions. Perform various join operations on the tables Emp and Dept. Create Sequence Next_Empno Start with 8000 Increment By 1. Create view from emp table where job is salesman. Create a Procedure that lists all employees' numbers and names from the 'emp' table using a cursor. Create Procedure that selects an employee row given the employee number and displays certain columns. Create statement-level triggers that display a message after an insert, update, or deletion to the 'emp' table.

Scenario 3

A new supermarket will be opened in 3 months. The owner wants to have a software to manage the supermarket data (inventory, customers, sales,...). Design a database to insert, retrieve, update data. ex. When a product is sold to a customer, the database changes may need to be done reducing the inventory. Real world need for creating views. Provide different Users different roles for separate DB.

Scenario 4

Design database for university which should include details about student, faculty, course, department. Create, populate the database, perform updates and retrieval. Create views and triggers that does not allow manipulation during holidays. Provide different privileges to different users.

Course Outcome

- CO1: Use typical data definitions and manipulation commands
- CO2: Design applications to test Nested and Join Queries
- CO3: Implement simple applications that use Views
- CO4: Critically analyze the use of Tables, Views, Functions and Procedures
- CO5: Implement applications that require a Front-end Tool


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DEAN-ACADEMICS
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HICET – Department of Computer Science and Engineering

Programme	Course Code	Name of the Course	L	T	P	C
BE	21MC3191	INDIAN CONSTITUTION	2	0	0	0

- Course Objective**
1. Sensitization of student towards self, family (relationship), society and nature.
 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
 3. Strengthening of self reflection.
 4. Development of commitment and courage to act.

Unit	Description	Instructional Hours
	BASIC FEATURES AND FUNDAMENTALE PRINCIPLES	
I	Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.	4
	FUNDAMENTAL RIGHTS	
II	Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.	4
	PARLIAMENTARY FORM OF GOVERNMENT	
III	The constitution powers and the status of the president in India. – Amendement of the constitutional powers and procedures – The historical perspective of the constitutional amendement of India – Emergency provisions : National emergency, President rule, Financial emergency.	4
	LOCAL GOVERNANCE	
IV	Local self government -constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article19 – scope of the right to life and personal liberty under article 21.	4
	INDIAN SOCIETY	
V	Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	4
Total Instructional Hours		20

- Course Outcome**
- CO1: Understand the functions of the Indian government.
- CO2: Understand and abide the rules of the Indian constitution.

TEXT BOOKS:

- T1: Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
- T2: R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.

HICET – Department of Computer Science and Engineering

- T3: Maciver and Page(1997), “ Society: An Introduction*Analysis “, Mac Milan India Ltd., New Delhi.
T4: K.L.Sharma, (1997) “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi.

REFERENCE BOOKS:

- R1: Sharma, Brij Kishore, “ Introduction to the Constitution of India., Prentice Hall of India, New Delhi.
R2: U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar.
R3: R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.


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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS4201	JAVA PROGRAMMING	3	0	0	3

- Course Objective**
1. Learn the basics of java programming language
 2. Discuss the packages and interfaces in java programming
 3. Learn IO streams and multithreading in java
 4. Learn generics and collections framework in java
 5. Understand event handling and swing in java

Unit	Description	Instructional Hours
I	INTRODUCTION Review of Object oriented programming-Introduction to java programming-Features of Java Language, JVM -The Java Environment-Primitive Data types-variables-arrays-control statements-classes and objects-access specifier-methods-constructor-finalize method-strings-Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes.	9
II	INTERFACES AND PACKAGES Interfaces-Defining an interface-implementing an interface-applying interface-variables in interface-extended interface-- Packages-defining package-access protection-importing packages -Exception Handling-exception types-uncaught exception-multiple catch-nested try-throw and finally-built-in exceptions-user defined exception.	9
III	IO STREAMS AND MULTITHREAD I/O basics-reading console input-writing console output-reading and writing files-Serialization- Multithreaded programming-java thread model-thread priorities-synchronization-thread class and runnable interface-creating multiple threads- inter thread communication.	9
IV	GENERICS AND COLLECTIONS FRAMEWORK Generics- simple Generic example-Generic class with parameters-The General Form of a Generic Class-Bounded Types-Creating Generic method-Generic interfaces- Generic class hierarchies-Generic restrictions. Collections overview-interfaces-classes-an iterator.	9
V	EVENT HANDLING AND SWING Window fundamentals-layout managers-working with 2D shapes-Using color, fonts and images-The Delegation Event Model-Event Classes-The ActionEvent Class-The AdjustmentEvent Class-The ComponentEvent Class- -The KeyEvent Class- The MouseEvent Class -Event Listener Interfaces-The ActionListener Interface-The AdjustmentListener Interface-The ComponentListener Interface- The KeyListener Interface - The MouseListener Interface- The MouseMotionListener Interface -Introduction to Swing-Swing components-Text Fields, Text Areas-Buttons-Check Boxes-Radio Buttons-Lists-Choices-Scrollbars-windows-Menus-Dialog Boxes.	9

Total Instructional Hours **45**

- Course Outcome**
- Upon completion of this course, the students will be able to
- CO1: To Understand the Basics of java Programming
 - CO2: Design program using user defined packages and interfaces
 - CO3: Develop applications using multithreading concepts in java
 - CO4: Design real time applications using generics and collection frameworks.
 - CO5: Apply event handling classes and swing concepts to create different applications in java

TEXT BOOKS:

- T1 Herbert Schildt, "The complete reference java 2", 11th edition, McGraw – Hill 2019.
- T2 "Core Java 2", Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.

Programme BE	Course Code 21CS4202	Name of the Course SOFTWARE ENGINEERING	L 3	T 1	P 0	C 4
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- Course Objective**
1. Compare different process models.
 2. Concepts of requirements engineering and Analysis Modeling.
 3. Apply systematic procedure for software design and deployment.
 4. Compare and contrast the various testing and maintenance.
 5. Manage project schedule, estimate project cost and effort required.

Unit	Description	Instructional Hours
	SOFTWARE PROCESS AND AGILE DEVELOPMENT	
I	Introduction to Software Engineering-Definitions of Software Engineering- The Serial or Linear Sequential Development Model -Iterative Development Model-The incremental Development Model-The Parallel or Concurrent Development Model-Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.-Introduction and Evolving Role of Software- Software Characteristics-Software Applications.	12
	REQUIREMENTS ANALYSIS AND SPECIFICATION	
II	Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management- Classical analysis: Structured system Analysis, Petri Nets-Data Dictionary.	12
	SOFTWARE DESIGN	
III	Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.	12
	TESTING AND MAINTENANCE	
IV	Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.	12
	PROJECT MANAGEMENT	
V	Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS	12
Total Instructional Hours		60

- Course Outcome**
- CO1: Compare different process models.
 - CO2: Concepts of requirements engineering and Analysis Modeling.
 - CO3: Apply systematic procedure for software design and deployment.
 - CO4: Compare and contrast the various testing and maintenance.
 - CO5: Manage project schedule, estimate project cost and effort required.

TEXT BOOKS:

- T1 Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011
T2 Roger S. Pressman, —Software Engineering – A Practitioner"s Approachl, Seventh Edition, Mc Graw-Hill International Edition, 2010.

REFERENCE BOOKS:

- R1: Rajib Mall, —Fundamentals of Software Engineeringl, Third Edition, PHI Learning Private Limited, 2009.
R2: Pankaj Jalote, —Software Engineering, A Precise Approachl, Wiley India, 2010.
R3: Kelkar S.A., —Software Engineeringl, Prentice Hall of India Pvt Ltd, 2007.
R4: Stephen R.Schach, —Software Engineeringl, Tata McGraw-Hill Publishing Company Limited,2007.



S. S. J.

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Programme BE	Course Code 21CS4203R	Name of the Course OPERATING SYSTEMS	L 3	P 0	T 0	C 3
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- Course Objective**
1. Study the basic concepts and Understand the structure of operating systems
 2. Learn about Processes, Scheduling algorithms and Deadlocks.
 3. Learn various memory management schemes.
 4. Study the concepts of File systems and directory structures..
 5. Learn the concepts of Mass Storage Structure

Unit	Description	Instructional Hours
I	OPERATING SYSTEMS OVERVIEW Introduction to operating systems - Computer System Organization-Operating System Structure , Operations and services - System Calls, System Programs, OS Generation and System Boot – Types of operating systems	8
II	PROCESS MANAGEMENT Processes-Process Concept, Process Scheduling, Threads Overview- Multithreading Models CPU Scheduling - Scheduling criteria, Scheduling algorithms, Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Deadlock-System model, Deadlock Prevention, Avoidance and Recovery.	12
III	MEMORY MANAGEMENT Introduction-Swapping-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory	9
IV	FILE SYSTEM IMPLEMENTATION Introduction to File Concepts- Access methods, Directory Structure, File Protection- File System Structure - File System Implementation, Directory implementation, Allocation Methods, Free Space Management	8
V	MASS STORAGE STRUCTURE Mass Storage Structure- Overview, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap Space Management, RAID structure, Case study: Managing Logical Volume Storage using RHEL 8.0	8
Total Instructional Hours		45

Course Outcome	CO1: Understand about the basic concepts of Operating systems.
	CO2: Design various Scheduling algorithms, deadlock, prevention and avoidance algorithms.
	CO3: Compare and contrast various memory management schemes.
	CO4: Design and Implement File systems and directory structures.
	CO5: Design and Implement Mass Storage Structure, various disk scheduling algorithms , RAID concepts.

TEXT BOOKS:

- T1: Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2018.
T2: William Stallings, "Operating Systems –Internals and Design Principles", 9/E, Pearson Publications, 2018

REFERENCE BOOKS:

- R1: Tom Adelstein, Bill Lubanovic , "Linux System Administration Solve Real-life Linux Problems Quickly", 2007, O'Reilly Media
R2: Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
R3: D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Third Edition, TataMcGraw-Hill Education, 2017.
R4: Andrew S. Tanenbaum, "Modern Operating Systems", 4/E, Pearson Publications, Paperback 2019.


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Programme BE	Course Code 21MA4151	Name of the Course PROBABILITY, STATISTICS AND QUEUEING THEORY	L 3	T 0	P 2	C 4
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- Course Objectives**
1. Construct a well defined knowledge of random variables.
 2. Explain the concept of two dimensional random variables and determine covariance.
 - 3 Illustrate the relation between two random variables by using correlation concepts along with R studio.
 4. Describe some basic concepts of statistical methods for testing the hypothesis together with R studio.
 5. Apply the basic characteristic features of a queuing system and analyze queuing models.

Unit	Description	Instructional Hours
I	PROBABILITY AND RANDOM VARIABLE Random variable –Discrete and continuous random variables – Probability mass function - Probability density function – Cumulative distribution functions - Moment generating functions. Introduction to R programming and Application of descriptive statistics – Mean, Median, Mode, variance and Box plot	9+3
II	TWO DIMENSIONAL RANDOM VARIABLES Joint probability mass function - Joint probability density function – Marginal Probability mass function – Marginal probability density function - Conditional Probability mass function - Conditional Probability density function – Independent random variables. Application of Normal distribution	9+3
III	CORRELATION AND REGRESSION Correlation – Karl Pearson’s correlation coefficient – Spearman’s Rank Correlation – Regression lines (problems based on Raw data only). Applications of Correlation and Regression	9+3
IV	HYPOTHESIS TESTING Large sample test based on Normal distribution – test of significance for single mean and difference of means - Small sample test – t test for single mean and difference of mean - F distribution for variance, Chi – Square test for independence of attributes – Goodness of fit. Application of Student t- test for Single mean and difference of means Application of Chi – square test	9+6
V	QUEUEING THEORY Markovian models: Single and Multiple server queueing models (Excluding proof) – (M/M/1):(∞/FCFS), (M/M/1):(N/FCFS), (M/M/C):(∞/FCFS) and (M/M/C):(N/FCFS).	9
Total Instructional Hours		45+15
Total(45+15)		60

- Course Outcomes**
- CO1: Understand the concepts of random variables.
CO2: Express the phenomenon of two dimensional random variables..
CO3: Compute correlation and predict unknown values using regression together with R studio.
CO4: Understand the concepts of statistical methods for testing the hypothesis along with R studio.
CO5: Identify the queuing models in the given system, analyze the result.

TEXT BOOKS:

T1 - Gupta S. P, “Statistical Methods”, Sultan Chand & Sons Publishers, 2017.

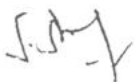
T2 – Medhi J, ” stochastic Processes”, New Age International Publishers, New Delhi, 2014.

REFERENCE BOOKS:

R1- Applied statistics and Probability for Engineers by C.Mont Gomery ,6th Edition, Wiley Publications.

R2 - A.O. Allen, “Probability, Statistics and Queueing Theory with Computer Applications”, Elsevier, Second Edition, 2012.

R3 - Walpole R. E., Myers S.L. & Keying Ye, “Probability and Statistics for Engineers and Scientists”, Pearson Education Inc, 9th edition, 2012.


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HiCET**

Programme	Course Code	Name Of The Course	L	T	P	C
BE	21CS4251	DESIGN AND ANALYSIS OF ALGORITHM	3	0	2	4

- Course Objective**
1. Learn the algorithm analysis techniques.
 2. Become familiar with the different algorithm design techniques
 3. Learn greedy technique to solve problems
 4. Understand backtracking and iterative development of algorithms
 5. Understand the limitations of Algorithm power

Unit	Description	Instructional Hours
I	ANALYSIS OF ALGORITHM Introduction – Algorithms – Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving- Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms	9
II	BRUTE FORCE AND DIVIDE AND CONQUER Brute Force – Closest-Pair and Convex-Hull Problems-Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem - Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers - Strassen’s Matrix Multiplication. <i>Program:</i> 1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. 2. Implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.	9+4(P)
III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE Computing a Binomial Coefficient – All Pairs Shortest Path Algorithm -Warshall’s and Floyd’ algorithm - Optimal Binary Search Trees – Knapsack Problem and Memory functions - Greedy Technique– MST - Prim’s algorithm- Kruskal’s Algorithm-Huffman Trees. <i>Program:</i> 1. Implement 0/1 Knapsack problem using Dynamic Programming 2. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it determine the speed-up achieved. 3. Compute the transitive closure of a given directed graph using Warshall's algorithm.	10+6(P)
IV	ITERATIVE IMPROVEMENT The Simplex Method-The Maximum-Flow Problem – maximum Matching in Bipartite Graphs- The Stable marriage Problem.	8
V	BACKTRACKING, BRANCH AND BOUND The General Method – 8-Queens Problem- Sum of Subsets - Hamiltonian Cycle - Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Decision Trees sorting and searching the arrays - P, NP and NP-Complete and NP – Hard Problems. <i>Program:</i> 1. Implement any scheme to find the optimal solution for the Traveling Sales Person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation. 2. Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution. 3. Implement N Queen's problem using Back Tracking.	9+5(P)
TOTAL HOURS		60 (45+15)

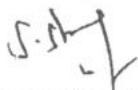
Course Outcome	CO1: Design algorithms for various computing problems
	CO2: Analyze the time and space complexity of algorithms
	CO3: Critically analyze the different algorithm design techniques for a given problem
	CO4: Modify existing algorithms to improve efficiency
	CO5: Apply algorithm techniques for real time applications

TEXT BOOKS:

- T1- AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
T2- Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

REFERENCE BOOKS:

- R1 - Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
R2- Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009.
R3 - Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.



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HiCET**

Programme
BE

Course Code
21CS4001

Name of the Course
JAVA PROGRAMMING LAB

L T P C
0 0 3 1.5

Course
Objective

1. To practice implementing Object Oriented Concepts, Package creation in Java using appropriate coding standards
2. To explore inheritance, interface and exception handling techniques.
3. To practice multithread programming.
4. To practice writing generic programs and collection classes in Java.
5. To develop simple applications using Event handling and swing concepts.

S. No.	Description Of the Experiments
1	<p>Simple Java program using user input</p> <p>a) Ritik wants a magic board, which displays a character for a corresponding number for his science project. Help him to develop such a Java application. For example, when the digits 65,66,67,68 are entered, the alphabet ABCD are to be displayed. [Assume the number of inputs should be always 4] Sample Input 1: Enter the digits: 65 66 67 68 Sample Output 1: 65-A 66-B 67-C 68-D</p> <p>b) Write a Java program to calculate the fuel consumption of your truck. The program should ask the user to enter the quantity of diesel to fill up the tank and the distance covered till the tank goes dry. Calculate the fuel consumption and display it in the format (liters per 100 kilometers). Convert the same result to the U.S. style of miles per gallon and display the result. If the quantity or distance is zero or negative display " is an Invalid Input". [Note: The US approach of fuel consumption calculation (distance / fuel) is the inverse of the European approach (fuel / distance). Also note that 1 kilometer is 0.6214 miles, and 1 liter is 0.2642 gallons.] The result should be with two decimal places. Sample Input 1: Enter the no of liters to fill the tank 20 Enter the distance covered 150 Sample Output 1: (Liters/100KM) 13.33 (Miles/gallons) 17.64</p> <p>c) Vohra went to a movie with his friends in a Wave theatre and during break time he bought pizzas, puffs and cool drinks. Consider the following prices: Rs.100/pizza Rs.20/puffs Rs.10/cooldrink Generate a bill in Java for What Vohra has bought. Sample Input 1: Enter the no of pizzas bought:10 Enter the no of puffs bought:12 Enter the no of cool drinks bought:5 Sample Output 1: Bill Details No of pizzas:10 No of puffs:12 No of cooldrinks:5</p>

Total price=1290

- d) HICET wants to recognize the department which has succeeded in getting the maximum number of placements for an academic year. The departments that have participated in the recruitment drive are CSE, ECE, MECH. Help the college find the department getting maximum placements. Check for all the possible output given in the sample snapshot.

Note: If any input is negative, the output should be "Input is Invalid". If all department has equal number of placements, the output should be "None of the department has got the highest placement".

Sample Input 1:

Enter the no of students placed in CSE:90

Enter the no of students placed in ECE:45

Enter the no of students placed in MECH:70

Sample Output 1:

Highest placement

CSE

- e) Rhea Pandey's teacher has asked her to prepare well for the lesson on seasons. When her teacher tells a month, she needs to say the season corresponding to that month. Write a program to solve the above task.

Spring – March to May,

Summer – June to August,

Autumn – September to November and,

Winter – December to February.

Month should be in the range 1 to 12. If not the output should be "Invalid month".

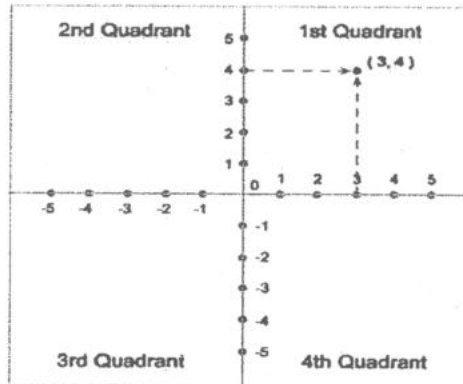
Sample Input 1:

Enter the month:11

Sample Output 1:

Season: Autumn

- f) Write a Java program to read the value of an integer m and display the value of n is 1 when m is larger than 0, 0 when m is 0 and -1 when m is less than 0.
- g) Write a Java program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies.



- h) Write a Java program to find the eligibility of admission for a professional course based on the following criteria:

Eligibility Criteria:

Marks in Maths ≥ 65 and Marks in Phy ≥ 55 and Marks in Chem ≥ 50 and Total in all three subject ≥ 190 or

Total in Maths and Physics ≥ 140

Input the marks obtained in Physics :65

Input the marks obtained in Chemistry :51

Input the marks obtained in Mathematics :72

Total marks of Maths, Physics and Chemistry: 188

Total marks of Maths and Physics: 137 The candidate is not eligible.

Expected Output:

The candidate is not eligible for admission.

2

Concepts of classes, objects, methods and constructors

- a) Write a Java program to create a class Student2 along with two method getData(), printData() to get the

	<p>value through argument and display the data in printData. Create the two objects s1, s2 to declare and access the values from class STtest.</p> <p>b) The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non-recursive functions to print the nth value in the Fibonacci sequence.</p> <p>c) Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.</p> <p>d) Write a Java program to count a total number of duplicate elements in an array.</p> <p>e) Write a Java program to merge two arrays of same size sorted in descending order.</p> <p>f) Write a Java program to find sum of rows and columns of a Matrix.</p> <p>g) Write a Java program to set zeroes in lower triangular of a matrix.</p> <p>h) Write a Java program to check whether a given substring is present in the given string.</p>
3	<p>Polymorphism Write a Java program to implement polymorphism.</p>
4	<p>Abstract class Write a java program to create an abstract class named Shape that contains an empty method named number Of Sides(). Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides() that shows the number of sides in the given geometrical figures.</p>
5	<p>Inheritance Write a Java Program illustrating a super class variable a referencing as sub class object.</p>
4	<p>Interface and exception handling</p> <p>a) Write a java program in which you will declare two interface sum and Add inherits these interface through class A1 and display their content.</p> <p>b) Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.</p>
5	<p>Packages</p>
6	<p>Multithreading Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.</p>
7	<p>Program to illustrate file I/O concept Write a Java Program to read an excel.</p>
8	<p>Object serialization.</p>
9	<p>Swing and Collection</p> <p>a) Create Generic number calculator using Java.</p> <p>b) Linked List implementation using collections</p> <p>c) Employee details using collection. OR JAVA application program using collection</p>
10	<p>Program that handles all mouse events.</p>
11	<p>Simple OPAC system for library using event-driven and concurrent programming paradigms with JDBC.</p>
12	<p>Remote method Invocation (CBTS)</p>

Course Outcome

- CO1: Understand the basics of Java Programming
- CO2: Design program using Inheritance, interface and exception handling techniques
- CO3: Develop applications using multithread programming.
- CO4: Implement data structure concepts using Generic programs and collection classes.
- CO5: Design real time applications using Event handling and Swing.


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HiCET**

Programme
BE

Course Code
21CS4002R

Name of the Course
OPERATING SYSTEMS LAB

L T P C
0 0 3 1.5

Course
Objective

1. Introduce the key role of an Linux Operating system
2. Insist the File system Management of an Linux Operating system
3. Emphasize the importance of local Linux users and groups in Linux Operating system
4. Insist the Storage Management of a Linux operation System
5. Learn about Installing and updating software packages in Linux Operating system.

1. Basic Linux commands
2. Manage files from the command lines
3. Getting help in Red Hat Enterprise Linux
4. Creating, viewing and editing text files
5. Managing local Linux users and groups
6. Controlling access to files with Linux file systems
7. Managing Red hat Enterprise Linux networking
8. Archiving and copying files between systems
9. Installing and updating software packages
10. Scheduling future Linux tasks
11. Adding disks, partitions and filesystems to a Linux system
12. Managing logical volume management storage

Total Practical Hours: 45

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

- Course Outcome
- CO1: Identify the need of an Linux Operating system
 - CO2: Know the Manage files of an Linux Operating system
 - CO3: Understand the need of local Linux users and groups in Linux Operating system
 - CO4: Know the Storage management method of a Linux Operating system
 - CO5: Understand the Installation and updatation of software packages in Linux Operating system


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Programme	Course Code	Name of the Course	L	T	P	C
BE	21MC4191	Essence Of Indian Traditional Knowledge	2	0	0	0

Course Objectives:

- 1) The course aims at imparting basic principles of thought process, reasoning and inferencing.
- 2) Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- 3) Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- 4) The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.

UNIT	DESCRIPTIVE	INSTRUCTIONAL HOURS
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies.	4

TOTAL INSTRUCTIONAL HOURS : 20

Course Outcomes:

- 1) Ability to understand the structure of Indian system of life.
- 2) Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

REFERENCE BOOKS:

- R1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
- R2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
- R3. Fritzof Capra, Tao of Physics
- R4. Fritzof Capra, The wave of Life.
- R5. V N Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Amaku,am
- R6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
- R7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
- R8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
- R9. P R Sharma (English translation), Shodashang Hridayam.


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Programme	Course Code	Name of the Course	L	T	P	C
BE	21HE4073	IDEATION SKILLS	1	0	0	0

- Course Objective**
1. To study the importance of ideation.
 2. To learn about the various tools for Ideation.
 3. To provide an insight in Prototyping and its significance.

Unit	Description	Instructional Hours
IDEATION: INTRODUCTION TO DESIGN THINKING METHODOLOGY		
I	Design Thinking Methodology and how it can be used as a powerful tool for developing new and innovative solutions - Inspiration – Implementation - Disruptive technology.	4
IDEATION: TOOLS FOR IDEATION		
II	Various resources to kindle new ideas for innovation. Explore the types of ideas in the past – Effect of the ideas and innovation of past on the world – Innovation Thinking – Case studies.	4
IDEATION: INTRODUCTION TO CUSTOMER DISCOVERY		
III	Intro to Customer Discovery - development of customer discovery plan that can lead to powerful business innovation - Customer Discovery Plan	4
PROTOTYPING AND PRODUCT IDEATION		
IV	Introduction to Prototyping - minimum viable product - High fidelity prototype vs low fidelity prototype – Prototyping tools	3
Total Instructional Hours		15

Course Outcome

Upon completion of the course, students will be able to
 CO1: Develop a strong understanding and importance of ideation
 CO2: Learn about the different kinds of tools for Ideation.
 CO3: Learn the need and significance of prototyping and its significance.

TEXT BOOKS:

T1 - Mark Baskinger and William Bardel, "Drawing Ideas: A Hand-Drawn Approach for Better Design", 2013
 T2 - Nigel Cross, "Design Thinking", Kindle Edition

REFERENCE BOOKS:

R1 - Kurt Hanks and Larry Belliston, "Rapid Viz : A New Method for the Rapid Visualitzation of Ideas", 2008.
 R2 - Kathryn McElroy , "Prototyping for Designers: Developing the Best Digital and Physical Products", 2017.


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HICET – Department of Computer Science and Engineering

Programme	Course Code	Name of the Course	L	T	P	C
BE	19CS5201	THEORY OF COMPUTING	3	1	0	4
Course Objective	<ol style="list-style-type: none"> 1. To understand the basic concepts of automata theory and finite automaton 2. To extend the concepts of automata theory in regular languages and expressions 3. To study about context free grammars and the normalizations of CFG 4. To learn the essence of push down automata with stack presentations and modeling turing machines 5. To discover the knowledge in decidability and tractability and to study the complexity classes 					
Unit	Description					Instructional Hours
I	Automata Theory Introduction-Need of automata theory-Formal proof- Additional Forms of Proof- Inductive Proofs-Central Concepts of Automata Theory-DFA and N DFA-Finite Automaton with ϵ - Transitions-Equivalence of DFA and NFA-Applications of Finite Automata.					12
II	Regular Expressions Regular Languages-Regular Expressions-Equivalence of finite Automaton and regular expressions-Minimization of DFA-Closure Properties and Decision Properties of Regular Languages-Problems based on Pumping Lemma-Applications of Regular Expressions.					12
III	Context Free Grammars Chomsky hierarchy of languages-Context-Free Grammar (CFG)-Parse Trees-Ambiguity in grammars and languages-Normal forms for CFG-Chomsky Normal Form (CNF)-Greibach Normal Form (GNF)-Pumping Lemma for Context Free Language (CFL)-Applications of Context Free Grammar.					12
IV	PushDown Automata and Turing Machines Definition of the Pushdown automata-Types of PDA-Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG-Definitions of Turing machines-Models-Computable languages and functions-Techniques for Turing machine construction-Multi head and Multi tape Turing Machines.					12
V	Undecidability The Halting problem – Partial Solvability- Undecidability- Decidable and undecidable problems- Basic Definition and properties of Recursive (RL) and Recursively enumerable (REL) languages. Intractable Problems- the Class P and NP-Introduction to NP-Hardness and NP-Completeness					12
Total Instructional Hours						60
Course Outcome	CO1: Understand the theoretical concepts of automata and equivalence of automata CO2: Remember the automata in applying to obtain regular expressions and languages CO3: Apply the normalization in context free grammar to obtain optimized CFG CO4: Understand PDA and turing machines and apply for making mathematical models CO5: Understand the decidability and tractability problems and apply for developed models					

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TEXT BOOKS:

- T1: Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Third Edition, Pearson Education, 2016.
T2: John C Martin, “Introduction to Languages and the Theory of Computation”, Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

REFERENCE BOOKS:

- R1: Mishra K L P and Chandrasekaran N, “Theory of Computer Science - Automata, Languages and Computation”, Third Edition, Prentice Hall of India, 2016.
R2: Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2015.
R3: Peter Linz, “An Introduction to Formal Language and Automata”, Sixth Edition, Jones & Bartlett Learning, 2016.
R4: Kamala Krithivasan and Rama. R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education 2009



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Programme	Course Code	Name of the Course	L	T	P	C
BE	19CS5202	COMPUTER NETWORKS (COMMON TO CSE & IT)	3	0	0	3

- Course Objective**
1. To study the Protocol Layering and Physical Level Communication.
 2. To understand the Data Communication System and the purpose of Layered Architecture.
 3. To analyze the concepts of Routing Methods and Sub-netting.
 4. To learn the functions of Network Layer and the various Routing Protocols.
 5. To familiarize the functions and Protocols of the Transport Layer.

Unit	Description	Instructional hours
	OVERVIEW & PHYSICAL LAYER	
I	Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission Media – Switching – Circuit-switched Networks – Packet Switching.	9
	DATA LINK LAYER	
II	Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC– PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction –IEEE 802.11, Bluetooth – Connecting Devices.	9
	NETWORK AND ROUTING	
III	Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms –Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.	9
	TRANSPORT LAYER	
IV	Process to process delivery, User datagram protocol (UDP), Transmission control protocol (TCP), Data traffic, Congestion, Congestion control, Quality of service, Techniques to improve QOS, Integrated services, Differentiated services, QOS in switched networks.	9
	APPLICATION LAYER	
V	Client server model, Socket interface, Name space, Domain name space, Distribution of name space, DNS in the internet, Resolution, DNS messages, DDNS, Encapsulation, Electronic mail, File transfer, HTTP, World wide web (WWW), Digitizing audio and video, Audio and video compression, Streaming stored audio/video, Streaming live audio/video, Real time interactive audio/video, Voice over IP.	9
Total Instructional Hours		45

Course Outcome

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

CO1: Learn about the Protocol Layering and Physical Level Communication
 CO2: Understand the Data Communication System and the purpose of Layered Architecture.
 CO3: Analyze the concepts of Routing Methods and Subnetting.
 CO4: Design protocols for various functions in the Network.
 CO5: Understand the functions and Protocols of the Transport Layer.

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TEXT BOOK:

T1: Larry Peterson, Bruce Davie, “Computer Networks: A Systems Approach”, Elsevier, Online Edition, 2019.
T2: Paul Goransson, Chuck Black and Timothy Culver, “Software Defined Networks - A Comprehensive Approach”, Elsevier, Second Edition, 2017.

REFERENCES:

R1: James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, Pearson Education, Seventh Edition, 2017.
R2: Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, Second Edition, 2015.
R3: Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw – Hill, Fifth Edition, 2013.
R4: Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill Publishers, 2011.




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Programme BE	Course Code 19EC5231	Name of the Course PRINCIPLES OF MICROPROCESSORS AND MICRO CONTROLLERS	L 3	T 0	P 0	C 3
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- Course Objective**
1. Study the Architecture of 8085 and 8086 microprocessor.
 2. Learn the design aspects of I/O and Memory Interfacing circuits.
 3. Study about communication and bus interfacing.
 4. Study the Architecture of 8051 microcontroller
 5. Study the concepts of microcontroller interfacing

Unit	Description	Instructional Hours
	8086 MICROPROCESSOR	
I	Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming – Modular Programming - Interrupts and interrupt service routines. Case study: 15 and 17 processors	9
	8086 SYSTEM BUS STRUCTURE	
II	8086 signals – Basic configurations – System bus timing –System design using 8086 – Introduction to Multiprogramming – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.	9
	I/O INTERFACING	
III	Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer Interface – Keyboard /display controller – Interrupt controller – DMA controller.	9
	8051 MICROCONTROLLER	
IV	Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.	9
	PROGRAMMING/INTERFACING MICROCONTROLLER	
V	Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor.	9
	Total Instructional Hours	45

- Course Outcome**
- CO1: Design and implement programs on 8086 microprocessor.
 CO2: Design I/O circuits.
 CO3: Design Memory Interfacing circuits.
 CO4: Design and implement 8051 microcontroller based systems.
 CO5: Design various interfacing and its programming methodologies

TEXT BOOKS:

- T1 Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Prentice Hall of India, 2011.

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- T2 Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011

REFERENCE BOOKS:

- R1: Douglas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012
R2: A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", 3rd Edition, Tata McGrawHill, 2012.
R3: Sunil Mathur and Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt Ltd, 2016.
R4: R.S.Gaonkar, "Microprocessor Architecture Programming and Application", with 8085, Wiley Eastern LTD., New Delhi, 2013.



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Programme	Course Code	Name of the Course	L	P	T	C
BE	19CS5203	DATA MINING	3	0	0	3

- Course Objective**
1. To introduce students to the basic concepts and techniques of Data Mining.
 2. To develop skills of using recent data mining software for solving practical problems.
 3. To gain experience of doing independent study and research.
 4. To learn the concepts of data processing.
 5. To perform data mining tasks with relevant tools

Unit	Description	Instructional Hours
I	DATA MINING Motivation -Steps in Data Mining – Architecture - Data Mining and Databases – Data Warehouses – Data Mining functionalities – Classification – Data Mining Primitives – Major issues. DATA PREPROCESSING: Descriptive data summarization -Data Cleaning – Data integration and transformation – Data Reduction – Data discretization and concept hierarchy generation.	9
II	DATA WAREHOUSE and OLAP TECHNOLOGY Need for Data Warehouse- multidimensional data model- Data Warehouse architecture - Data Warehousing to Data mining. MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Frequent item sets, Association rules – mining various kinds of Association rules.	9
III	WEKA TOOL Introduction – Installation- Visualisation – filtering- selecting attributes- other popular packages. CLASSIFICATION TASK: Introduction – Decision trees – Naïve Bayes’ classification Artificial Neural Networks and Support Vector Machines.	9
IV	CLUSTERING AND ESTIMATION CLASSIFICATION AND PREDICTION: Issues regarding classification and prediction -Accuracy and error measures – Evaluating the accuracy of classifiers and predictors. CLUSTER ANALYSIS: Types of data – Partitioning Methods: k means and k Medoids.	9
V	MINING OF TIME SERIES Trend analysis – similarity search – sequence patterns in transactional data bases sequential pattern mining: concepts and primitives. MINING TEXT, MULTIMEDIA AND THE WORLD WIDE WEB: Text data analysis and information retrieval- Dimensionality reduction for text – text mining approaches – similarity search in multimedia data.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Develop understanding level in basic mining concepts and techniques
 - CO2: Develop skills using data mining OLAP and Weka tools
 - CO3: Enhance knowledge in mining software for solving practical problems
 - CO4: Represent concepts of data preprocessing
 - CO5: Read and write own mining algorithms and concepts for research.

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TEXT BOOKS:

- T1: Han Jiawei, Micheline Kamber and Jian Pei “Data Mining: Concepts and Techniques”, Morgan Kaufmann, 2011.
T2: Shawkat Ali A B M, Saleh A. Wasimi, “Data Mining: Methods and Techniques”, Fifth Indian Reprint, Cengage Learning, 2011.

REFERENCE BOOKS:

- R1: Soman K. P., Shyam Diwaker, Ajay V. “Insight into Data Mining Theory and Practice”, Fifth Printing, PHI Learning, 2011.
R2: Arun K Pujari, “Data Mining Techniques”, University Press, 2013.
R3: G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
R4: Daniel T. Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.



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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E	19CS5252	OBJECT ORIENTED ANALYSIS AND DESIGN	2	0	2	3
Course Objective	<ol style="list-style-type: none"> 1. To express software design with UML diagrams 2. To design software applications using OO concepts. 3. To identify various scenarios based on software requirements 4. To transform UML based software design into pattern based design using design patterns 5. To understand the various testing methodologies for OO software 					
Unit	Description	Instructional Hours				
	UNIFIED PROCESS AND USE CASE DIAGRAMS					
I	Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization. Experiments: Document the Software Requirements Specification (SRS) for the Student information system.	6+3				
	STATIC UML DIAGRAMS					
II	Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams. Experiments: Identify use cases and develop the Use Case model for Student information system. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that for Recruitment system.	6+3				
	DYNAMIC AND IMPLEMENTATION UML DIAGRAMS					
III	Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modeling –When to use State Diagrams - Activity diagram – When to use activity diagrams - Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams. <i>Experiments: Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams for Airline/Railway reservation system. Draw relevant State Chart and Activity Diagrams for the same system for Exam registration.</i>	6+3				
	DESIGN PATTERNS					
IV	GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code. <i>Experiments: Improve the reusability and maintainability of the software system by applying appropriate design pattern</i>	5+4				
	TESTING					
V	Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans <i>Experiments: Implement the modified system and test it for various scenarios</i>	6+3				
TOTAL INSTRUCTIONAL HOURS		45				

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Course Outcome	CO1: Express software design with UML diagrams
	CO2: Design software applications using OO concepts.
	CO3: Identify various scenarios based on software requirements.
	CO4: Transform UML based software design into pattern based design using design patterns
	CO5: Understand the various testing methodologies for OO software

TEXT BOOKS:

T1: Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative DevelopmentI, Third Edition, Pearson Education, 2005.

T2: Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

REFERENCE BOOKS :

R1: Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented SoftwareI, Addison-Wesley, 1995.

R2: Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling LanguageI, Third edition, Addison Wesley, 2003.

R3: Simon Bennett, Steve Mc Robb and Ray Farmer, “Object Oriented Systems Analysis and Design Using UML”, Fourth Edition, Mc-Graw Hill Education, 2010.

R4: Paul C. Jorgensen, “Software Testing:- A Craftsman“s Approach”, Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.



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Programme B.E	Course Code 19EC5031	Name of the Course PRINCIPLES OF MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L 0	T 0	P 3	C 1.5
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- Course Objective**
1. To introduce ALP concepts and features
 2. To write ALP for arithmetic and logical operations in 8086 and 8051
 3. To generate waveforms using Microprocessors. CO4: Execute Programs in 8051
 4. To explain the difference between simulator and Emulator
 5. To write ALP Programs for Arithmetic Operations

- | S. No. | Description of the Experiments |
|--------|--|
| | Using 8086 Micro processor and MASM software |
| 1. | Basic arithmetic and Logical operations. |
| 2. | Code conversion and decimal arithmetic. |
| 3. | Matrix operations |
| 4. | Searching |
| 5. | Sorting |
| | Using 8086 Micro processor and Interfacing |
| 6. | Parallel interface |
| 7. | Serial interface |
| 8. | Key board and Display interface |
| 9. | A/D and D/A interface |
| | Using 8051 Micro controller |
| 10. | Basic arithmetic and Logical operations. |
| 11. | Square and Cube program, Find 2's complement of a number |
| 12. | Stepper motor control interface |

Total hours 45

- Course Outcome**
- CO1: Write ALP Programmes for Arithmetic Operations
 CO2: Write ALP for arithmetic and logical operations in 8086 and 8051
 CO3: Generate waveforms using Microprocessors. CO4: Execute Programs in 8051
 CO4: Explain the difference between simulator and Emulator
 CO5: Write ALP Programmes for Arithmetic Operations



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Programme	Course Code	Course Name	L	T	P	C
B.E	19CS5351	INTERNET AND WEB TECHNOLOGY	2	0	2	3
Course Objective	<ol style="list-style-type: none"> To understand the concepts of object oriented programming paradigm. To learn the basics involved in publishing content on the World Wide Web. To expose students to the basic tools and applications used in Web publishing. To understand how web pages are connected to database through JDBC. To know about server side programming 					
Unit	Description					Instructional Hours
	INTRODUCTION TO OBJECT ORIENTED PROGRAMMING					
I	Objected oriented concepts – object oriented programming (review only) — advanced concept in OOP – relationship – inheritance – abstract classes – polymorphism – Object Oriented design methodology – approach – best practices. UML class diagrams – interface – common base class. <i>Illustrative Programs: Polymorphism and inheritance</i>					5+2
	NETWORKING AND SECURITY					
II	Internetworking – Working with TCP/IP – IP address – sub netting – DNS – VPN – proxy servers – firewalls – Client/Server concepts - World Wide Web – components of web application – MIME types, browsers and web servers – types of web content – URL – HTML – HTTP protocol – Web applications – performance – Application servers – Web security. User Experience Design – Basic UX terminology – UXD in SDLC – Rapid prototyping in Requirements. <i>Illustrative programs: write an HTML page that has one input, which can take multiline text and a submit button. Once the user clicks the submit button it should show the number of characters, words and lines in the text entered using an alert message.</i>					6+3
	HTML AND CSS					
III	Client Tier using HTML – Basic HTML tags – Look and feel using CSS – Client side scripting using Java Script and Validations - Document Object Model (DOM). <i>Illustrative programs: Create an XML template to describe the result of students in an examination. The description should include the students roll number, name, three subject names and marks, total marks, percentage and result.</i>					6+3
	JDBC					
IV	Business tier using POJO (Plain Old Java Objects) – Introduction to Frameworks – Introduction to POJO – Multithreaded Programming – Java I/O – Java Database Connectivity (JDBC). <i>Illustrative programs :Write a program for maintaining database by sending queries. Design and implement a servlet book query with a help of JDBC and SQL. Create MS-Acess database, create on ODBC link, complie and execute java JDBC socket.</i>					6+4
	SERVLETS					
V	Presentation tier using JSP – Role of Java EE in Enterprise applications – Basics of Servlets - To introduce server side programming with JSP - Standard Tag Library. <i>Illustrative programs: Write a servlet program to connect database and extract data from the tables and display them, Authenticate the user when he/she submits the login form using the user name and password from the database using JSP.</i>					6+4
Total Instructional Hours					29+16=45	

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Course Outcome	CO1: Understand the concepts of OOP paradigm.
	CO2: Understand the basics of world wide web.
	CO3: Understand the Principles behind the design and construction of Web applications.
	CO4: Apply the concepts of JDBC.
	CO5: Understand about server side programming.

TEXT BOOKS:

- T1: Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
T2: Raj Kamal, "Internet and Web Technologies", Tata McGraw-Hill

REFERENCE BOOKS:

- R1: Douglas E Comer, Internet Book, The: Everything You Need to Know About Computer Networking and How the Internet Works, 4/E, Prentice Hall, 2007.
R2: Jeffrey C. Jackson, Web Technologies: A Computer Science Perspective, Prentice Hall, 2007.
R3: Herbert Schildt, Java: The Complete Reference, McGraw-Hill Professional, 2006.
R4: Ted Wugofski, XML Black Book 2nd Edition , Certification Insider Press




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Programme B.E	Course Code 19CS5352	Name of the Course ADVANCED JAVA PROGRAMMING	L 2	T 0	P 2	C 3
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- Course Objective**
1. To learn GUI concepts using Swing and JavaFX.
 2. To learn network programs using java
 3. To understand concepts needed for distributed and multi-tier applications
 4. To understand Servlets and JDBC to develop web pages.
 5. To understand bean concepts for enterprise application development

Unit	Description	Instructional Hours
I	GUI INTRODUCTION Introducing Swing- swing menus-Introducing JavaFX-Exploring JavaFX Controls- JavaFX Menus. <i>Illustrative Programs: Calculator using Swing, GUI application with controls menus and event handling using JavaFX</i>	4+4(P)
II	NETWORK PROGRAMMING IN JAVA Networking classes and Interfaces-InetAddress- URL classes – URL Connection- Reading data from the server –Reading the Header- writing data to server --Sockets – Client Socket-Server Socket- secure sockets - UDP datagram and Sockets - multicast sockets - sending Email. <i>Illustrative Programs: chat application using TCP/IP, client/server application using UDP Communication, send email from java application.</i>	5+4(P)
III	APPLICATIONS IN DISTRIBUTED ENVIRONMENT Remote method invocation - Activation models - RMI custom sockets - Object serialization - RMI- Iiop implementation -CORBA - IDL technologies - Naming services - CORBA programming model. <i>Illustrative Programs: simple calculator application using RMI, Client/Server Application (Bank Details) using CORBA</i>	5+6(P)
IV	MULTI-TIER APPLICATION DEVELOPMENT: Introduction to servlet - servlet life cycle - Developing and deploying servlets - handling request and response - Introduction to JDBC-JDBC drivers and architectures - CURD operation using JDBC-connecting to non conventional database. <i>Illustrative Programs: Login form validation using servlet, implement CURD operations on student database.</i>	4+4(P)
V	ENTERPRISE APPLICATIONS: Introduction to J2EE – J2EE Architecture and specifications, Client server application, web application, enterprise applications, 2,3 and n-tier applications. J2EE Frameworks: Struts MVC, Hibernate, Spring, J2EE Containers- Web Services Support- Packaging Application. <i>Illustrative Programs: Create Application Helloworld with struts on netbeans, create J2EE Application by integrating Strut+Spring+Hibernate.</i>	5+4(P)
Total Instructional Hours		(23 + 22) 45

- Course Outcome**
- CO1: To make use of GUI concepts in java programs.
- CO2: Use the methods of network programming to create an application.
- CO3: To make the students to develop distributed business applications and multitier applications
- CO4: To develop web pages using advanced server-side programming through servlets and JDBC.
- CO5: To use bean concepts for developing enterprise application.

TEXT BOOKS:

- T1: J. McGovern, R. Adatia, Y. Fain, 2003, J2EE 1.4 Bible, Wiley-dreamtech India Pvt. Ltd, New Delhi.
T2: H. Schildt, 2002, Java 2 Complete Reference, 5th Edition, Tata McGraw Hill, New Delhi.

REFERENCE BOOKS:

- R1: Hortsman & Cornell, "core Java 2 Advanced Feature, 9th Edition", Pearson Education, 2013.
R2: Ed Roman, "Mastering Enterprise Java Beans", John Wiley & sons Inc., 1999.
R3: Elliotte Rusty Harold, "Java Network programming", O'Reilly publishers, 2000.
R4: Patrick Naughton, "Complete Reference: Java2, 9th Edition", Tata McGraw-Hill, 2003




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Dean-Academics

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E	19CS5353	FUNDAMENTALS OF OPEN SOURCE SOFTWARE	2	0	2	3
Course Objective	1. To understand open source operating systems and application 2. To understand MYSQL database with Query 3. To learn programming using a Server Side Script language. 4. To study python programming language and understand the features. 5. To understand how object oriented database is connecting to python.					
Unit	Description					Instructional Hours
I	INTRODUCTION Introduction to Open sources – Need of Open Sources – Advantages of Open Sources– Application of Open Sources. List of open source software and open source hardware -Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux. <i>Illustrate Programs: Windows and Linux installation with dual boot, Micro kernel installation like MYSQL, PHP and PYTHON.</i>					6+3
II	OPEN SOURCE DATABASE MySQL: Introduction – Setting up account – Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata – Using sequences –MySQL and Web. <i>Illustrate Programs:..DML and DDL command using MYSQL</i>					6+3
III	OPEN SOURCE PROGRAMMING LANGUAGES PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Debugging and error handling, case study- Symfony. <i>Illustrate Programs: Running PHP: Simple applications like login form, File handling ,Exception handling and Database connectivity using PHP</i>					6+3
IV	PYTHON: Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment. Illustrate Programs: control flow statement, string manipulation and function by using python, create class and object using python, File handling and Exception handling using python.					5+4
V	PYTHON DATABASES AND PERSISTENCE Persistence options in python-DBM Files-Pickled Objects-Shelve Files-The ZODB Object- Oriented Database-SQL Database Interfaces- ORMs: Object Relational Mappers- PyForm: A Persistent Object Viewer. <i>Illustrate Programs: Database connectivity.</i>					6+3
TOTAL INSTRCTIONAL HOURS						45
Course Outcome	CO1. Understand open source operating systems and application. CO2. Develop MYSQL query. CO3. Develop PHP program with database connection. CO4. Create a python program using exception. CO5. Develop a python application using database.					

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TEXT BOOKS:

- T1.Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2003
T2.Steve Suchring, "MySQL Bible", John Wiley, 2002

REFERENCE BOOKS :

- R1: Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002
R2: Wesley J. Chun, "Core Python Programming", Prentice Hall, 2001
R3: Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
R4: Vikram Vaswani, "MYSQL: The Complete Reference", 2nd Edition, Tata McGraw- Hill Publishing Company Limited, Indian Reprint 2009.




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Programme B.E	Course Code 19CS5354	Name of the Course R Programming	L	T	P	C
			2	0	2	3
Course Objective	1. To learn the basics of R Programming and R overview. 2. To learn the R functions and R strings. 3. To discuss about the R package and R files. 4. To understand the R data base and R charts. 5. To learn the concepts of R linear & non linear regression, R distribution.					
Unit	Description					Instructional Hours
I	R Overview: Evolution of R – Features of R - What is R? - Why R?-Installing R - R environment – R basic syntax – R data types – R variables – R constants- R operators. <i>Illustrative programs: Take input from the user, Addition of two numbers.</i>					9
II	R Functions and Strings: R Decision Making – R Loops – R Functions – R Strings – R Vectors – R List – Matrices – R Arrays – R Factors – R data frame. <i>Illustrative programs: factorial of given number, Prime Number, Sum of natural numbers, Create an array two 3x3 matrices.</i>					9
III	R Package and R Files: R Packages – R Data reshaping – R CSV Files - R Excel File – R Binary files – R XML Files – R JSON Files. <i>Illustrative programs: Joining column and rows in data frame, Create and read the XML file for employee details.</i>					9
IV	R Data base and R charts: R Web data – R data base – R Pie chart – R Bar chart – R Box Plots – R histogram – R Line Graphs – R Scatter plots – R Mean , Median, Mode. <i>Illustrative programs: pie chart in the current R working directory, boxplot graph for the relation between mpg (miles per gallon) and cyl (number of cylinders).</i>					9
V	R Linear Regression, Non Linear Regression, R Distribution: R Linear Regression - R Multiple Regression - R Logistic Regression - R Normal, Binominal distribution – R Poisson regression – R Time series analysis – R Nonlinear least square – R decision tree. <i>Illustrative programs: height of the probability distribution at each point for a given mean and standard deviation.</i>					9
Total Instructional Hours						45
Course Outcome	CO1: Understand the fundamentals of R Programming. CO2: Design the program using R functions and R String. CO3: Develop the application using R packages and R files. CO4: Understand and design the application using R database and R charts. CO5: Design the application using R linear & non linear regression, R distribution.					

TEXT BOOKS:

- T1: “Hands-On Programming with R”, Garrett Grolemond, First Edition.
 T2: Lawrence Leemis. *Learning Base R*. Lightning Source, 2016.

REFERENCE BOOKS:

HICET – Department of Computer Science and Engineering

- R1: Torsten Hothorn and Brian S. Everitt. *A Handbook Using R*. Chapman & Hall/CRC Press, Boca Raton, Florida, USA, 3rd edition, 2014.
- R2: Ruey S. Tsay. *Multivariate Time Series Analysis With R and Financial Applications*. John Wiley, New Jersey, 2014.
- R3: Michael J. Crawley. *An Introduction using R*. Wiley, 2nd edition, 2014.
- R4: Mark Gardener. *Beginning R*. First Edition, Wrox Publication, 2012.



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1. Programme	Course Code	Course Name	L	T	P	C
3. BE3	19CS6181	PRINCIPLES OF MANAGEMENT	3	0	0	3

Course Objective:

1. To study the evolution of Management and learn the functions and responsibilities of managers.
2. To Plan and know the tools and techniques to be used in the performance of the managerial job.
3. To enable them to analyze and understand the environment of the organization.
4. To understand the proper vocabulary to communicate effectively.
5. To comprehend the cognizance of the importance of control methods.

Unit

Description

Instructional Hours

	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	
I	Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.	9
	PLANNING	
II	Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.	9
	ORGANISING	
III	Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management	9
	DIRECTING	
IV	Foundations of individual and group behavior – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.	9
	CONTROLLING	
V	System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.	9
	Total Instructional Hours	45

Course Outcome

- CO1: Understand the functions and responsibilities of managers.
- CO2: Interpret the planning, policies, various tools and techniques.
- CO3: Solve organizational problems and develop optimal managerial decisions.
- CO4: Importance of proper vocabularies to articulate ones own position and communicate effectively.
- CO5: Grasp both qualitative and quantitative information and formulate best control methods.

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TEXT BOOKS:

- T1: Stephen P. Robbins & Mary Couifer, —Management, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
- T2: JAF Stoner, Freeman R.E and Daniel R Gilbert —Management, Pearson Education, 6th Edition, 2004.

REFERENCE BOOKS:

- R1: Stephen A. Robbins & David A. Decenzo & Mary Coulter, —Fundamentals of Management Pearson Education, 7th Edition, 2011.
- R2: Robert Kreitner & Mamata Mohapatra, — Management, Biztantra, 2008.
- R3: Harold Koontz & Heinz Weihrich —Essentials of management Tata McGraw Hill, 1998.
- R4: Tripathy PC & Reddy PN, —Principles of Management, Tata McGraw Hill, 1999.



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Programme: BE C
 Course Code: 19CS6201
 Name of the Course: ARTIFICIAL INTELLIGENCE
 L T P C: 3 1 0 4

- Course Objective**
1. To understand the various characteristics of Intelligent agents
 2. To learn the different search strategies in AI
 3. To learn to represent knowledge in solving AI problems
 4. To understand the different ways of designing software agents.
 5. To know about the various applications of AI.

Unit	Description	Instructional Hours
	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	
I	Introduction-Definition - The Foundations of Artificial Intelligence - The History of Artificial Intelligence - Future of Artificial Intelligence - Agents and Environments - Good Behavior: The Concept of Rationality - The Nature of Environments - The Structure of Agents.	10
	SOLVING PROBLEMS BY SEARCHING	
II	Problem - Solving Agents - Example Problems - Searching for Solutions - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions. BEYOND CLASSICAL SEARCH: Local Search Algorithms and Optimization Problems - Local Searching Continuous Spaces - Searching with Non-deterministic Actions - Searching with Partial Observations. ADVERSARIAL SEARCH: Stochastic Games.	13
	KNOWLEDGE AND REASONING	
III	Knowledge - Based Agents - The Wumpus World - Logic - Propositional Logic: A Very Simple Logic - Propositional Theorem Proving - Effective Propositional Model Checking - Agents Based on Propositional Logic. FIRST ORDER LOGIC: Representation Revisited - Syntax and Semantics of First - Order Logic - Using First - Order Logic - Knowledge Engineering in First - Order Logic.	13
	PLANNING AND ACTING IN THE REAL WORLD	
IV	Time, Schedules, and Resources - Hierarchical Planning - Planning and Acting in Non-deterministic Domains - Multi-agent Planning. KNOWLEDGE REPRESENTATION: Ontological Engineering - Categories and Objects - Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information - The Internet Shopping World.	12
	APPLICATIONS	
V	AI applications - Language Models - Information Retrieval- Information Extraction - Natural Language Processing - Machine Translation - Speech Recognition - Robot - Hardware - Perception - Planning - Moving	12
	Total Instructional Hours	60

- Course Outcome**
- CO1: Understand the various characteristics of Intelligent agents
 - CO2: Learn the different search strategies in AI
 - CO3: Learn to represent knowledge in solving AI problems
 - CO4: Understand the different ways of designing software agents
 - CO5: Learn about the various applications of AI.

TEXT BOOKS:
 1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.

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REFERENCE BOOKS:

- R1: Ed Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
- R2: M.J. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science), Jones and Bartlett Publishers, Inc., First Edition, 2008
- R3: Nils J. Nilsson, —The Quest for Artificial Intelligence, Cambridge University Press, 2009.
- R4: William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.
- R5: Gerhard Weiss, —Multi Agent Systems, Second Edition, MIT Press, 2013.



S. J.
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Programme: BE Course Code: 19CS6251R Name of the Course: COMPILER DESIGN L T P C: 2 2 0 3 3.5

- Course Objective**
1. To learn the design principles of a Compiler.
 2. To learn about the Lexical analysis.
 3. To learn about Syntax analysis.
 4. To apply the concepts for syntax directed translation and run time environment.
 5. To apply the concepts of code optimization and code generation.

Unit	Description	Instructional Hours
	INTRODUCTION TO COMPILERS	
I	Introduction - Analysis of the source program -Translators-Compilation and Interpretation- Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools. <i>Illustrative programs: Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs, comments and new lines. Design a LEX code to construct a DFA which accepts the language: all the strings ending with "11" over inputs '0' and '1'.</i>	4+2
II	LEXICAL ANALYSIS Lexical Analysis-Need and Role of Lexical Analyzer- Lexical Errors- Specification and Recognition of tokens -Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analyzers-LEX. Case Study: Flex, Flex++ a fast scanner generator. <i>Illustrative programs: Implementation of Lexical Analyzer using JLex, flex or other lexical analyser generating tools</i>	8+3
III	SYNTAX ANALYSIS Syntax analysis-Need and Role of the Parser- Top Down Parsing - Recursive Descent Parser Predictive Parser-LL(1) Parser-Bottom Up Parsing-Shift Reduce Parser- LR(0), SLR(1), LALR(1), CLR(1) parsers - Error Handling and Recovery in Syntax Analyzer- Case Study: Bison, YACC compatible Parser Generator. <i>Illustrative programs: Implementation of LR(0), SLR(1) Parsing- Implementation of Symbol Table and YACC. Implement an YACC program for Binary to Decimal Conversion, Write YACC program to recognize string with grammar. { aⁿbⁿ n ≥ 0 }</i>	8+6
IV	SYNTAX DIRECTED TRANSLATION & RUN TIME ENVIRONMENT Syntax directed Definitions-S-attributed definitions - L-attributed definitions - Construction of Syntax Tree- Bottom-up and Top-down translation - type checking-Type Conversions. Case Study: Applying Syntax directed Translation in python language to generate syntax tree RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Parameter Passing-Symbol Tables- Dynamic Storage Allocation- <i>Illustrative programs: Implement type checking. Implement any one storage allocation strategies(Heap, Stack, Static).</i>	8+6
V	CODE OPTIMIZATION AND CODE GENERATION Intermediate code generation - Intermediate languages - Declarations - Assignment statements-DAG -Introduction to code optimization - Principal sources of optimization - Optimization of Basic Blocks -Introduction to global data-flow analysis- Implement control flow analysis and Data flow Analysis- Construction of DAG. <i>Illustrative programs: Implementation of Simple Code Optimization Techniques (Constant Folding, Constant Propagation, Common Sub-Expression Elimination, Code Movement, Dead Code Elimination, Strength Reduction)</i>	3+6

Total Instructional Hours 54

- Course Outcome**
- CO1: Learn the design principles of a Compiler.
 - CO2: Learn about the Lexical analysis.

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- CO3: Learn about Syntax analysis.
- CO4: Apply the concepts for syntax directed translation and run time environment.
- CO5: Apply the concepts of code optimization and code generation.

TEXT BOOKS:

- T1: Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers - Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.
- T2: Aho A. V., Ullman J.D. Principles of Compiler Design, Narosa.

REFERENCE BOOKS:

- R1: Robert E. Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
- R2: Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
- R3: Keith D. Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
- R4: Charles N. Fischer, Richard J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008.



S.M. ✓

1/8/17

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Programme Course Code Name of the Course L T P C
 B.E. 19CS6252 **MOBILE COMPUTING AND APPLICATION DEVELOPMENT** 2 0 2 3

Course Objective

1. To understand the basic concepts of mobile computing and develop mobile applications using GUI, Layouts and Event Listener.
2. To learn the basics of mobile telecommunication system and to develop mobile applications using GPS
3. To be familiar with the network layer protocols and Ad-Hoc networks.
4. To know the basis of transport layer protocols.
5. To gain knowledge about application Layer and to analyze and discover own mobile application for simple needs.

Unit	Description	Instructional Hours
I	INTRODUCTION Introduction to Mobile Computing – Applications of Mobile Computing- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA. <i>Illustrative programs: Develop an application that uses GUI components; Font , Colours, Layout Managers and event listeners.</i>	(6+3)
II	MOBILE TELECOMMUNICATION SYSTEM Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Localization and calling - Handover – Security –GPRS – Services & Architecture – Protocols - UMTS – Architecture – Handover – Security. <i>Illustrative programs: a) Write an application that draws basic graphical primitives on the screen b) Develop a native application that uses GPS location information</i>	(6+3)
III	MOBILE NETWORK LAYER Mobile IP – DHCP – Mobile AdHoc Networks – Routing, DSDV, DSR, AODV , Vehicular Ad Hoc networks (VANET) –MANET Vs VANET. <i>Illustrative programs: a) Implement an application that writes data to the SD card. b) Implement an application that creates an alert upon receiving a message</i>	(6+3)
IV	MOBILE TRANSPORT LAYER Traditional TCP– Congestion control, Slow start, Fast retransmit /Fast recovery , Implications of Mobility, Classical TCP – Indirect, Snooping, Mobile TCP- Fast retransmit /Fast recovery , Transmission/Time-out freezing, Selective Retransmission – Transaction Oriented TCP. <i>Illustrative programs: a) Create an android application using Fragments b) Develop an Android Application that creates Alarm Clock.</i>	(6+3)
V	MOBILE APPLICATION LAYER WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML. <i>Illustrative programs: Develop a Mobile application for simple needs (Mini Project)</i>	(6+3)
Total Instructional Hours		45

Course Outcome

- CO1: Explain the basics of mobile telecommunication systems and develop mobile applications using GUI, Layouts and Event Listener.
- CO2: Illustrate the generations of telecommunication systems in wireless networks and to develop mobile applications using GPS.
- CO3: Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
- CO4: Explain the functionality of Transport layer.
- CO5: Understand about the functionality of Application Layer and to analyze, and discover own mobile application for simple needs.

TEXT BOOKS:

- T1: Jochen Schiller, —Mobile CommunicationsI, PHI, Second Edition, 2003.
- T2: Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile ComputingI, PHI Learning Pvt.Ltd; New Delhi – 2012

REFERENCE BOOKS:

- R1: Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
- R2: Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile ComputingI, Springer, 2003.
- R3: William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital SystemsI, Second Edition,TataMcGraw Hill Edition, 2006.
- R4: C.K.Toth, —AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002.



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PROGRAMME B.Tech	COURSE CODE 19IT6003	NAME OF THE COURSE Project Based Learning (Common to CSE, ECE, AIML)	L 0	T 0	P 3	C 1.5
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- Course Objective**
1. To help the students look into the functioning of simple to complex devices and systems
 2. To enable the students to design and build simple systems on their own
 3. To help experiment with innovative ideas in design and team work
 4. To create an engaging and challenging environment in the engineering lab

COURSE ASSESSMENT METHODS:

DIRECT

1. Project reviews 50%
2. Workbook report 10%
3. Demonstration & Viva – voce 40%

IN-DIRECT

1. Course-end survey

Content:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines. In the fifth semester, students will focus primarily on Design and developing a prototype.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the Engineering Clinics Expo at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Total Practical Hours

45

S.No	Project Title	Technology	Domain
1.	A Gesture-based Tool for Sterile Browsing of Radiology Images	Artificial Intelligence	Health Care
2.	A new hint to transportation - Analysis of the NYC bike share system	Data Analytics	Transport
3.	A Novel Method for Handwritten Digit Recognition System	Artificial Intelligence	Education

4.	AI based discourse for Banking Industry	Artificial Intelligence	Banking & Finance
5.	AI-based localization and classification of skin disease with erythema	Artificial Intelligence	Health Care
6.	AI-powered Nutrition Analyzer for Fitness Enthusiasts	Artificial Intelligence	Health Care
7.	Airlines Data Analytics for Aviation Industry	Data Analytics	Logistic & Transport
8.	Analytics for Hospitals Health-Care Data	Data Analytics	Health Care
9.	Car Resale value Prediction	Applied Data Science	Retails & E-Commerce
10.	Classification of Arrhythmia by Using Deep Learning with 2-D ECG Spectral Image Representation	Artificial Intelligence	Health Care
11.	Containment Zone Alerting Application	Cloud Application Development	Logistic & Transport
12.	Corporate Employee Attrition Analytics	Data Analytics	Banking & Finance
13.	Crude Oil Price Prediction	Artificial Intelligence	Retails & E-Commerce
14.	Customer Care Registry	Cloud Application Development	Retails & E-Commerce
15.	Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy	Artificial Intelligence	Health Care
16.	Detecting Parkinsons Disease using Machine Learning	Applied Data Science	Health Care
17.	Developing a Flight Delay Prediction Model using Machine Learning	Applied Data Science	Logistic & Transport
18.	Early Detection of Chronic Kidney Disease using Machine Learning	Applied Data Science	Health Care
19.	Efficient Water Quality Analysis and Prediction using Machine Learning	Applied Data Science	Water
20.	Emerging Methods for Early Detection of Forest Fires	Artificial Intelligence	Climate Change
21.	Exploratory Analysis of Rain Fall Data in India for Agriculture	Applied Data Science	Rural & Agriculture Development
22.	Fertilizers Recommendation System For Disease Prediction	Artificial Intelligence	Banking & Finance
23.	Gas Leakage Monitoring And Alerting System	Internet Of Things (IoT)	Safety
24.	Hazardous Area Monitoring For Industrial Plant Powered By IoT	Internet Of Things (IoT)	Safety
25.	Industry-Specific Intelligent Fire Management System	Internet Of Things (IoT)	Safety
26.	Intelligent Vehicle Damage Assessment and Cost Estimator for Insurance Companies	Artificial Intelligence	Banking & Finance
27.	Inventory Management System for Retailers	Cloud Application Development	Retails & E-Commerce
28.	IoT Based Safety Gadget For Child Safety Monitoring And Notification	Internet Of Things (IoT)	Safety
29.	IoT Based Smart Crop Protection System For Agriculture	Internet Of Things (IoT)	Rural & Agriculture Development
30.	Machine Learning based Vehicle Performance Analyzer	Applied Data Science	Logistic & Transport
31.	Natural Disasters Intensity Analysis and Classification using Artificial Intelligence	Artificial Intelligence	Climate Change

32.	News Tracker Application	Cloud Application Development	Education
33.	Nutrition Assistant Application	Cloud Application Development	Health Care
34.	Personal Assistance For Seniors Who Are Self-Reliant	Internet Of Things (IoT)	Accessibility & Assistance
35.	Personal Expense Tracker Application	Cloud Application Development	Banking & Finance
36.	Plasma Donor Application	Cloud Application Development	Education
37.	Real-Time Communication System Powered by AI for Specially Abled	Artificial Intelligence	Health Care
38.	Real-Time River Water Quality Monitoring And Control System	Internet Of Things (IoT)	Water
39.	Retail Store Stock Inventory Analytics	"	Data Analytics"
40.	Signs With Smart Connectivity For Better Road Safety	Internet Of Things (IoT)	Safety
41.	Skill and Job Recommender	Cloud Application Development	Education
42.	Smart Fashion Recommender Application	Cloud Application Development	Retails & E-Commerce
43.	Smart Lender - Applicant Credibility Prediction for Loan Approval	Applied Data Science	Banking & Finance
44.	Smart Solutions For Railways	Internet Of Things (IoT)	Logistic & Transport
45.	Smart Waste Management System For Metropolitan Cities	Internet Of Things (IoT)	Climate Change
46.	SmartFarmer - IoT Enabled Smart Farming Application	Internet Of Things (IoT)	Smart Farming
47.	Trip Based Modeling of Fuel Consumption in Modern Fleet Vehicles Using Machine Learning	Applied Data Science	Climate Change
48.	University Admit Eligibility Predictor	Applied Data Science	Education
49.	VirtualEye - Life Guard for Swimming Pools to Detect Active Drowning	Artificial Intelligence	Safety
50.	Visualizing and Predicting Heart Diseases with an Interactive Dash Board	Data Analytics	Health Care
51.	Web Phishing Detection	Applied Data Science	Cyber Security

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Programme	Course Code	Name of the Course	L	T	P	C
BE	19CS6301	BUSINESS INTELLIGENCE – DATA WAREHOUSING AND ANALYTICS	3	0	0	3

- Course Objective**
1. To study about Transaction Processing and Analytical applications.
 2. To demonstrate Business Intelligence framework.
 3. To demonstrate Data Warehouse implementation and methodology.
 4. To apply a business scenario, identify the metrics, indicators to achieve the business goal
 5. To apply application of concepts using open source/MS Office

Unit	Description	Instructional Hours
I	INTRODUCTION TO BUSINESS INTELLIGENCE Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP).	9
II	BUSINESS INTELLIGENCE PROCESS AND FRAMEWORK BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.	9
III	BASICS OF DATA INTEGRATION (EXTRACTION TRANSFORMATION LOADING) Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data - types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle)	9
IV	INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using Microsoft Excel	9
V	BASICS OF ENTERPRISE REPORTING A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards	9
TOTAL INSTRUCTIONAL HOURS		45

- Course Outcome**
- CO1: Understand difference between Transaction Processing and Analytical applications and describe the need for Business Intelligence
 - CO2: Demonstrate to understand technology and processes associated with Business Intelligence framework
 - CO3: Demonstrate to understand Data Warehouse implementation methodology and project life cycle
 - CO4: Formulate given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal
 - CO5: Demonstrate application of concepts using open source/MS Office

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TEXT BOOKS:

T1: “Fundamentals of Business Analytics” by R.N.Prasad and Seema Acharya, Wiley 2011.

T2: “Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things” by Bernard Marr

REFERENCE BOOKS:

R1: Business Intelligence by David Loshin, Second Edition, Elsevier, 2012.

R2: Business intelligence for the enterprise by Mike Biere, IBM Press, 2003.

R3: Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre, Addison-Wesley Professional, 2003.

R4: “Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales” by Victor Finch



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HICET – Department of Computer Science and Engineering

Programme	Course Code	Name of the Course	L	T	P	C
BE	19CS6302	EMBEDDED SYSTEMS	3	0	0	3

- Course Objective**
1. Learn the architecture and programming of ARM processor.
 2. Be familiar with the embedded computing platform design and analysis.
 3. Be exposed to the basic concepts of real time Operating system design.
 4. Learn the system design techniques and networks for embedded systems
 5. Learn the basic concepts of embedded system to develop the realtime applications.

Unit	Description	Instructional Hours
	INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS	
I	Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries – ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption..	9
	EMBEDDED COMPUTING PLATFORM DESIGN	
II	The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis – Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.	9
	PROCESSES AND OPERATING SYSTEMS	
III	Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems- POSIX-Windows CE.	9
	SYSTEM DESIGN TECHNIQUES AND NETWORKS	
IV	Design methodologies- Design flows – Requirement Analysis – Specifications- System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.	9
	CASE STUDY	
V	Data compressor – Alarm Clock – Audio player – Software modem-Digital still camera – Telephone answering machine-Engine control unit – Video accelerator.	9
	Total Instructional Hours	45

- Course Outcome**
- CO1: Understand the architecture and programming of ARM processor.
 - CO2: Understand and remember the concepts of embedded computing platform design and analysis.
 - CO3: Understand the basic concepts of real time Operating system design.
 - CO4: Apply the system design techniques to develop software for embedded systems.
 - CO5: Apply the embedded-system concepts to develop the real time applications.

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TEXT BOOKS:

- T1: Marilyn Wolf, "Computers as Components – Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
T2: Shibu. K.V, "Introduction to Embedded Systems", 2e, Mc graw Hill, 2017.

REFERENCE BOOKS:

- R1: Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
R2: David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
R3: Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall,1999.
R4: C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997.



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Programme	Course Code	Name of the Course	L	T	P	C
BE	19CS6304	BIG DATA ANALYTICS AND TOOLS	3	0	0	3
Course Objective	1. To know the fundamental concepts of big data and analytics					
	2. To explore various tools and practices for working with big data					
	3. To learn about stream computing and its importance					
	4. To know about the applications and researches in integration of large amounts of data					
	5. To apply the logics of security in handling large amount of data					
Unit	Description	Instructional Hours				
I	INTRODUCTION TO BIG DATA: Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data Storage – A General Overview of High-Performance Architecture – HDFS – MapReduce and YARN – Map Reduce Programming Model	9				
II	ACHIEVING ORGANIZATIONAL ALIGNMENT FOR BIG DATA ANALYTICS: The Culture Clash Challenge- Aspects of Adopting- Right Decision Makers -Roles-Developing a strategy for Integrating Big data Analytics into Enterprise- Strategic Plan-Practices- Acceptability- Scalability- Data Reuse-Oversight and Governance-Mainstream Technology. <i>Case Study: Enterprise Integration- Exercises</i>	9				
III	MINING AND MAPREDUCE CONCEPTS: Data Mining- Statistical Limits on Data Mining- MapReduce and the New Software Stack-Distributed File Systems- MapReduce- Algorithms Using MapReduce-Extensions to MapReduce- Applications of Near- Neighbor Search- Shingling of Documents-Similarity-Preserving Summaries of Sets	9				
IV	STREAM MEMORY: Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications. <i>Case Studies – Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics</i>	9				
V	NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION: NoSQL Databases : Schema-less Models! Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases <i>Case Study: Google's Big Table and its security.</i>	9				
		Total Instructional Hours	45			
Course Outcome	CO1: Better understanding to work with big data tools and its analysis techniques					
	CO2: Explore about various tools and practices for working with big data					
	CO3: Learn about stream computing and its importance					
	CO4: Understand about the applications and researches in integration of large amounts of data					
	CO5: Apply the logics of security in handling large amount of data					

TEXT BOOKS:

T1: Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

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- T2: David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

REFERENCE BOOKS:

- R1: EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
R2: Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
R3: Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
R4: Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.



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Programme BE	Course Code 19CS6305	Name of the Course SOFT COMPUTING	L T P C 3 0 0 3
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Course Objective	<ol style="list-style-type: none"> 1. To learn the basic concepts of Soft Computing. 2. To apply Artificial Neural Networks and various categories of ANN. 3. To become familiar with various techniques like neural networks. 4. To apply fuzzy systems, fuzzy logic and its techniques to solve problems. 5. To learn the concepts of Genetic algorithms based solutions for real-world and engineering problems.
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Unit	Description	Instructional Hours
I	INTRODUCTION TO SOFT COMPUTING: Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.	9
II	ARTIFICIAL NEURAL NETWORKS: Back propagation Neural Networks – Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network – Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines – Spike Neuron Models.	9
III	FUZZY SYSTEMS: Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification – Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning – Introduction to Fuzzy Decision Making.	9
IV	GENETIC ALGORITHMS: Basic Concepts- Working Principles -Encoding-Fitness Function – Reproduction -Inheritance Operators – Cross Over – Inversion and Deletion -Mutation Operator – Bit-wise Operators -Convergence of Genetic Algorithm.	9
V	HYBRID SYSTEMS: Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination – LR-Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP- Inference by Fuzzy BP – Fuzzy ArtMap: A Brief Introduction – Soft Computing Tools – GA in Fuzzy Logic Controller Design – Fuzzy Logic Controller.	9
Total Instructional Hours		45

Course Outcome	<p>CO1: Apply various soft computing concepts for practical applications.</p> <p>CO2: Choose and design suitable neural network for real time problems.</p> <p>CO3: Explain the importance of optimization techniques and neural networks.</p> <p>CO4: Use fuzzy rules and reasoning to develop decision making and expert system.</p> <p>CO5: Review the various hybrid soft computing techniques and apply in real time problems.</p>
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TEXT BOOKS:

- T1: N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
- T2: S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.

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REFERENCE BOOKS:

- R1: Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, —Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
- R2: Kwang H.Lee, —First course on Fuzzy Theory and Applications, Springer, 2005.
- R3: George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.
- R4: S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.



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Programme
B.E.

Course Code
19CS6307

Name of the Course

RESPONSIVE WEB DESIGN AND
DEVELOPMENT

L T P C
3 0 0 3

Course
Objective

1. To identify the various issues of web design process and evaluation..
2. To determine templates for web pages and layout.
3. To develop simple web applications using scripting languages..
4. To determine the various issues of web project development.
5. To address the core issues of web page maintenance and evaluation.

Unit	Description	Instructional Hours
I	INTRODUCTION TO HTML AND XHTML Origins and Evolution of HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Formatting - Images - Hypertext Links – Lists - Tables - Frames and Forms.	6
II	CASCADING STYLE SHEETS Introduction - Levels of Style Sheets - Style Specification Formats – Style Classes - Properties and Property Values - Color - The span and div Tags.	7
III	HTML 5 Media Queries supporting different viewports – Syntax - Fluid Layouts- Fluid Images- Serving Different Images for different screen sizes - HTML 5 for responsive designs - semantic elements in HTML5 – Embedding Media in HTML5.	10
IV	CSS 3 Selectors - Typography and Color Modes – Aesthetics with CSS3 – Text shadows - Box shadows - Background Gradients – patterns - Multiple Background images Transitions - Transformations and Animations Forms with HTML5 and CSS3.	10
V	BASICS OF JAVASCRIPT Basic OOPS Concepts - Introduction to JavaScript - JavaScript & HTML – The DOM: Objects in the Browser - Conditionals & Control Flow - Repetitive Code. <u>JavaScript framework: Angular JS, Express JS, Jest.</u> jQUERY: Introduction to jQuery - Working with jQuery Objects – Reading JavaScript Documentation - Libraries, Plugins, and Widgets - Loops, Chaining and Refactoring - Using jQuery Plugins.	12
Total Instructional Hours		45

Course
Outcome

- CO1: Identify the various issues of web design process and evaluation.
CO2: Determine templates for web pages and layout.
CO3: Develop simple web applications using scripting languages.
CO4: Determine the various issues of web project development.
CO5: Address the core issues of web page maintenance and evaluation.

TEXT BOOKS:

- T1: Ben Frain, —Responsive Web Design using HTML5 and CSS3, PACKT Publishing, 2012.
T2: Thomas Powell and Fritz Schneider, Javascript 2.0 : The Complete reference, Tata McGraw Hill,2012.

REFERENCE BOOKS:

- R1: Thomas Powell, — HTML and CSS: The Complete Referencel, Tata McGraw Hill, 2010.
- R2: Jehl, Scott, Marcotte, Ethan (2014), Responsible responsive design. New York : A Book Apart (188 p).
- R3: <http://webdesignbyolga.com/responsive/>
- R4: Ethan Marcotte, "Responsive Web Design", May 25, 2010



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Programme	Course Code	Name of the Course	L T P C
	19CS6306	INTRODUCTION TO MACHINE LEARNING MODELS	

- Course Objective**
1. To understand the need for machine learning for various problem solving
 2. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
 3. To learn the new approaches in machine learning
 4. Watson Studio provides you with the environment and tools to solve your business problems by collaboratively working with data.
 5. You can choose the tools you need to analyze and visualize data, to cleanse and shape data, to ingest streaming data, or to create and train machine learning models.

Unit	Description	Instructional Hours
	INTRODUCTION TO MACHINE LEARNING	
I	Machine learning Introduction-Types of Machine learning -Supervised, Unsupervised and reinforcement-Over fitting and Regression-Classification-Clustering-Parametric vs non-Parametric models-Linear model	9
	INTRODUCTION TO IBM CLOUD	
II	Introduction to IBM cloud- Resources-IBM Cloud Infrastructure- Security-IBM Cloud Foundry-Cloud Park for data- IBM cloud vs Amazon cloud - Cloud Native Storage and Data Service	9
	INTRODUCTION TO WATSON STUDIO	
III	Introduction to Watson studio- Project creation- Storage- Access control- Prebuilt Watson application- Watson Solutions- Catalog and govern data	9
	MACHINE LEARNING IN WATSON	
IV	Watson knowledge studio and Watson knowledge catalog-Watson Discovery Services-Watson Auto AI-Watson Open Scale- visual recognition- Watson API	9
	NATURAL LANGUAGE PROCESSING	
V	NLP Introduction-Natural language Understanding (NLU)-Conversational AI-Building blocks of chatbot-Watson Assistant-Speech to Text -Text to speech.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Analyze methods and theories in the field of machine learning
 - CO2: Understand an introduction to the basic principles, techniques
 - CO3: Watson studio helps enterprises simplify the process of experimentation to deployment, speed data exploration and model development and training

CO4: Demonstrate AI model.
CO5: Analyze AI model

TEXT BOOKS:

T1 :IBM CourseWare

REFERENCE BOOKS:

R1: Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

R2: Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.




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Programme	Course Code	Name of the Course	L	T	P	C
	19CS6253	PREDICTIVE MODELLING				

Course Objective

1. To learn how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.
2. To know the use of the binary classifier and numeric predictor nodes to automate model selection.
3. To advise on when and how to use each model. Also learn how to combine two or more models to improve prediction

Unit	Description	Instructional Hours
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INTRODUCTION TO PREDICTIVE MODELLING

I	What is Predictive Analytics? - What does a predictive model do? - Descriptive v/s Predictive v/s Prescriptive Analytics - The need for a methodology CRISP-DM (Cross-Industry Standard Process for Data Mining). <i>Illustrative program: Collect and understand the data</i>	9+2(p)
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INTRODUCTION TO SPSS MODELER

II	IBM SPSS Modeler (Nodes, Streams), Manager Pane and Project Pane- collecting Initial Data-Understand data- Set the unit of Analysis (DISTINCT, AGGREGATE, SETTOFLAG)- Integrate data (APPEND, MERGE), Relationship between a categorical and continuous field, Relationship between two continuous fields. <i>Illustrative program: Set the unit of analysis for the data</i> a) Remove duplicate records b) Aggregate transactional data c) Create flag fields and aggregate the data	9+4(p)
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Integrate data

- a) Appending Report
- b) Merge field

USING FUNCTIONS IN SPSS

III	Date and Time Functions-Conversion Functions-String Functions-Statistical Functions, Measure of Central Tendency, Measures of Variability-Missing Value Functions, Undefined and Blank Values Function. <i>Illustrative program: Identify relationships in the data</i> a) Examine the relationship between categorical fields b) Examine the relationship between a categorical and continuous field	9+3(p)
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Predict customer churn in telecom dataset

- a) Build Model using CHAID
- b) Examine the CHAID Model
- c) Apply the model to new data

DATA FIELD TRANSFORMATION

Field transformation- Additional Field Transformation-Sequence, Data-Sampling- balancing- partitioning data, Derive, Binning, Reclassify, Control Language for Expression Manipulation (CLEM), Filler, Transform, Sequence Functions, Restructure Data. *Illustrative program: Create a Segmentation Model*

Create homogeneous groups (clusters) of customers based on usage patterns. Using functions in IBM SPSS Modeler

IV

- a) Date and Time Functions
- b) String Functions
- c) Statistical Functions
- d) Missing Value Function

9+3(p)

Add fields to the data

- a) Derive fields as formula
- b) Derive fields as flag or nominal
- c) Reclassify categorical fields
- d) Bin a continuous field into a categorical field with equal counts

INTRODUCTION TO MODEL

V

Modelling Algorithms-Supervised Models- Partition the data- Segmentation Models-Creating a model in IBM SPSS Modeler-Introduction to Linear Regression-Introduction to Logistic Regression-Introduction to Neural Networks-Multilayer Perceptron (MLP)-Radial Basis Function (RBF). *Illustrative program: Create a Linear Regression Model to Predict Employee Salaries. Use Logistic Regression to Predict Response to a Charity Promotion Campaign. Predicting Credit Risk using Neural Networks*

9+3(p)

Total Instructional Hours (45+15) 60

- | | |
|-----------------------|--|
| Course Outcome | CO1: Understand design, build, evaluate and implement predictive models for various business applications. |
| | CO2: Compare the underlying predictive modeling techniques. |
| | CO3: Select appropriate predictive modeling approaches. |
| | CO4: Apply predictive modeling approaches using a suitable package such as SPSS Modeler. |
| | CO5: To advice on when and how to use each model. Also learn how to combine two or more models to improve prediction |

TEXT BOOKS:

T1 :IBM CourseWare

REFERENCE BOOKS:

- R1: IBM SPSS Modeler Essentials ,by Jesus Salcedo, Keith McCormick
R2: Fundamentals of Machine Learning for Predictive Data Analytic ,by John D Kelleher
R3: Applied Predictive Modeling, by Max Kuhn


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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.Tech/B.E	19IT6308	Web Development	0	0	3	3

Course Objective

1. To build web applications using the Express.js framework
2. Focus on industry-practices like functional programming
3. To get practice with object-oriented design and object-oriented design
4. To Learn about the PostgreSQL with Sequelize models
5. To practice EJS Templating, security, and version control.

Experiment No.

Description of the Experiments

- 1 **Introduction to Node.js**
In this module students are introduced to Node.js - they learn how to install it and write programs on it and use Node.js REPL. Students also start using GitHub and learn how to collaborate on code with others using the git tool.
- 2 **Working with NPM**
This module is an introduction to Node.js package manager for students where they start writing custom NPM modules. They also explore and use built-in modules of Node.js
- 3 **Node.js deep dive**
In this module students start building their first application and learn how to use closure to emulate private methods.
- 4 **Testing**
In this module students are introduced to testing. They start writing tests for their application, learn how to use Jest to run the tests and pre-commit hooks to run the tests automatically before each commit
- 5 **Databases and Sequelize**
In this module students get to learn about databases and set up a PostgreSQL database. They learn how to connect to a database from a Node.js application and then work on the database by creating Sequelize models to manipulate data.
- 6 **Backend Web development with Express.js**
In this module, students develop their first application and connect it to the PostgreSQL database on their machine, and begin learning the basics of the CRUD pattern by building some additional features to the application that they're working on.
- 7 **Add User Interface for To-do Application**
This module teaches students how to create interfaces for their application. They also practice converting a given visual design into working HTML and CSS.
- 8 **EJS Templating**
This module teaches touches upon the basics of the MVC pattern, instructing student how to render dynamic data inside their HTML pages using EJS templates. This module also lets the student practice how to deploy their work to a remote server.
- 9 **HTML forms to save and accept user inputs**
This module teaches students how to accept user input on their application via form element in HTML. Students also explore more of the CRUD pattern, moving onto creation of resources using forms, deletion of existing resources, and learn about Cross Site Request Forgery (CSRF) and how authenticity tokens can be used to prevent such attacks. Students are also introduced to APIs.
- 10 **User Authentication and final wrap-up**
In this module students dig deeper into Sequelize association, migration and validation. They build a functional user sign-up page, learn about password storage and play around with browser cookies, sessions, user authentication, and related best practices. They also learn to display one-off flash messages.

**Course
Outcome**

- CO1: Build web applications using Express.js.
CO2: Manipulate data using both imperative and functional programming techniques.
CO3: Model real-world systems using object-oriented design.
CO4: Write HTML & CSS to create elegant web pages.
CO5: Build database applications using Sequelize.

TEXT BOOKS:

This course does not require students to use physical textbooks. Instead, original course material (videos, text and images) has been prepared for students to go through and is open-sourced under Creative Commons Attribution-ShareAlike 4.0 International License © Freshworks Inc. & Pupilfirst Pvt. Ltd. This course material may include some third-party content with a compatible license, and external links for additional reading on the Internet. Students are also taught how to search for information on their own.

REFERENCE BOOKS:

- R1- 1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
R2- 2. Mike Cantelon, Marc Hartert, T.J. Holowaychuk, Nathan Rajlich" Node.js in Action", Manning Publications, 2014.
R3- 3. David Gutman, Fullstack Node.js The Complete Guide to Building Production Apps with Node.js , Fullstack.io 2019.

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Programme
B.E.

Course Code
19CS8311

Name of the Course / NPTEL

~~INTRODUCTION TO INTERNET OF THINGS~~

L P T C
3 0 0 3

Course
Objective

1. To understand the basic concepts and various building blocks of Internet of Things
2. To understand Smart Objects and IoT Architectures
3. To build simple IoT Systems using Raspberry Pi
4. To understand data analytics in the context of IoT and security issues in IoT
5. To develop IoT infrastructure for popular applications

Unit	Description	Instructional Hours
I	INTRODUCTION TO INTERNET OF THINGS Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT Levels and Deployment Templates	9
II	IOT NETWORK ARCHITECTURE AND DESIGN Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack, The "Things" in IoT	9
III	DEVELOPING INTERNET OF THINGS IoT Design Methodology, IoT Physical Devices and Endpoints: Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT devices	9
IV	DATA ANALYTICS AND SECURING IOT DATA ANALYTICS: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics. SECURING IOT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	9
V	CASE STUDIES Smart and Connected Cities: Smart City IoT Architecture, Street Lighting Architecture, Smart Parking Architecture and Smart Traffic Control Transportation: An IoT Architecture for Transportation, Connected Roadways Network Architecture, Connected Fleet Architecture, Connected Roadways Security Weather monitoring system, Air Pollution Monitoring	9
Total Instructional Hours		45

Course
Outcome

- CO1: Explain the concept of IoT and various building blocks
- CO2: Understand various architectures and working of state-of-the-art IoT systems
- CO3: Design IoT system using Raspberry Pi
- CO4: Apply data analytics related to IoT and evaluate security issues related to the Internet of Things
- CO5: Analyze applications of IoT in real time scenario.

TEXT BOOKS:

- T1: Arshdeep Bahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015
- T2: David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.

REFERENCE BOOKS:

- R1: Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.
- R2: Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine -to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
- R3: Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) [Kindle Edition] by Cuno Pfister, 2011
- R4: Adrian McEwen & Hakim Cassimally, "Designing the Internet of Things"- (Nov 2013) .



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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
BE	19CS6401	INTRODUCTION TO JAVA PROGRAMMING	3	0	0	3

- Course Objective**
1. To understand basic characteristics of Java
 2. To understand Object Oriented Programming concepts and inheritance
 3. To know the principles of polymorphism and interfaces
 4. To define exceptions and use I/O streams
 5. To develop a java application with threads and generic classes

Unit	Description	Instructional Hours
I	INTRODUCTION TO JAVA FUNDAMENTALS Introduction to java programming-Features of Java Language-JVM -The Java Environment-Fundamental Programming Structures in Java – Comments -Primitive Data types-variables-operators - control statements- arrays- Packages-defining package-access protection-importing packages- JavaDoc comments.	9
II	INTRODUCTION TO OOP AND INHERITANCE Object Oriented Programming – Class and Objects - Constructor - Inheritance – Super classes-sub classes –Protected members – constructors in sub classes- the Object classes- Method overloading -method over riding –Abstract class and Method – Encapsulation-Garbage collection- static –final keyword.	9
III	INHERITANCE AND INTERFACES Polymorphism-aggregation-association - Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning -inner classes, Array Lists – Strings	9
IV	EXCEPTION HANDLING AND I/O Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	9
V	MULTITHREADING AND GENERIC PROGRAMMING Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.	9
TOTAL INSTRUCTIONAL HOURS		45

- Course Outcome**
- CO1:Understand basic Java programs with concepts
 - CO2:Develop Java programs using OOP principles and inheritance
 - CO3:Develop Java programs with the concepts interfaces
 - CO4:Build Java applications using exceptions and I/O streams
 - CO5:Develop Java applications with threads and generic classes

TEXT BOOKS:

- T1- Herbert Schildt, —Java The complete referencel, 8th Edition, McGraw Hill Education, 2011.
- T2 - Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentalsl, 9th Edition, Prentice Hall, 2013.

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REFERENCE BOOKS :

- R1 - Paul Deitel, Harvey Deitel, —Java SE 8 for programmersI, 3rd Edition, Pearson, 2015.
- R2 - Steven Holzner, —Java 2 Black bookI, Dreamtech press, 2011.
- R3 -Timothy Budd, —Understanding' Object-oriented programming •with Javal, Updated Edition, Pearson Education, 2000.
- R4 -C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.



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Programme B.E	Course Code 19CS7201	Course Name CRYPTOGRAPHY AND NETWORK SECURITY	L 3	T 0	P 0	C 3
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- Course Objective**
1. To Know about the fundamentals of networks security, security architecture, threats and vulnerabilities
 2. Use the different cryptographic operations of symmetric cryptographic algorithms
 3. Apply the different cryptographic operations of public key cryptography
 4. Identify the various Authentication schemes to simulate different applications.
 5. Understand various Security practices and System security standards

Unit	Description	Instructional Hours
I	INTRODUCTION Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.	9
II	SYMMETRIC KEY CRYPTOGRAPHY MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: DES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.	9
III	PUBLIC KEY CRYPTOGRAPHY MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.	9
IV	MESSAGE AUTHENTICATION AND INTEGRITY Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509	9
V	SECURITY PRACTICE AND SYSTEM SECURITY Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Explain the fundamentals of networks security, security architecture, threats and vulnerabilities
- CO2: classify the symmetric encryption techniques.
- CO3: Illustrate various Public key cryptographic techniques.
- CO4: Discuss on the various Authentication schemes.
- CO5: Understand various Security practices and System security standards

TEXT BOOKS:

- T1: William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall of India/Pearson Education, New Delhi, 2010
- T2: Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill Publishing Company, New Delhi, 2007.

REFERENCE BOOKS:

- R1: Behrouz Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill Publishing Company, New Delhi, 2010
- R2: Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2
- R3: Kaufman, Perlman and Speciner, "Network Security: Private Communication in a public world", Prentice Hall of India/ Pearson Education, New Delhi, 2004.
- R4: C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd



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Programme B.E	Course Code 19CS7202	Name of the Course CLOUD COMPUTING	L 3	T 0	P 0	C 3
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- Course Objective**
1. To understand the concept of cloud computing.
 2. To visualizes the different clouds models with respect to services and cloud eco system.
 3. To learn about cloud offering and cloud management.
 4. To learn about different cloud enabling technologies.
 5. To understand about different implementations of virtualizations, management software

Unit	Description	Instructional Hours
I	INTRODUCTION Introduction - Essentials - Benefits - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics - Cloud Adoption. Cloud Models – Cloud Characteristics - Measured Service -Cloud deployment models Security in a Public Cloud - Public versus Private Clouds - Cloud Infrastructure Self Service.	9
II	CLOUD SERVICES AND SOLUTIONS Principle Technologies - Cloud Strategy - Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined. Cloud Solutions - Introduction - Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) – Cloud sourcing.	9
III	CLOUD OFFERINGS AND CLOUD MANAGEMENT Cloud Offerings - Information Storage, Retrieval, Archive and Protection - Cloud Analytics - Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud. Cloud Management - Resiliency - Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Metering.	9
IV	CLOUD ENABLING TECHNOLOGIES Data center Technology – Virtualization Technology – Web Technology – Multitenant Technology – service technology – case study in AWS.	8
V	CLOUD VIRTUALIZATION Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements - Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Center.	10
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the concept of cloud computing.
- CO2: Visualizes the different clouds models with respect to services and cloud eco system
- CO3: Knowledge of cloud offering and cloud management.
- CO4: Understand the different cloud enabling technologies.
- CO5: Understand about different implementations of virtualizations, management software

TEXT BOOKS

T1: Dr.Kumar Saurabh, Cloud Computing, Second Edition, Wiley-India,2012

T2: Thomas Erl, Zaigham Mahmood, Ricardo Puttini, —Cloud Computing: Concepts,Technology and Architecture, Prentice Hall Service Technology Series

REFERENCE BOOKS:

- R1: David Marshall, Wade A. Reynolds, - Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006
- R2: Chris Wolf, Erick M. Halter, - Virtualization: From the Desktop to the Enterprise, Apress 2005.
- R3: Danielle Ruest, Nelson Ruest - Virtualization: A Beginner's Guide, TMH, 2009.
- R4: Thomas Erl, Zaigham Mahmood, Ricardo Puttini, —Cloud Computing: Concepts,Technology and Architecture, Prentice Hall Service Technology Series, 2013




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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS7251	MACHINE LEARNING TECHNIQUES	2	0	2	3

- Course Objective**
1. To introduce the basic concepts and techniques of Machine Learning.
 2. To have a thorough understanding of the Supervised and Unsupervised learning techniques
 3. To study the various probability based learning techniques
 4. To understand graphical models of machine learning algorithms
 5. To improve classification efficiency.

Unit	Description	Instructional Hours
I	<p>FOUNDATIONS OF LEARNING Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation-generalization tradeoff – bias and variance – learning curve. <i>Illustrative Programs: Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.</i></p> <p>LINEAR MODELS Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures – support vector machines – soft margin SVM – going beyond linearity – generalization and overfitting – regularization – validation. <i>Illustrative Programs: Create a training dataset using SVM, implement decision boundary using SVM</i></p> <p>DISTANCE-BASED MODELS Nearest neighbor models – K-means – clustering around medoids – silhouette – hierarchical clustering – k-d trees – locality sensitive hashing – non-parametric regression – ensemble learning – bagging and random forests – boosting – meta learning. <i>Illustrative Programs: Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.</i></p> <p>TREE AND RULE MODELS Decision trees – learning decision trees – ranking and probability estimation trees – regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first-order rule learning. <i>Illustrative Programs: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.</i></p> <p>REINFORCEMENT LEARNING Markov Chain Monte Carlo Methods – Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control. <i>Illustrative Programs: Metropolis-Hastings Algorithm by using Markov Chain Monte Carlo Methods, HMM Baum-Welch (Forward-Backward) Algorithm</i></p>	7+2
II		7+2
III		7+2
IV		7+2
V		7+2

Total Instructional Hours 45

Course CO1: Explain theory underlying machine learning .

- Outcome** CO2: Construct algorithms to learn linear and non-linear models
CO3: Implement data clustering algorithms.
CO4: Construct algorithms to learn tree and rule-based models.
CO5: Apply reinforcement learning techniques for real life problems.

TEXT BOOKS:

- T1: Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, —Learning from Datal, AML Book Publishers, 2012.
T2: P. Flach, —Machine Learning: The art and science of algorithms that make sense of datal, Cambridge University Press, 2012.

REFERENCE BOOKS:

- R1: K. P. Murphy, —Machine Learning: A probabilistic perspectivel, MIT Press, 2012.
R2: M. Mohri, A. Rostamizadeh, and A. Talwalkar, —Foundations of Machine Learningl, MIT Press, 2012.
R3: C. M. Bishop, —Pattern Recognition and Machine Learningl, Springer, 2007.
R4: D. Barber, —Bayesian Reasoning and Machine Learningl, Cambridge University Press, 2012.



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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS7001	CLOUD COMPUTING LABORATORY	0	0	3	1.5

- Course Objective**
1. To configure various virtualization tools such as Virtual Box, VMware workstation.
 2. To design and deploy a web application in a PaaS environment.
 3. To learn how to simulate a cloud environment to implement new schedulers.
 4. To install and use a generic cloud environment that can be used as a private cloud.
 5. To manipulate large data sets in a parallel environment.

- | S. No. | Description of the Experiments |
|--------|---|
| 1. | Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8. |
| 2. | Install a C compiler in the virtual machine created using virtual box and execute Simple Programs |
| 3. | Install Google App Engine. Create hello world app and other simple web applications using python/java. |
| 4. | Use GAE launcher to launch the web applications. |
| 5. | Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim. |
| 6. | Find a procedure to transfer the files from one virtual machine to another virtual machine. |
| 7. | Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version) |
| 8. | Install Hadoop single node cluster and run simple applications like wordcount. |

Total hours 45

- Course Outcome**
- CO1: Configure various virtualization tools such as Virtual Box, VMware workstation.
- CO2: Design and deploy a web application in a PaaS environment.
- CO3: Learn how to simulate a cloud environment to implement new schedulers.
- CO4: Install and use a generic cloud environment that can be used as a private cloud.
- CO5: Manipulate large data sets in a parallel environment.



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Programme B.E	Course Code 19CS7002	Name of the Course SECURITY LABORATORY	L 0	T 0	P 3	C 1.5
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- Course Objective**
1. To develop code for classical Encryption Techniques to solve the problems.
 2. To build cryptosystems by applying symmetric and public key encryption algorithms.
 3. To construct code for authentication algorithms.
 4. To develop a signature scheme using Digital signature standard.
 5. To demonstrate the network security system using open source tools.

- | S. No. | Description of the Experiments |
|--------|---|
| | Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts: |
| 1. | <ol style="list-style-type: none"> a. Caesar Cipher b. Playfair Cipher c. Hill Cipher d. Vigenere Cipher e. Rail fence – row & Column f. Transformation Transformation Implement the following algorithms |
| 2. | <ol style="list-style-type: none"> a. DES b. RSA Algorithm c. Diffiee-Hellman d. MD5 e. SHA-1. |
| 3. | Perform an experiment how to use DumpSec. |
| 4. | Generate password hashes with openssl. |
| 5. | Setup a honey pot and monitor the honeypot on network (KF Sensor) |
| 6. | Installation of rootkits and study about the variety of options |
| 7. | Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler) |
| 8. | Demonstrate intrusion detection system (ids) using any tool (snort or any other open source software) |

Total hours 45

- Course Outcome**
- CO1: Develop code for classical Encryption Techniques to solve the problems
- CO2: Build cryptosystems by applying symmetric and public key encryption algorithms
- CO3: Construct code for authentication algorithms
- CO4: Develop a signature scheme using Digital signature standard
- CO5: Demonstrate the network security system using open source tools




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Programme B.E	Course Code 19CS7301	Name of the Course MULTICORE ARCHITECTURE AND PROGRAMMING	L 3	T 0	P 0	C 3
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- Course Objective**
1. To Describe the need for multi-core processors, and their architecture.
 2. To understand the challenges in parallel and multi-threaded programming.
 3. To learn about the various parallel programming paradigms such as OpenMP and MPI.
 4. To develop multi-core programs and design parallel solutions.
 5. To compare and contrast serial and parallel programming.

Unit	Description	Instructional Hours
I	MULTI-CORE PROCESSORS Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.	9
II	PARALLEL PROGRAM CHALLENGES Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutex, locks, semaphores, barriers) – deadlocks and live locks – communication between threads (condition variables, signals, message queues and pipes).	9
III	SHARED MEMORY PROGRAMMING WITH Open MP Open MP Execution Model – Memory Model – Open MP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.	9
IV	DISTRIBUTED MEMORY PROGRAMMING WITH MPI MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation.	9
V	PARALLEL PROGRAM DEVELOPMENT: Case studies – n-Body solvers – Tree Search – Open MP and MPI implementations and comparison.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Describe multi-core architectures and identify their characteristics and challenges.
CO2: Identify the issues in programming Parallel Processors.
CO3: Write programs using Open MP and MPI.
CO4: Design parallel programming solutions to common problems.
CO5: Compare and contrast programming for serial processors and programming for parallel processors.

TEXT BOOKS:

- T1: Peter S. Pacheco, —An Introduction to Parallel Programming, Morgan-Kaufman/Elsevier, 2011.
T2: Darryl Gove, —Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011.

REFERENCE BOOKS:

- R1: Michael J Quinn, —Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.
- R2: Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
- R3: Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.
- R4: Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.




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Programme B.E	Course Code 19CS7302	Name of the Course CYBER FORENSICS	L 3	T 0	P 0	C 3
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- Course Objective**
1. To Learn basics of Computer Forensics
 2. Be familiar with forensics tools
 3. Learn to analyze and validate forensics data
 4. To gain the Knowledge about the Ethical Hacking
 5. To Understand the concepts of Ethical hacking in web applications

Unit	Description	Instructional Hours
	INTRODUCTION TO COMPUTER FORENSICS	
I	An overview of Digital Forensics-Preparing for digital forensics-preparing a Digital Forensics Investigation. Data Acquisition: Understanding Storage Formats for Digital Evidence-Validating Data Acquisitions-Performing RAID Data Acquisition-Using Network Acquisition Tools-Using other Forensics Acquisition Tools.	9
	EVIDENCE COLLECTION AND FORENSICS TOOLS	
II	Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9
	ANALYSIS AND VALIDATION	
III	Validating Forensics Data – Data Hiding Techniques – Performing Live Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics	9
	ETHICAL HACKING	
IV	Introduction to Ethical Hacking – Foot printing – Scanning Networks – Enumeration – System Hacking – Malware Threats :Trojan and Backdoors – Sniffing	9
	ETHICAL HACKING IN WEB	
V	Social Engineering – Denial of Service – Session Hijacking – Hacking Web servers – Hacking Web Applications –Web based Password Cracking Techniques– SQL Injection – Hacking Wireless Networks – Hacking Mobile Platforms.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Explain the basics of computer forensics
- CO2: Use a number of different computer forensic tools to a given scenario
- CO3: Apply and validate forensics data
- CO4: Understand about Ethical hacking
- CO5: Implement real-world hacking techniques in Ethical hacking.

TEXT BOOKS:

- T1: Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
- T2: CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCE BOOKS:

- R1: John R.Vacca, —Computer Forensics, Cengage Learning, 2005
- R2: MarjieT.Britz, —Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
- R3: AnkitFadia — Ethical Hacking Second Edition, Macmillan India Ltd, 2006
- R4: Kenneth C.Brancik —Insider Computer Fraud Auerbach Publications Taylor & Francis Group–2008.

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Programme B.E	Course Code 19CS7303	Name of the Course WIRELESS SENSOR NETWORKS	L 3	T 0	P 0	C 3
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- Course Objective**
1. To Familiarize the students with the fundamentals of wireless communication technology and modulation techniques.
 2. To learn the concepts of Adhoc networks and design issues of sensor networks.
 3. To Study the architecture and protocols of wireless sensor networks
 4. To understand the design issues and to learn the concepts of routing protocols
 5. To Discuss the various challenges in providing QoS and to learn about energy management.

Unit	Description	Instructional Hours
I	INTRODUCTION Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.	9
II	AD HOC NETWORKS – INTRODUCTION Introduction to Adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering	9
III	WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.	9
IV	WSN ROUTING PROTOCOLS Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.	9
V	QOS AND ENERGY MANAGEMENT QoS: Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, Need for energy management, classification, battery, transmission power, and system power management schemes. Case study: Energy Efficient Environmental monitoring.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Explain the concepts and applications of various wireless communication techniques.
 - CO2: Analyze the design issues of ad hoc and sensor networks.
 - CO3: Learn architecture of various wireless sensor networks and MAC protocols
 - CO4: To analyze the design issues and concepts of routing protocols.
 - CO5: Evaluate the QoS related performance measurements of WIRE LESS sensor networks and real time case studies.

TEXT BOOKS:

- T1: C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference, 2008.
- T2: Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002

REFERENCE BOOKS:

- R1: Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
- R2: Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005.
- R3: Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
- R4: Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.




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Programme B.E	Course Code 19CS7304	Name of the Course C# and .NET AND PROGRAMMING	L	T	P	C
			3	0	0	3

- Course Objective**
- 1.To understand the basics of C# and .NET.
 - 2.To implement the C# language constructs and OOP.
 - 3.To implement advanced programming in C#.
 - 4.Fundamental window programming.
 - 5.Build web based applications using c#.

Unit	Description	Instructional Hours
	INTRODUCTION TO C#	
I	Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.	9
	OBJECT ORIENTED ASPECTS OF C#	
II	Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.	9
	APPLICATION DEVELOPMENT ON .NET	
III	Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.	9
	WEB BASED APPLICATION DEVELOPMENT ON .NET	
IV	Programming web application with web forms, ASP.NET introduction, working with XML and .NET,Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.	9
	CLR AND .NET FRAMEWORK	
V	Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET.	9
	Total Instructional Hours	45

- Course Outcome**
- CO1: To learn the basics of .net Frame work and C# language.
 - CO2: To learn C# elements and OOPS concepts.
 - CO3: To learn interface and inheritance concepts in C# language.
 - CO4: To learn fundamentals of window application programming and create a window application.
 - CO5: To develop web applications and learn advanced features of C#.

TEXT BOOKS:

- T1: Stanley B.Lippman , "C# Primer : A practical approach", Pearson Education,1991.
- T2: David.S.Platt, Introducing Microsoft . Net , Microsoft Press, 3rd, Edition, 2003.

REFERENCE BOOKS:

- R1: Ben Albahari, Pter Drayton, Brad Merrill, "C# Essentials", Oreilly& Associates, 2001.
R2: E.Balagurusamy, Programming in C # Tata McGraw Hill, 2002.
R3: Conard.J., et.al., Introducing .Net, wrox Press, 2000.
R4: Eric Gunnerson , "A Programmers Introduction to C# ",A Press, 2000.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS7305	SOFTWARE TESTING	3	0	0	3
Course Objective	<ol style="list-style-type: none"> 1. To learn the criteria for test cases. 2. To learn the design of test cases. 3. To understand test management and test automation techniques. 4. To apply test metrics and measurements. 5. To document test plans and test cases designed. 					
Unit	Description	Instructional Hours				
	INTRODUCTION					
I	Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.	9				
	TEST CASE DESIGN					
II	Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.	9				
	LEVELS OF TESTING					
III	The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.	9				
	TEST AMANAGEMENT					
IV	People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group - Capability Maturity Model (CMM) – Project Maturity Model (PMM).	9				
	TEST AUTOMATION					
V	Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics. Tools: Selenium, TestingWhiz, Sahi, Tosca Testsuite and Katalon Studio.	9				
		Total Instructional Hours	45			

**Course
Outcome**

- CO1: Prepare test planning based on the document.
- CO2: Design test cases suitable for a software development for different domains.
- CO3: Use automatic testing tools.
- CO4: Develop and validate a test plan.
- CO5: Document test plans and test cases designed.

TEXT BOOKS:

- T1: "The Art of Software Testing", Second Edition, Glenford J. Myers, Corey Sandler, Tom Badgett, Wiley, 2004.
- T2: Paul C. Jorgensen Software Testing: A Craftsman's Approach, Fourth Edition, CRC Press, 2013.

REFERENCE BOOKS:

- R1: Testing Computer Software, Cem Kaner, Jack Falk, Hung Quoc Nguyen, Second edition, Wiley Publications, 2010
- R2: Ron Patton, —Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com
- R3: James Whittaker- How to Break Software: A Practical Guide to Testing, May 2002.
- R4: Mark Fewster and Dorothy Graham—"Software Test Automation – Effective Use of Test Execution Tools", May 2000.



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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS7401	FOUNDATION SKILLS IN INFORMATION TECHNOLOGY(NASSCOM)	3	0	0	3

- Course Objective**
1. To introduce the basics of C programming language
 2. To Learn about the concepts of structure and unions
 3. To be exposed about sorting, searching, hashing algorithms
 4. To Learn various testing and maintenance measures
 5. To outline the principles for Software Project Management

Unit	Description	Instructional Hours
I	BASIC PROGRAMMING CONCEPTS IN C LANGUAGE Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays.	9
II	FUNCTIONS, POINTERS, STRUCTURES AND UNIONS Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.	9
III	SORTING, SEARCHING, HASHING TECHNIQUES Sorting algorithms: Insertion sort – Selection sort – Shell sort – Bubble sort – Quick sort – Merge sort – Radix sort – Searching: Linear search – Binary Search Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing	9
IV	SOFTWARE TESTING AND ITS TYPES Software testing fundamentals-Internal and external views of Testing-white box testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing -alpha and beta testing -Acceptance testing – Performance testing— Usability and Accessibility testing – Compatibility testing – Test cases-Testing the documentation	9
V	STAFFING IN SOFTWARE PROJECTS Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the basics of C programming language
CO2: Apply the concepts of structures and unions
CO3: Apply the sorting, searching, hashing algorithms.
CO4: Understand the various testing and maintenance.
CO5: Understand the Project Management principles while developing software.

TEXT BOOKS:

- T1: Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988.
T2: Roger S. Pressman, "Software Engineering – A Practitioner"s Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.

REFERENCE BOOKS:

- R1: Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.
- R2: Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
- R3: Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
- R4: Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.



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Programme BE	Course Code 19CS8301	Name of the Course DIGITAL IMAGE PROCESSING	L 3	T 0	P 0	C 3
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- Course Objective**
1. To learn the fundamentals of digital image processing
 2. To Understand simple image enhancement techniques in Spatial and Frequency domain
 3. To learn concepts of degradation function and restoration techniques.
 4. To understand image segmentation and representation strategies.
 5. To apply image compression and recognition methods

Unit	Description	Instructional Hours
I	DIGITAL IMAGE FUNDAMENTALS: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.	9
II	IMAGE ENHANCEMENT: Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	9
III	IMAGE RESTORATION: Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	9
IV	IMAGE SEGMENTATION: Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	9
V	IMAGE COMPRESSION AND RECOGNITION: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Learn the basic concepts of digital image processing like sampling, sensing and color images
- CO2: Understand simple image enhancement techniques in Spatial and Frequency domain
- CO3: Learn the restoration concepts and filtering techniques.
- CO4: Understand the basics of segmentation, features extraction
- CO5: Apply the concept of compression and recognition methods for color models.

TEXT BOOKS:

T1: Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition, 2010.

T2: S.Jayaraman, S.Esakkirajan, T.Veerakumar, "Digital Image Processing" Tata McGrawHill,2009

REFERENCE BOOKS:

- R1: Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2007.
R2: William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002
R3: Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
R4: Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.




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Programme BE	Course Code 19CS8302	Name of the Course HIGH SPEED NETWORKS	L 3	T 0	P 0	C 3
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- Course Objective**
1. To understand the challenges of High Speed Networks and its related performance.
 2. To analyze the cause of congestion, Frame relay and related factors.
 3. To analyze the cause of ATM congestion control, TCP flow control and related factors for Quality of Service
 4. To understand resource allocation and service management approaches.
 5. To understand network management and its protocols.

Unit	Description	Instructional Hours
I	HIGH SPEED NETWORKS: Introduction-frame relay networks –ATM protocol architecture-ATM logical connection –ATM cells-ATM service categories -AAL-high speed LANS: the emergence of high speed LANS-Ethernets-fiber channel-wireless LANS	9
II	CONGESTION AND TRAFFIC MANAGEMENT: Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.	9
III	TCP AND ATM CONGESTION CONTROL: TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management.	9
IV	INTEGRATED AND DIFFERENTIATED SERVICES: Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services	9
V	PROTOCOLS FOR QOS SUPPORT : RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the challenges of High Speed Networks and its related performance.
- CO2: Analyze the cause of congestion, Frame relay and related factors.
- CO3: Analyze the cause of ATM congestion control, TCP flow control and related factors for Quality of Service.
- CO4: Understand resource allocation and service management approaches.
- CO5: Understand network management and its protocols.

TEXT BOOKS:

- T1: William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education, Second Edition, 2002.
- T2: Behrouz A. Forouzan, "Data Communication And Computer Networking", 4th, 2011

REFERENCE BOOKS:

- R1: Warland & Pravin Varaiya, "HIGH PERFORMANCE COMMUNICATION NETWORKS", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
- R2: Irvan Pepelnjk, Jim Guichard and Jeff Apcar, "Mpls and Vpn Architecture", Volume 1 and 2, Cisco Press, 2003
- R3: Adrian Farrel, "The Internet And Its Protocols", Elsevier Publications, 2011
- R4: Fred Halsall: Data Communication Computer Networks, And Open Systems: Addison Wesley, Fifth edition, 2005.



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Programme BE	Course Code 19CS8303	Name of the Course INFORMATION SECURITY	L 3	T 0	P 0	C 3
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- Course Objective**
1. To understand the basics of Information Security.
 2. To know the legal, ethical and professional issues in Information Security.
 3. To know the aspects of risk management.
 4. To become aware of various standards in this area.
 5. To know the technological aspects of Information Security.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	History, Definition-Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.	9
	SECURITY INVESTIGATION	
II	Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.	9
	SECURITY ANALYSIS	
III	Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem.	9
	LOGICAL DESIGN	
IV	Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.	9
	PHYSICAL DESIGN	
V	Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: To discuss the basics of information security.
- CO2: To illustrate the legal, ethical and professional issues in information security.
- CO3: To demonstrate the aspects of risk management.
- CO4: To become aware of various standards in the Information Security System.
- CO5: To design and implementation of Security Techniques.

TEXT BOOKS

- T1: Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2017.
- T2: Mark Stamp, "Information Security: Principles and Practice", John Wiley and Sons, 2011.

REFERENCE BOOKS

- R1: Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.
- R2: Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw- Hill, 2003.
- R3: Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.
- R4: Alexander, David; Finch, Amanda; Sutton, David; Taylor, Andy, "Information Security Management Principles, BCS Learning & Development Ltd, 2013.



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Programme BE	Course Code 19CS8304	Name of the Course HUMAN COMPUTER INTERACTION	L 3	T 0	P 0	C 3
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Course Objective	1. To learn the foundations of Human Computer Interaction.
	2. To understand the design technologies for individuals and persons with disabilities.
	3. To understand the mobile human computer interaction.
	4. To learn to design augmented reality and data visualization
	5. To learn the guidelines for mobile user interface

Unit	Description	Instructional Hours
I	FOUNDATIONS OF HCI: The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity-Paradigms.	9
II	DESIGN & SOFTWARE PROCESS: Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	9
III	MODELS AND THEORIES: Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-task analysis-models of the system	9
IV	AUGMENTED REALITY: Ubiquitous computing and augmented realities- Ubiquitous computing application research-virtual and augmented reality-information and data visualization-Hypertext, Multimedia and WWW	9
V	MOBILE HCI: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	9
Total Instructional Hours		45

Course Outcome	CO1: Design effective dialog for HCI.
	CO2: Design effective HCI for individuals and persons with disabilities.
	CO3: Understand the mobile human computer interaction.
	CO4: Understand the augmented reality and data visualization and websites
	CO5: Apply the HCI implications for designing mobile applications.

TEXT BOOKS:

- T1: Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I - IV).
- T2: Brian Fling, "Mobile Design and Development", First Edition , O'Reilly Media Inc., 2009 (UNIT –V).

REFERENCE BOOKS:

- R1: Ben Shneiderman, Catherine Plaisant, "Designing the User Interface", 6th Edition., et al., Addison Wesley, 2017.
- R2: Faulkner, "The essence of Human-Computer Interaction", Prentice Hall, 1998
- R3: Barfield L, "The user interface: concepts & design", Addison Wesley, 1993
- R4: Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.



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Programme BE	Course Code 19CS8305	Name of the Course RESPONSIVE WEB DESIGN	L 3	T 0	P 0	C 3
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- Course Objective**
1. To identify the various issues of web design process and evaluation..
 2. To determine templates for web pages and layout.
 3. To develop simple web applications using scripting languages..
 4. To determine the various issues of web project development.
 5. To address the core issues of web page maintenance and evaluation.

Unit	Description	Instructional Hours
	INTRODUCTION TO HTML AND XHTML	6
I	Origins and Evolution of HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Formatting - Images - Hypertext Links – Lists - Tables - Frames and Forms.	
	CASCADING STYLE SHEETS	7
II	Introduction - Levels of Style Sheets - Style Specification Formats – Style Classes - Properties and Property Values - Color - The span and div Tags.	
	HTML 5	
III	Media Queries supporting different viewports – Syntax - Fluid Layouts- Fluid Images- Serving Different Images for different screen sizes - HTML 5 for responsive designs - semantic elements in HTML5 – Embedding Media in HTML5.	10
	CSS 3	
IV	Selectors - Typography and Color Modes – Aesthetics with CSS3 – Text shadows - Box shadows - Background Gradients – patterns - Multiple Background images Transitions - Transformations and Animations Forms with HTML5 and CSS3.	10
	BASICS OF JAVASCRIPT	
	Basic OOPS Concepts - Introduction to JavaScript - JavaScript & HTML – The DOM: Objects in the Browser - Conditionals & Control Flow - Repetitive Code.	
V	JavaScript framework: Angular JS, Express JS, Jest. jQuery: Introduction to jQuery - Working with jQuery Objects – Reading JavaScript Documentation - Libraries, Plugins, and Widgets - Loops, Chaining and Refactoring - Using jQuery Plugins.	12
Total Instructional Hours		45

- Course Outcome**
- CO1: Identify the various issues of web design process and evaluation.
 CO2: Determine templates for web pages and layout.
 CO3: Develop simple web applications using scripting languages.
 CO4: Determine the various issues of web project development.
 CO5: Address the core issues of web page maintenance and evaluation.

TEXT BOOKS:

- T1: Ben Frain, —Responsive Web Design using HTML5 and CSS3, PACKT Publishing, 2012.
 T2: Thomas Powell and Fritz Schneider, Javascript 2.0 : The Complete reference, Tata McGraw Hill,2012.

REFERENCE BOOKS:

- R1: Thomas Powell, — HTML and CSS: The Complete Referencel, Tata McGraw Hill, 2010.
- R2: Jehl, Scott, Marcotte, Ethan (2014), Responsible responsive design. New York : A Book Apart (188 p).
- R3: <http://webdesignbyolga.com/responsive/>
- R4: Ethan Marcotte, "Responsive Web Design", May 25, 2010



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Programme BE	Course Code 19CS8306	Name of the Course INFORMATION RETRIEVAL TECHNIQUES	L 3	T 0	P 0	C 3
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- Course Objective**
1. To understand the basic concepts and techniques in Information Retrieval.
 2. To understand how statistical models of text can be used in Information Retrieval
 3. To understand machine learning techniques for text classification and clustering.
 4. To understand various search engine system operations.
 5. To learn different techniques of recommender system.

Unit	Description	Instructional Hours
I	INTRODUCTION Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces	9
II	MODELING AND RETRIEVAL EVALUATION Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.	9
III	INDEXING Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency	9
IV	WEB RETRIEVAL AND WEB CRAWLING The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation	9
V	RECOMMENDER SYSTEM Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Use an open source search engine framework and explore its capabilities
 CO2: Apply appropriate IR Models
 CO3: Apply appropriate method of classification or clustering
 CO4: Design and implement innovative features in a search engine
 CO5: Design and implement a recommender system

TEXT BOOKS:

- T1: Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book, 2016.
- T2: Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.

REFERENCE BOOKS:

- R1: Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.
- R2: Pattern Recognition and Machine Learning, Christopher Bishop, 2007
- R3: Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
- R4: Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.



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Programme	Course Code	Name of the Course	L	T	P	C
BE	19CS8307	USER INTERFACE DESIGN	3	0	0	3
Course Objective	1. To learn the basics of User Interface Design.					
	2. To understand the process of design interface and business functions.					
	3. To understand the concepts of screen design, web systems, windows and menus.					
	4. To learn about multimedia and to design effective web pages.					
	5. To understand the design process and to evaluate user interface design.					
UNIT	Description					Instructional Hours
	INTERACTIVE SOFTWARE AND INTERACTION DEVICE					
I	Human-Computer Interface – Characteristics of Graphics Interface –Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.					9
	HUMAN COMPUTER INTERACTION					
II	User Interface Design Process – Obstacles –Usability –Human Characteristics In Design – Human Interaction Speed –Business Functions –Requirement Analysis – Direct – Indirect Methods – Basic Business Functions – Design Standards – General Design Principles – Conceptual Model Design – Conceptual Model Mock-Ups.					9
	WINDOWS					
III	Characteristics– Components– Presentation Styles– Types– Managements– Organizations– Operations– Web Systems– System Timings - Device– Based Controls Characteristics– Screen – Based Controls — Human Consideration In Screen Design – Structures Of Menus – Functions Of Menus– Contents Of Menu– Formatting – Phrasing The Menu – Selecting Menu Choice– Navigating Menus– Graphical Menus. Operate Control – Text Boxes– Selection Control– Combination Control– Custom Control– Presentation Control.					9
	MULTIMEDIA					
IV	Text for Web Pages – Effective Feedback– Guidance & Assistance– Internationalization– Accessibility– Icons– Image– Multimedia – Coloring- Case Study: Addressing usability in E- Commerce sites.					9
	DESIGN PROCESS AND EVALUATION					
V	User Interface Design Process - Usability Testing - Usability Requirements and Specification procedures and techniques- User Interface Design Evaluation					9
Total Instructional Hours					45	
Course Outcome	CO1: Learn the basics of User Interface Design.					
	CO2: Analyze the requirements of User Interface Design Process and Business functions.					
	CO3: Understand and analyze various controls of screen, web systems, windows and menus.					
	CO4: Design web pages using multimedia.					
	CO5: Analyze the user interface requirements and design process.					

TEXT BOOKS:

- T1: Wilhert. O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, 2002.
 T2: Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.

REFERENCE BOOKS:

- R1: Alan Cooper, "The Essential of User Interface Design", Wiley - Dream Tech Ltd., 2002..
- R2 Designing Interfaces: Patterns for Effective Interaction Design by Jenifer Tidwell, Orelly Publications, 2005.
- R3: Sharp, Rogers, Preece, 'Interaction Design', Wiley India Edition, 2007.
- R4: Alan Dix et al, " Human - Computer Interaction ", Prentice Hall, 1993.



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DEAN-ACADEMICS / PRINCIPAL

**Dean (Academics)
HiCET**

HICET – Department of Computer Science and Engineering

Programme BE	Course Code 19CS8308	Name of the Course VISUALIZATION TECHNIQUES	L 3	T 0	P 0	C 3
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- Course Objective**
1. To know the basics of Data Representation
 2. To understand the importance of data visualization.
 3. To learn Non-Computer Visualization and Fisheye views
 4. To know the different dimensions of visualization techniques
 5. To create various visualizations

Unit	Description	Instructional Hours
I	INTRODUCTION Introduction – Issues – Data Representation – Data Presentation – Common Mistakes in design	9
II	FOUNDATIONS FOR DATA VISUALIZATION Visualization stages – Experimental Semiotics based on Perception Gibson’s Affordance theory – A Model of Perceptual Processing – power of visual perception-Types of Data-visualization and data objects.	9
III	COMPUTER VISUALIZATION Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Interacting with visualization	9
IV	MULTIDIMENSIONAL VISUALIZATION One Dimension – Two Dimensions – Three Dimensions – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.	9
V	CASE STUDIES Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis	9
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the fundamentals of data representation
 - CO2: Implement the concepts of data visualization and data objects
 - CO3: Explore complex information spaces and applications of fisheye view
 - CO4: Implement the different dimensions of Visualization Techniques
 - CO5: Illustrate various examples of Visualization

TEXT BOOKS:

- T1: Colin Ware “Information Visualization Perception for Design” Morgan Kaufmann Publishers, 2004, 2nd edition.
- T2: Robert Spence “Information visualization – Design for interaction”, Pearson Education, 2nd edition, 2007

REFERENCE BOOKS:

- R1: Stephen Few, "Information Dashboard Design-The Effective Visual Communication of Data": O'Reilly Media Publisher, 1st Edition 2006
- R2: Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, "Readings in Information Visualization Using Vision to think", Morgan Kaufmann Publishers
- R3: Thomas Strothotte, —Computer Visualization—Graphics Abstraction and Interactivityl, Springer, 2011
- R4: ChaomeiChan, "Information Visualization", Beyondthehorizon, 2ndedition, Springer Verlag, 2004.



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DEAN-ACADEMICS / PRINCIPAL

**Dean (Academics)
HiCET**

Programme BE	Course Code 19CS8309	Name of the Course DEEP LEARNING	L 3	T 0	P 0	C 3
Course Objective	<ol style="list-style-type: none"> To learn the foundation of deep networks and optimization algorithms of deep learning To study about the various models for Deep Learning To know the essence of deep learning merging with python To be familiar with Tensor flow for learning Deep networking To study the various applications of Deep Learning Techniques 					

Unit	Description	Instructional Hours
	BASICS	
I	Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.	9
	FEEDFORWARD NETWORKS	
II	Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders. DEEP NEURAL NETWORKS: Difficulty of training deep neural networks, Greedy layerwise training.	9
	BETTER TRAINING OF NEURAL NETWORKS	
III	Newer optimization methods for neural networks (Adagrad, adadelata, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization). RECURRENT NEURAL NETWORKS: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs. CONVOLUTIONAL NEURAL NETWORKS: LeNet, AlexNet.	10
	GENERATIVE MODELS	
IV	Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines. RECENT TRENDS: Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning.	9
	APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION	
V	Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks. APPLICATIONS OF DEEP LEARNING TO NLP: Introduction to NLP and Vector Space Model of Semantics.	8
Total Instructional Hours		45

Course Outcome	CO1: Understand the concepts of deep networks and apply the optimization of deep learning models
	CO2: Remember the concepts of machine learning and apply it with deep learning models
	CO3: Apply the deep learning concepts with python programming language
	CO4: Apply the Tensor flow library for deep learning and understand FFNNs, CNNs, RNNs
	CO5: Understand the applications of Deep Learning in various domains

TEXT BOOKS:

- T1: Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book,2017 (Unit I,II,V)
- T2: Francois Chollet, "Deep Learning with Python" Manning Publications,2018 (Unit III)

REFERENCE BOOKS:

- R1: Giancarlo Zaccane, Md. RezaulKarim, " Deep Learning with TensorFlow:Explore neural networks and build intelligent systems with python", Packt Publishing, 2nd edition, 2018 (Unit IV)
R2: Li Deng, Dong Yu " Deep Learning Methods and Applications", NowPublishers, 2014
R3: Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127
R4: Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.




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DEAN-ACADEMICS / PRINCIPAL

**Dean (Academics)
HICET**

Programme BE	Course Code 19CS8310	Name of the Course BLOCK CHAIN TECHNOLOGY	L 3	T 0	P 0	C 3
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- Course Objective**
1. To learn the basic concepts of distributed database and cryptography.
 2. To understand the fundamentals of block chain systems and its applications.
 3. To learn about the distributed consensus and energy utilization.
 4. To learn the concepts of crypto currency.
 5. To introduce the applications of crypto currency and block chain technologies.

Unit	Description	Instructional Hours
	BASICS	
I	Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.	9
	BLOCK CHAIN	
II	Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.	11
	DISTRIBUTED CONSENSUS	
III	Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	9
	CRYPTOCURRENCY	
IV	History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.	9
	CRYPTOCURRENCY REGULATION	
V	Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Block chain.	7
Total Instructional Hours		45

- Course Outcome**
- CO1: Understand the basic concepts of distributed database and cryptography
 - CO2: Evaluate block chain systems and its applications.
 - CO3: Analyze the distributed consensus and energy utilization
 - CO4: Evaluate the crypto currency related performance measurements.
 - CO5: Apply the logics crypto currency and block chain technologies.

TEXT BOOKS:

- T1: Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies": A Comprehensive Introduction, Princeton University Press (July 19, 2016).

T2: Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

REFERENCE BOOKS:

R1: Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

R2: Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System

R3: DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper. 2014.

R4 Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts



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HICET**

CO'S, PO'S & PSO'S MAPPING (ACADEMIC YEAR – 2022 – 2023)

Semester – I

Course Code & Name: 22MA1101/ MATRICES AND CALCULUS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name: 22CY1151/ CHEMISTRY FOR CIRCUIT ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	1	1	1	1	-	1	-	1	2	-	-
CO2	2	3	2	1	1	1	1	-	1	-	1	2	-	-
CO3	2	2	2	2	1	1	1	-	1	-	1	2	-	-
CO4	2	2	3	1	2	1	1	-	1	-	2	2	-	1
CO5	2	3	3	2	2	1	1	-	1	-	1	2	-	-
Avg	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	0	1

Course Code & Name: 22HE1151 / ENGLISH FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2					1	2	2	2	3	1	1	1	2
CO2	2	1			1	1	1	2	2	3		2		2
CO3	2	1			1	1	2	3	3	3		1	1	2
CO4	2	1				1	2	2	2	3	1	1		
CO5	2					1	1	2	3	3		1	1	2
Avg	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2

Course Code & Name: 22CS1151 / Problem solving using C Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2			3	2		3	3	3	2	
CO2	3	2	2	2	2				2					2
CO3	2	2	2	2			2			3	3	3	2	2
CO4	3	3	2		2			2					2	
CO5	3	3	2	2	3					3	3	3		3
Avg	2.8	2.6	2.2	1.6	1.4	0	1	0.8	0.4	1.2	1.8	1.8	1.2	1.4

Course Code & Name: 22CS1152 /Object Oriented Programming using Python

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

Course Code & Name: 22IT1152 /Introduction to Web Application Development

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3			1	2					1	2	1
CO2	3	3	3	1	2	1	2				1	1	2	2
CO3	3	2	3	2	1		2		1		2	2	2	2
CO4	3	3	3	1		1	2		1			2	2	3
CO5	3	3	3		2		2		1		1	3	1	2
Avg	3	2.8	3	1.2	1	0.6	2		0.6		0.8	2	1.8	2

SEMESTER - II

Course Code & Name : 22MA2103 Differential Equations And Linear Algebra

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
AVG	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name : 22PH2101 Basics of Material Science

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					1	2	2	2	3	1	1	1	2
CO2	2	1			1	1	1	2	2	3		2		2
CO3	2	1			1	1	2	3	3	3		1	1	2
CO4	2	1				1	2	2	2	3	1	1		
CO5	2					1	1	2	3	3		1	1	2
Avg	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2

Course Code & Name : 22HE2151 Effective Technical Communication

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	1	1	1	-	1	-	1	2	-	-
CO2	2	3	2	1	1	1	1	-	1	-	1	2	-	-
CO3	2	2	2	2	1	1	1	-	1	-	1	2	-	-
CO4	2	2	3	1	2	1	1	-	1	-	2	2	-	1
CO5	2	3	3	2	2	1	1	-	1	-	1	2	-	-
Avg	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	-	1

Course Code & Name: 22PH2151 Physics for Circuit Engineering

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	3	2	0	0	0	3	0	3	0	1	0

CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	2	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	1	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 22IT2251 Python programming and Practices

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	3	0	1	0	0	2	0	0	1	1	0
CO2	3	1	1	3	0	3	0	1	2	0	0	2	1	1
CO3	3	1	1	3	0	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	0	2	0	0	2	0	0	1	1	0
Avg	3	1	1	3	0	2	0	1	2	0	0	1	1	1

Course Code & Name: 22CS2253 Java Fundamentals

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3	0	0	1	1	0	0	0	0	1	1	0
CO2	3	3	3	1	2	1	1	0	0	0	1	1	1	1
CO3	3	2	3	2	1		2	0	1	0	2	2	3	2
CO4	3	3	3	1	0	1	2	0	1	0	0	2	2	3
CO5	3	3	3	0	2		2	0	1	0	1	3	3	3
Avg	3	2.8	3	0.8	1	1	1.6	0	0.6	0	0.8	1.8	2	1.8

Course Code & Name: 22IT2253 Dynamic Web Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	1	0	0	1	0	0	0	0	0	1	1	1	2
CO2	1	1	1	0	1	0	0	0	1	0	0	1	1	2
CO3	1	1	1	0	1	0	0	0	0	1	0	1	0	1

CO4	1	1	1	0	0	0	0	0	0	1	0	1	1	0	1
CO5	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
Avg	1.4	1	1	0	0.6	0	0	0	0	0.4	0.4	0.6	1	0.6	1.4

Course Code & Name: 22ME2001 Engineering Practices

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	0	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	0	2	3	0	1	2	0	3	2	1	0
CO3	3	2	2	0	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	0	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	0	2	0	0	0	0	0	2	3	1	0
Avg	3	1	2	0	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 22HE2071 Design Thinking

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 22HE2072 Soft Skills and Aptitude 1

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	0	2	0	0	1	0	1	0	3	1	0
CO2	3	1	2	0	1	0	0	1	0	1	0	1	0	0
CO3	3	1	1	0	3	0	0	1	0	1	0	2	1	0
CO4	3	1	3	0	2	0	0	1	0	1	0	1	1	1
CO5	3	1	3	0	1	0	0	1	0	1	0	1	1	0
Avg	3	1	2	0	2	0	0	1	0	1	0	2	1	0

Semester – III

Course Code & Name: 21MA3104 Discrete Mathematics and Graph Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	2	3
CO3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
Avg	2.8	2.8	2.8	2.8	2.8	-	-	-	-	-	-	2.6	2.4	2.6

Course Code & Name: 21CS3201 Data Structures

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2			3	2		3	3	3	2	
CO2	3	2	2	2	2				2					2
CO3	2	2	2	2			2			3	3	3	2	2
CO4	3	3	2		2			2					2	
CO5	3	3	2	2	3					3	3	3		3
Avg	2.8	2.6	2.2	1.6	1.4	0	1	0.8	0.4	1.2	1.8	1.8	1.2	1.4

Course Code & Name: 21CS3202 Database Management Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	3	0	1	3	0	0	3	1	1	2	2	1
CO2	2	2	3	1	1	1	0	0	3	1	1	2	2	2
CO3	3	2	3	2	2	0	0	0	1	1	1	2	2	3
CO4	3	1	3	1	1	2	0	0	1	2	1	2	3	3
CO5	1	2	2	1	3	2	1	0	2	3	3	2	3	1
Avg	2	1.6	2.8	1	1.6	1.6	0.2	0	2	1.6	1.4	2	2.4	2

Course Code & Name: 21CS3203 Computer Organization and Architecture

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	0	0	0	0	0	0	0	0	1	3	3	2
CO2	2	1	1	0	0	0	0	0	0	0	0	1	2	2
CO3	2	1	2	0	0	0	0	0	0	1	0	2	0	2
CO4	3	3	1	0	0	0	0	0	0	0	1	1	0	2
CO5	3	1	1	0	0	0	0	0	0	1	1	1	1	2
Avg	2	2	1	0	0	0	0	0	0	0	1	2	1	2

Course Code & Name: 21CS3251 Digital Principles and System Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1	0	1	0	1	1	3	0	0
CO2	3	3	2	2	2	2	0	1	0	1	0	1	0	2
CO3	3	3	2	2	2	2	0	1	0	1	0	2	0	1
CO4	3	3	2	2	2	2	0	1	0	1	1	1	0	1
CO5	3	3	2	2	2	2	0	1	0	1	1	1	0	2
Avg	3	3	2	2	2	2	0	1	0	1	1	2	0	1

Course Code & Name: 21CS3001 Data Structures Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	0	0	0	1	0	0	0	0	0	1	1	1	0
CO2	3	2	1	1	1	0	0	0	1	0	0	1	1	0
CO3	3	2	1	1	1	0	0	0	1	1	0	1	0	1
CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Course Code & Name: 21CS3002 Database Management Systems Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	3	0	1	1	0	0	1	1	1	1	2	2
CO2	1	2	3	1	1	1	0	0	1	1	1	1	2	2
CO3	1	2	3	2	2	0	0	0	1	1	1	1	2	2
CO4	1	1	3	1	1	2	0	0	1	2	1	2	2	3
CO5	1	2	2	1	3	2	1	0	2	3	3	2	2	3
Avg	3	2	0	0	1	0	0	0	0	0	1	2	1	0

Semester – IV

Course Code & Name: 21MA4151 Probability, Statistics and Queuing Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO2	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO4	2	2	3	1	2	-	-	-	-	-	2	2	3	3
CO5	2	3	3	2	2	-	-	-	-	-	3	2	3	3
Avg	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4

Course Code & Name: 21CS4201 Java Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1												2	2
CO2	1	2	2	1									2	2
CO3	1		2	2	2				1	1			2	2
CO4	1		2	2	2								2	2
CO5	1		2	3	2				2	2			2	2
Avg	1	0.2	1.6	1.6	1.2				0.6	0.6			2	2

Course Code & Name: 21CS4202 Software Engineering

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	-	2	2	-	3	3	-	3	3	3
CO2	2	3	3	2	2	-	2	2	3	3	2	2	3	3
CO3	3	3	3	2			3			2	3	2	2	2
CO4	3	2	2	2	2				2		2	2	2	2
CO5	2	2	2	2			2				2	2	2	2
Avg	2.6	2.6	2.6	2.2	2	2	2.25	2	2.666667	2.666667	2.25	2.2	2.4	2.4

Course Code & Name: 21CS4203R

Operating Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	2	-	-	-	-	-	3	-
CO2	2	3	3	3	-	-	3	-	-	-	3	-	3	2
CO3	3	-	-	-	-	-	2	-	-	-	2	3	3	-
CO4	3	2	3	-	-	-	2	-	3	-	2	-	3	-
CO5	3	-	-	-	-	-	3	-	3	-	2	3	3	-
Avg	2.8	1	1.2	0.6	0	0	2.4	0	1.2	0	1.8	1.2	3	0.4

Course Code & Name: 21CS4251 Design and Analysis of Algorithm

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3			1	1					1	1	
CO2	3	3	3	1	2	1	1				1	1	1	1
CO3	3	2	3	2	1		2		1		2	2	3	2
CO4	3	3	3	1		1	2		1			2	2	3
CO5	3	3	3		2		2		1		1	3	3	3
Avg	3.00	2.80	3.00	0.80	1.00	0.60	1.60	-	0.60	-	0.80	1.80	2.00	1.80

Course Code & Name: 21CS4001 Java Programming Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO	PSO
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													1	2
CO1	3	3	1	3	3				2	1	2	2	2	3
CO2	3	3	1	3	3				2	1	2	2	2	3
CO3	3	3	1	3	3				2	1	2	2	2	3
CO4	3	3	1	3	3				2	1	2	2	2	3
CO5	3	3	1	3	3				2	1	2	2	2	3
Avg	3	3	1	3	3	0	0	0	2	1	2	2	2	3

Course Code & Name: 21CS4002R Operating Systems Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	0	0	0	1	0	0	0	0	0	1	1	1	0
CO2	3	2	1	1	1	0	0	0	1	0	0	1	1	0
CO3	3	2	1	1	1	0	0	0	1	1	0	1	0	1
CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Semester – V

Course Code & Name: 19CS5201/ Theory of Computing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	1	-	-	2	2	-	3	2	1
CO2	3	3	3	3	-	1	-	-	2	2	-	3	2	1
CO3	3	3	3	3	-	1	-	-	2	2	-	3	2	1
CO4	3	3	3	3	-	1	-	-	2	2	-	3	2	1
CO5	3	3	2	2	-	1	-	-	2	2	3	3	2	2
Avg	3	3	2.8	2.8	0.4	1	0	0	2	2	0.6	3	2	1.2

Course Code & Name: 19CS5202/ Computer Networks

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO	PSO
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													1	2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19EC5231 / Principles of Microprocessors and Microcontrollers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19CS5203 / Data Mining

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3			3	1		2	2	2	3
CO2	3	3	3	2	3			3	1		2	2	2	3
CO3	3	2	3	2	3			3	1		2	2	2	3
CO4	3	3	3	2	3			3	1		2	2	2	3
CO5	3	3	3	2	3			3	1		2	2	2	3
Avg	3	2.8	3	2	3	0	0	3	1	0	2	2	2	3

Course Code & Name: 19CS5252/ Object Oriented Analysis And Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO1					3	3	3							
CO2	2	2			3	3								
CO3	2		2	3	3	3								
CO4	2	1	2	2		3								
CO5	2	2	2	2	3	3	3				2	2		
Avg	2	1.6	2	2.3	3	3	3				2	2		

Course Code & Name: 19CS5251/ INTRODUCTION TO DESIGN THINKING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19EC5031 Principles of Microprocessors and Microcontrollers Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

PROFESSIONAL ELECTIVE-1

Course Code & Name: 19CS5351 Internet and Web Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	2	1		2	3		3	2	

CO2	3	3	3	3	2	2	1			3		3		2
CO3	3	3	3	3	2	1	1		1	3		3	2	2
CO4	3	3	3	3	2	1			1	3		3		3
CO5	3	3	3	3	2	1			1	3		3	2	
Avg	3	3	3	3	2	1.4	0.6	0	1	3	0	3	1.2	1.4

Course Code & Name: 19CS5352 Advanced Java Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	0	0	3	0	0	0	0	0	2	2	1	2
CO2	3	1	3	0	3	0	0	0	1	0	0	1	1	2
CO3	3	1	2	0	3	0	0	0	0	1	0	3	0	1
CO4	1	1	3	0	0	0	0	0	1	0	1	1	0	1
CO5	3	1	1	0	0	0	0	0	0	1	1	1	1	1
Avg	3	1	2	0	2	0	0	0	0	0	1	2	1	1

Course Code & Name: 19CS5353 Fundamentals of Open Source Software

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	0	0	3	0	0	0	0	0	2	2	1	2
CO2	3	1	3	0	3	0	0	0	1	0	0	1	1	2
CO3	3	3	2	0	3	0	0	0	0	1	0	3	0	1
CO4	1	1	3	0	0	0	0	0	1	0	1	1	0	1
CO5	3	1	1	0	0	0	0	0	0	1	1	1	1	1
Avg	3	2	2	0	2	0	0	0	0	0	1	2	1	1

Course Code & Name: 19CS5354 R Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	0	0	0	1	0	0	0	0	0	1	1	1	0
CO2	3	2	1	1	1	0	0	0	1	0	0	1	1	0
CO3	3	2	1	1	1	0	0	0	1	1	0	1	0	1

CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Course Code & Name: 19CS5355 Computer Graphics and Multimedia

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3		2	0	0	0	0	2	3	3	3	3
CO2	2	3				0	0	0	0	1	3	1		3
CO3	1		3		2	0	0	0	0	2	0	2	2	
CO4		1		3		0	0	0	0	1	1	1	3	
CO5			3	3	2	0	0	0	0	2	1	1		3
Avg	1.7	2.3	3	3	2	0	0	0	0	2	2	2	2.3	2.8

Course Code & Name: 19CS5001/Engineering Clinic

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Semester – VI

Course Code & Name: 19CS6181 Principles of Management

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1			1			2	2	2	3	3	2		
CO2	2		1	2	1			2	3		3	1	1	
CO3	2		2	2	2	2		3	2	3		1		

CO4	2		3		2	2			3	3	2	1		1
CO5	0				2	2	2		2					
Avg	1.4	0	1.2	1	1.4	1.2	0.8	1.4	2.4	1.8	1.6	1	0.2	0.2

Course Code & Name: 19CS6201 Artificial Intelligence

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	2	2	1	1	2	2	3	3	2
CO2	3	3	3	2	2	2	2	1	1	2	1	2	3	2
CO3	3	3	3	2	2	2	2	1	1	2	1	2	3	3
CO4	3	3	2	2	2	2	2	1	2	2	1	3	3	2
CO5	3	3	2	2	2	2	2	1	2	2	2	3	3	2
Avg	3	3	2.4	2	2	2	2	1	1.4	2	1.4	2.6	3	2.2

Course Code & Name: 19CS6253 PREDICTIVE MODELING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS6252 MOBILE COMPUTING AND APPLICATION DEVELOPMENT

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	1	-	-	1	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	1	-	-	-	-	-	1	2	-
CO4	1	1	1	1	1	1	-	-	-	-	-	1	2	-
CO5	1	1	1	-	1	1	-	-	-	1	-	1	2	-

Avg	1	0.6	1	0.2	0.4	0.8				0.2		0.6	1.2	
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Course Code & Name: 19CS6251R COMPILER DESIGN

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	-	-	1	1	-	-	-	-	1	1	-
CO2	3	3	3	1	2	1	1	-	-	-	1	1	1	1
CO3	3	2	3	2	1		2	-	1	-	2	2	3	2
CO4	3	3	3	1		1	2		1	-	-	2	2	3
CO5	3	3	3	-	2	-	2	-	1	-	1	3	3	3
Avg	3.0	2.8	3.0	1.3	1.7	1.0	1.6	-	1.0	-	1.3	1.8	2.0	2.3

Course Code & Name: 19IT6003 Project based Learning

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	0	0	0	1	0	0	0	0	0	1	1	1	0
CO2	3	2	1	1	1	0	0	0	1	0	0	1	1	0
CO3	3	2	1	1	1	0	0	0	1	1	0	1	0	1
CO4	3	2	1	1	0	0	0	0	1	0	1	1	0	1
CO5	3	0	0	0	0	0	0	0	0	1	1	1	1	0
Avg	3	1	1	1	1	0	0	0	1	0	1	1	1	0

Course Code & Name: 19CS6301 Business Intelligence – Data Warehousing and Analytics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0

CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS6302 Embedded Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	0	2	0	0	1	0	1	1	3	1	0
CO2	3	2	2	0	1	0	0	1	0	1	0	1	0	0
CO3	3	2	1	0	3	0	0	1	0	1	0	2	1	0
CO4	3	2	3	0	2	0	0	1	0	1	1	1	1	1
CO5	3	2	3	0	1	0	0	1	0	1	1	1	1	0
Avg	3	2	2	0	2	0	0	1	0	1	1	2	1	0

Course Code & Name: 19CS6304 Big Data Analytics and Tools

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	0	0	0	0	0	0	2	3	3	2	1
CO2	3	2	1	2	1	0	0	0	0	1	3	1	3	0
CO3	3	2	1	1	1	0	0	0	0	2	0	2	1	0
CO4	3	2	1	0	0	0	0	0	0	1	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	2	1	1	1	0
Avg	3	2	1	1	0	0	0	0	0	2	2	2	2	0

Course Code & Name: 19CS6305 Soft Computing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0

CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19CS6306 DEVELOPMENT OF MACHINE LEARNING MODELS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS6307 RESPONSIVE WEB DESIGN AND DEVELOPMENT

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19IT6308 Web Development - I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	0	0	2	0	0	0	0	0	1	2	3	0
CO2	3	2	1	0	1	0	0	0	0	0	0	3	2	0
CO3	3	2	0	0	3	0	0	0	0	1	0	2	0	0
CO4	3	3	1	0	0	0	0	0	0	0	1	2	0	0
CO5	3	3	0	0	0	0	0	0	0	1	1	3	1	0
Avg	3	2	0	0	1	0	0	0	0	0	1	2	1	0

Course Code & Name: 19CS6401 Introduction to Java Programming

PO&	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO		
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PSO										10	11	12	PSO 1	PSO 2
CO1	3	3	3	1	3				1		1	2	2	3
CO2	3	3	3	1	3				1		1	2	2	3
CO3	3	2	3	2	3				1		2	2	2	3
CO4	3	3	3	1	3				1		1	2	2	3
CO5	3	3	3	1	3				1		1	2	2	3
Avg	3	2.8	3	1.2	3	0	0	0	1	0	1.2	2	2	3

Semester – VII

Course Code & Name: 19CS7201 Cryptography and Network Security

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2										3	2
CO2	3		2			2							3	2
CO3		1	2	2										3
CO4	3		2									2		3
CO5	1	3	3	3								2		3
Avg	2	1.2	2.2	1	0	0.4	0	0	0	0	0	0.8	1.2	2.6

Course Code & Name: 19CS7202 Cloud Computing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1			2	2	1		1	2	2	3
CO2	3	2	3	1			2	2	1		1	2	2	3
CO3	3	2	3	2			2	2	1		2	2	2	3
CO4	3	2	3	1			2	2	1		1	2	2	3
CO5	3	2	3	1			2	2	1		1	2	2	3
Avg	3	2	3	1.2	0	0	2	2	1	0	1.2	2	2	3

Course Code & Name: 19CS7251 MACHINE LEARNING TECHNIQUES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3			3		1	1	1	1	1	3	3	3	3
CO2	3	3	2	3	3	1		1	1	1	3	3	3	3
CO3	3	3	2	3	3	1		1	1	1	3	3	3	3
CO4	3	3	2	3	2	1		1	1	1	3	3	3	3
CO5	3	3		3	1	1	1	1	1	1	3	3	3	3
Avg	3	3	2	3	2.25	1	1	1	1	1	3	3	3	3

Course Code & Name: 19CS7001 Cloud Computing Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	1	2	0	0	0	0	0	0	1	1	0
CO2	3	2	1	1	2	0	0	1	0	0	0	2	1	1
CO3	3	3	1	1	2	0	0	1	0	0	0	1	1	1
CO4	3	2	1	1	0	0	0	1	0	0	0	2	1	1
CO5	3	1	1	1	2	0	0	0	0	0	0	1	1	0
Avg	3	2	1	1	2	0	0	1	0	0	0	1	1	1

Course Code & Name: 19CS7002 SECURITY LABORATORY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	2	3	3	1	1	1		2	2	3	2
CO2	3	3	2	2	3	3	1	1	3		2	3	3	2
CO3	3	3	2	2	3	3	1	1	3		2	3	2	2
CO4	2	3	2	2	2	3	1	1	3		2	3	1	2
CO5	3	2	1	2	3	2	1	2	1		2	2	1	1
Avg	2.8	2.8	1.6	2	2.8	2.8	1	1.2	2.2	0	2	2.6	2	1.8

Course Code & Name: 19CS7901 Project Phase I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19CS7301 Multi-core Architecture and Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	0	2	0	0	0	2	0	0	1	1	0
CO2	3	2	1	0	2	0	0	1	2	0	0	2	1	1
CO3	3	3	1	0	2	0	0	1	2	0	0	1	1	1
CO4	3	2	1	0	0	0	0	1	0	0	0	2	1	1
CO5	3	1	1	0	2	0	0	0	2	0	0	1	1	0
Avg	3	2	1	0	2	0	0	1	2	0	0	1	1	1

Course Code & Name: 19CS7302 Cyber Forensics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	0	0	0	0	0	0	2	3	3	2	1
CO2	3	2	1	2	1	0	0	0	0	1	3	1	3	0
CO3	3	2	1	1	1	0	0	0	0	2	0	2	1	0
CO4	3	2	1	0	0	0	0	0	0	1	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	2	1	1	1	0
Avg	3	2	1	1	0	0	0	0	0	2	2	2	2	0

Course Code & Name: 19CS7303 Wireless Sensor Networks

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO1	3	3	1	0	1	0	0	0	0	1	3	0	1	1
CO2	2	2	1	0	1	1	0	1	0	0	3	1	3	0
CO3	3	3	1	0	1	1	0	1	0	0	0	2	1	1
CO4	1	2	1	0	0	1	0	1	0	0	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	0	1	1	1	0
Avg	2	2	1	0	1	1	0	1	0	0	2	1	2	1

Course Code & Name: 19CS7304 C# and .Net Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19CS7305 Software Testing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	0	0	0	0	0	0	2	3	3	2	1
CO2	3	2	1	2	1	0	0	0	0	1	3	1	3	0
CO3	3	2	1	1	1	0	0	0	0	2	0	2	1	0
CO4	3	2	1	0	0	0	0	0	0	1	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	2	1	1	1	0
Avg	3	2	1	1	0	0	0	0	0	2	2	2	2	0

Course Code & Name: 19CS7401 Foundation Skills in Information Technology (NASSCOM)

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1		3							2	2	1
CO2	1	2	3	1	2							1	2	1

CO3	1	1		2	1							2	2	1
CO4	1	2	2									1		2
CO5	1	1		2	1							1	2	1
Avg	1.00	1.40	1.20	1.00	1.40	-	-	-	-	-	-	1.40	1.60	1.20

Semester – VIII

Course Code & Name: 19CS8901 Project Phase II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	0	1	0	0	0	0	1	3	0	1	1
CO2	2	2	1	0	1	1	0	1	0	0	3	1	3	0
CO3	3	3	1	0	1	1	0	1	0	0	0	2	1	1
CO4	1	2	1	0	0	1	0	1	0	0	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	0	1	1	1	0
Avg	2	2	1	0	1	1	0	1	0	0	2	1	2	1

Course Code & Name: 19CS8301 Digital Image Processing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS8302 High Speed Networks

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1

CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS8303 Information Security

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	0	1	0	0	0	0	1	3	0	1	1
CO2	2	2	1	0	1	1	0	1	0	0	3	1	3	0
CO3	3	3	1	0	1	1	0	1	0	0	0	2	1	1
CO4	1	2	1	0	0	1	0	1	0	0	1	1	2	1
CO5	3	2	1	0	0	0	0	0	0	0	1	1	1	0
Avg	2	2	1	0	1	1	0	1	0	0	2	1	2	1

Course Code & Name: 19CS8304 Human Computer Interaction

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS8305 RESPONSIVE WEB DESIGN

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19CS8306 Information Retrieval Techniques

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Course Code & Name: 19CS8307 User Interface Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS8308 Visualization Techniques

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	0	3	2	0	0	0	3	0	3	0	1	2
CO2	3	1	0	2	2	3	0	1	2	0	3	2	1	2
CO3	3	3	0	2	2	3	0	1	2	0	2	2	1	2
CO4	3	1	0	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	0	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	0	2	2	2	0	1	1	0	2	2	1	1

Course Code & Name: 19CS8309 Deep Learning

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3	2	1	0	0	2	0	0	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	0	2	1	1
CO3	3	3	1	3	2	1	0	1	2	0	0	1	1	1
CO4	3	2	1	3	0	1	0	1	0	0	0	2	1	1
CO5	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	1	2	0	0	1	1	1

Course Code & Name: 19CS8310 Block Chain Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	0
CO2	3	1	2	2	2	3	0	1	2	0	3	2	1	0
CO3	3	3	2	2	2	3	0	1	2	0	2	2	1	0
CO4	3	1	2	2	0	3	0	1	0	0	2	2	1	0
CO5	3	1	2	1	2	0	0	0	0	0	2	3	1	0
Avg	3	2	2	2	2	2	0	1	1	0	2	2	1	0

Year	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I	II	22MA2103- Differential Equations And Linear Algebra	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2
		22PH2101- Basics of Material Science	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2
		22HE2151 - Effective Technical Communication	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	0	1
		22PH2151- Physics for Circuit Engineering	2.8	2.6	2.2	1.6	1.4	0	1	0.8	0.4	1.2	1.8	1.8	1.2	1.4
		22IT2251 - Python programming and Practices	2	3	3	-	2	-	-	-	2	-	-	2	2	2
		22IT2253- Dynamic Web Design	1.4	1	1	0	0.6	0	0	0	0.4	0.4	0.6	1	0.6	1.4
		22ME2001- Engineering Practices	3	1	2	0	2	2	0	1	1	0	2	2	1	0
		22HE2071- Design Thinking	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		22HE2072- Soft Skills and Aptitude 1	3	1	2	0	2	0	0	1	0	1	0	2	1	0
		22CS2253-Java Fundamentals	3	2.8	3	0.8	1	1	1.6	0	0.6	0	0.8	1.8	2	1.8

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2019

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
II	III	21MA3104 – Discrete Mathematics and Graph Theory	2.8	2.8	2.8	2.8	2.8	-	-	-	-	-	-	2.6	2.4	2.6	
		21CS3201 - Data Structures	2.8	2.6	2.2	1.6	1.4	0	1	0.8	0.4	1.2	1.8	1.8	1.8	1.2	1.4
		21CS3202 - Database Management Systems	2	1.6	2.8	1	1.6	1.6	0.2	0	2	1.6	1.4	2	2	2.4	2
		21CS3203 – Computer Architecture	2	2	1	0	0	0	0	0	0	0	0	1	2	1	2
		21CS3251 – Digital Principles and System Design	3	3	2	2	2	2	0	1	0	1	1	1	2	0	1
		21CS3253 – Clean coding and devops	2	1.6	2.8	1	1.6	1.6	0.2	0	2	1.6	1.4	2	2	2.4	2
		21CS3001 – Data Structures Laboratory	3	1	1	1	1	0	0	0	0	1	0	1	1	1	0
		21CS3002R – Database Management Systems Laboratory	3	2	0	0	1	0	0	0	0	0	0	1	2	1	0
	IV	21CS4201 – Java Programming	1	0.2	1.6	1.6	1.2					0.6	0.6			2	2
		21CS4202- Software Engineering	2.6	2.6	2.6	2.2	2	2	2.2	2	2	2.66	2.66	2.2	2.2	2.4	2.4

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		21CS4203R– Operating Systems	2.8	1	1.2	0.6	0	0	2.4	0	1.2	0	1.8	1.2	3	0.4	
		21CS4204– Data visualization	3	3	1	3	3	0	0	0	2	1	2	2	2	3	
		21MA4151 - Probability, Statistics and Queuing Theory	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4	
		21CS4251 – Design and Analysis of Algorithms	3.00	2.80	3.00	0.80	1.00	0.60	1.60	-	0.60	-	0.80	1.80	2.00	1.80	
		21CS4001 – Java Programming Laboratory	3	3	1	3	3	0	0	0	2	1	2	2	2	3	
		21CS4002- Operating Systems Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0	
		21CS4003-Data visualization Laboratory	3	3	1	3	3	0	0	0	2	1	2	2	2	3	
		21MC4191-Essence of Indian tradition knowledge															
III	V	19CS5201 – Theory of Computing	3	3	2.8	2.8	0.4	1	0	0	2	2	0.6	3	2	1.2	
		19CS5202 – Computer Networks	3	2	1	3	2	2	0	1	2	0	0	1	1	1	
		19CS5203 – Data Mining	3	2.8	3	2	3	0	0	3	1	0	2	2	2	2	3
		19EC5231 –Principles of Microprocessors and Micro Controllers	3	2	2	2	2	2	0	1	1	0	2	2	2	1	0
		19CS5252 – Object Oriented Analysis and Design	2	1.6	2	2.3	3	3	3	3				2	2		
		19CS5251 – INTRODUCTION TO DESIGN	3	2	1	3	2	2	2	0	1	2	0	0	1	1	1

		THINKING														
		19CS53XX -Professional Elective I														
		19CS5001 – Engineering Clinic	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19EC5031 - Principles of Microprocessors and Microcontrollers Laboratory	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19HE5071-Soft Skills - I														
		19HE5072-Design Thinking														
	VI	19CS6181 – Principles of Management	1.4	0	1.2	1	1.4	1.2	0.8	1.4	2.4	1.8	1.6	1	0.2	0.2
		19CS6201 – Artificial Intelligence	3	3	2.4	2	2	2	2	1	1.4	2	1.4	2.6	3	2.2
		19CS6202 – Mobile Computing	1	0.6	1	0.2	0.4	0.8				0.2		0.6	1.2	
		19XX6401 - Open Elective– I														
		19CS63XX -Professional Elective– I														
		19CS6251R – Compiler Design	3.0	2.8	3.0	1.3	1.7	1.0	1.6	-	1.0	-	1.3	1.8	2.0	2.3
		19CS6252 – MOBILE COMPUTING AND APPLICATION DEVELOPMENT	1	0.6	1	0.2	0.4	0.8				0.2		0.6	1.2	
		19CS6253-PREDICTIVE MODELING	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19IT6003 Project based Learning	3	1	1	1	1	0	0	0	1	0	1	1	1	0

		19HE6071-Soft Skills - II														
		19HE6072-Intellectual Property Rights (IPR)														
		19CS6701-Internship/Industrial Training														

PROFESSIONAL ELECTIVE COURSES

Elective	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
I	V	19CS5351 – Internet and Web Technology	3	3	3	3	2	1.4	0.6	0	1	3	0	3	1.2	1.4	
		19CS5352 – Advanced Java Programming	3	1	2	0	2	0	0	0	0	0	0	1	2	1	1
		19CS5353 – Fundamentals of Open Source Software	3	2	2	0	2	0	0	0	0	0	0	1	2	1	1
		19CS5354 – R Programming	3	1	1	1	1	0	0	0	0	1	0	1	1	1	0
		19CS5355 – Computer Graphics and Multimedia	1.7	2.3	3	3	2	0	0	0	0	0	2	2	2	2.3	2.8
II	VI	19CS6301 – Business Intelligence – Data Warehousing And Analytics	3	2	1	3	2	2	0	1	2	0	0	1	1	1	
		19CS6302 – Embedded Systems	3	2	2	0	2	0	0	1	0	1	1	1	2	1	0
		19CS6304 – Big Data Analytics and Tools	3	2	1	1	0	0	0	0	0	0	2	2	2	2	0
		19CS6305 – Soft Computing	3	2	2	2	2	2	2	0	1	1	0	2	2	1	0

		19CS7251 – Machine Learning Techniques	3	3	2	3	2.25	1	1	1	1	1	3	3	3	3
		19CS7001 – Cloud Computing Laboratory	3	2	1	1	2	0	0	1	0	0	0	1	1	1
		19CS7002 – Security Laboratory	2.8	2.8	1.6	2	2.8	2.8	1	1.2	2.2	0	2	2.6	2	1.8
		19CS7901 – Project Phase I	3	2	2	2	2	2	0	1	1	0	2	2	1	0
	VIII	19CS83XX -Professional Elective -IV														
		19CS81XX -Professional Elective- V														
		19CS8901-Project Work – Phase II	2	2	1	0	1	1	0	1	0	0	2	1	2	1

PROFESSIONAL ELECTIVE COURSES

Elective	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
III	VII	19CS7301 - Multi-core Architecture and Programming	3	2	1	0	2	0	0	1	2	0	0	1	1	1	
		19CS7302 – Cyber Forensics	3	2	1	1	0	0	0	0	0	2	2	2	2	2	0
		19CS7303 – Wireless Sensor Networks	2	2	1	0	1	1	0	1	0	0	2	1	2	2	1
		19CS7304 - C# and .Net Programming	3	2	2	2	2	2	0	1	1	0	2	2	2	1	0
		19CS7305 – Software Testing	3	2	1	1	0	0	0	0	0	0	2	2	2	2	2

		19IT7003 – Professional Readiness for Innovation, Employability and Entrepreneurship	3	3	3	2	2	1	1	-	1	-	2	2	1	1
IV	VIII	19CS8301 – Digital Image Processing	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19CS8302 – High Speed Networks	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19CS8303 – Information Security	2	2	1	0	1	1	0	1	0	0	2	1	2	1
		19CS8304 – Human Computer Interaction	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19CS8305 – Responsive Web Design	3	2	2	2	2	2	0	1	1	0	2	2	1	0
V		19CS8306 – Information Retrieval Techniques	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19CS8307 - User Interface Design	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19CS8308 - Visualization Techniques	3	2	0	2	2	2	0	1	1	0	2	2	1	1
		19CS8309 – Deep Learning	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19CS8310- Block Chain Technology	3	2	2	2	2	2	0	1	1	0	2	2	1	0

OPEN ELECTIVE COURSES

Elective	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
II	VII	19CS7401 – Foundation Skills in Information Technology (NASSCOM)	1.00	1.40	1.20	1.00	1.40	-	-	-	-	-	-	1.40	1.60	1.20

1-Low, 2-Medium, 3-High, - No Correlation



Chairman, Board of Studies

**Chairman - BoS
CSE - HiCET**



Dean – Academics

**Dean (Academics)
HiCET**