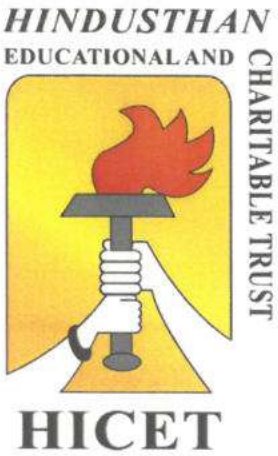
HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

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

Coimbatore - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING



IV - CSE

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the odd semester

Academic year 2023-2024

(Academic Council Meeting Held on 19.06.2023)

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

Dean-Academics

Chairman - BoS
CSE - HiCET

Dean (Academics)
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ACADEMIC COUNCIL
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HINDUSTHAN COLLEGE OF ENGG & TECH

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.

Chairman, Board Of Studies

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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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CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (UG)

REGULATION-2019

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

SEMESTER I – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1101	Calculus	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	19EC1154	Basics of Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
MANDATORY										
8	19MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	19HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
10	19HE1072	Career Guidance – Level I	EEC	2	0	0	0	100	0	100
Total Credits				**16**	**2**	**10**	**20**	**550**	**350**	**900**

SEMESTER II – 22 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2104	Differential Equations And Linear Algebra	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	19PH2151	Material Science	BS	2	0	2	3	50	50	100
4	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	19CS2152	Essentials of C and C++ Programming	ES	2	0	2	3	50	50	100
6	19ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
9	19HE2072	Career Guidance – Level II	EEC	2	0	0	0	100	0	100
Total Credits				**14**	**2**	**16**	**22**	**500**	**400**	**900**

SEMESTER III – 20 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3104	Discrete Mathematics and Graph Theory	BS	3	1	0	4	25	75	100
2	19CS3201	Data Structures	PC	3	0	0	3	25	75	100
3	19CS3202	Database Management Systems	PC	3	0	0	3	25	75	100
4	19CS3203	Computer Architecture	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19CS3251	Digital Principles and System Design / ICC-3	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19CS3001R	Data Structures Laboratory	PC	0	0	3	1.5	50	50	100
7	19CS3002R	Database Management Systems Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY										
8	19MC3191	Indian Constitution	MC	2	0	0	0	0	0	0
9	19HE3072	Career Guidance Level – III	EEC	2	0	0	0	100	0	100
10	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total Credits				**20**	**1**	**8**	**20**	**450**	**450**	**900**

SEMESTER IV – 21 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CS4201	Java Programming / ICC4	PC	3	0	0	3	25	75	100
2	19CS4202	Software Engineering	PC	3	1	0	4	25	75	100
3	19CS4203	Operating Systems	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4	19MA4151	Probability, Statistics and Queuing Theory	BS	3	0	2	4	50	50	100
5	19CS4251R	Design and Analysis of Algorithms	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19CS4001R	Java Programming Laboratory / ICC5	PC	0	0	3	1.5	50	50	100
7	19CS4002R	Operating Systems Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY										
8	19MC4191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	0	0	0
9	19HE4072	Career Guidance Level – IV	EEC	2	0	0	0	100	0	100
10	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total Credits				**19**	**1**	**10**	**21**	**375**	**425**	**800**

SEMESTER V – 24 Credits

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	Object Oriented Analysis and Design / ICC6	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
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 – 24 Credits

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
3	19**6401	Open Elective I	OE	3	0	0	3	25	75	100
4	19CS63**	Professional Elective II	PE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19CS6251R	Compiler Design	PC	2	0	3	3.5	50	50	100
6	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
8	19HE6071	Soft Skill-II	EEC	1	0	0	1	100	0	100
9	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
10	19CS6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits				**19**	**1**	**6**	**24**	**425**	**575**	**1000**

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	19CS73**	Professional Elective III / ICC9	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**

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

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	19IT7307	Web Development - II	PE	3	0	0	3	25	75	100

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	19CS8311	Introduction to Internet of Things / NPTEL	PE	3	0	0	3	25	75	100
6	19IT8314	Web Development - III	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

S. 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
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

➢ **Following are the Industry Core Courses (ICC) which will be offered as choice based course in the following semesters:**

ICC. No.	Sem. No	Course Code	Name of the Course	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	19CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	19CS2153	Java Fundamentals	2	0	2	3	50	50	100
ICC3	III	19CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	19CS4204	Data Visualization	3	0	0	3	25	75	100
ICC5	IV	19CS4003	Data Visualization Laboratory	0	0	3	1.5	50	50	100
ICC6	V	19CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	19CS6253	Predictive Modeling	3	0	2	4	25	75	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

Life Skill Courses									
S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	21LSZ401	General Studies for Competitive Examinations	3	0	0	3	25	75	100
2	21LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	25	75	100
3	21LSZ403	Indian Ethos and Human Values	3	0	0	3	25	75	100
4	21LSZ404	Indian Constitution and Political System	3	0	0	3	25	75	100
5	21LSZ405	Yoga for Human Excellence	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

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

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Programme	Course Code	Course Name	L	T	P	C
B.E	19CS7201	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

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: SDES – 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	Course Code	Name of the Course	L	T	P	C
B.E	19CS7202	CLOUD CGMPUTING (Common To CSE & AIML)	3	0	0	3

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 – 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 Architecturel, 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.

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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	**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. *Illustrative Programs: Implement and demonstratethe FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.*	7+2
II	**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. *Illustrative Programs: Create a training dataset using SVM, implement decision boundary using SVM*	7+2
III	**DISTANCE-BASED MODELS** Nearest neighbor models – K-means – clustering around medoids – silhouttes – hierarchical clustering – k-d trees – locality sensitive hashing– non-parametric regression – ensemble learning – bagging and random forests – boosting – meta learning. *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.*	7+2
IV	**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. *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 toclassify a new sample.*	7+2
V	**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. *Illustrative Programs: Metropolis–Hastings Algorithm by using Markov Chain Monte Carlo Methods, HMM Baum–Welch (Forward–Backward) Algorithm*	7+2
	Total Instructional Hours	**45**

CO1: Explain theory underlying machine learning .

Course 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	Course Code	Name of the Course	L	T	P	C
B.E	19CS7002	SECURITY LABORATORY	0	0	3	1.5

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
1.	Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts: a. Caesar Cipher b. Playfair Cipher c. Hill Cipher d. Vigenere Cipher e. Rail fence – row & Column f. Transformation
2.	Transformation Implement the following algorithms 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	Course Code	Name of the Course	L	T	P	C
B.E	19CS7306	AI ANALYST	3	0	0	3

Course Objective

1. To Familiarize the students about the evolution and relevance of AI in the world today.
2. Analyze existing and future implementations of AI solutions across multiple industries.
3. Discuss AI technology building blocks, including: natural language processing, machine and deep learning, neural networks, virtual agents, autonomics and computervision.
4. Develop a deeper understanding of machine learning techniques and the algorithm
5. Understanding the ethics and future workforce in AI

Unit	Description	Instructional Hours
I	**AI LANDSCAPES:** Definition and brief history of AI - AI Explained- AI Technologies -AI Industry Impact - Autonomous Vehicles - Smart Robotics — Goals and applications of AI - Problem-solving techniques in AI	9
II	**INTRODUCTION TO MACHINE LEARNING:** Types and approaches of ML - Different ML algorithms - Basics of neural networks - evaluating a machine learning model - Introduction to IBM Watson - IBM Watson services offerings - capabilities of each Watson service - Introduction to IBM Watson Studio	9
III	**NATURAL LANGUAGE PROCESSING:NLP** Definition and scope of NLP - Applications of NLP - Challenges and limitations in NLP- Text Preprocessing- Tokenization - Stemming and Lemmatization - Language Modeling – N-gram modelling – Text Classification – Named Entity Recognition	9
IV	**COMPUTER VISION & DEEP LEARNING:** Computer Vision Overview- AI Vision through Deep Learning - Computer Vision for the Enterprise - Deep Learning Explained - Deep learning ecosystem	9
V	**FUTURE TRENDS FOR AI:** Evolution of AI and its current state - Overview of the impact of AI on various industries - Ethical issues and challenges in AI - Bias and fairness in AI algorithms - Responsible AI development practices - AI and Automation in the Workplace - AI and Automation in the Workplace - AI in Smart Cities and IoT	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Recognize various machine learning techniques utilized in designing AI systems and applications to address real-world problems.

CO2: Utilize these techniques in applications that involve perception, reasoning, and learning

CO3: Perform analysis and design of a real-world problem to facilitate implementation and gain comprehension of the dynamic behavior of a system.

CO4: Explain the role of agents and how it is related to the environment and the way of evaluating it and how agents can act by establishing goals

CO5: Acquire the knowledge of real-world Knowledge representation

TEXT BOOKS:

T1 :IBM Courseware

REFERENCE BOOKS:

R1: Artificial Intelligence: A Modern Approach - Stuart Russell and Peter Norvig

R2: Deep Learning- Ian Goodfellow, Yoshua Bengio, and Aaron Courville

R3: Pattern Recognition and Machine Learning - Christopher M. Bishop

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PROFESSIONAL ELECTIVE -3

Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS7301	MULTICORE ARCHITECTURE AND PROGRAMMING	3	0	0	3

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-Kauffman/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	Course Code	Name of the Course	L	T	P	C
B.E	19CS7302	CYBER FORENSICS	3	0	0	3

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
I	**INTRODUCTION TO COMPUTER FORENSICS** 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
II	**EVIDENCE COLLECTION AND FORENSICS TOOLS** Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9
III	**ANALYSIS AND VALIDATION** Validating Forensics Data – Data Hiding Techniques – Performing Live Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics	9
IV	**ETHICAL HACKING** Introduction to Ethical Hacking – Foot printing – Scanning Networks – Enumeration – System Hacking – Malware Threats :Trojan and Backdoors – Sniffing	9
V	**ETHICAL HACKING IN WEB** 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 Certfied 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	Course Code	Name of the Course	L	T	P	C
B.E	19CS7303	WIRELESS SENSOR NETWORKS	3	0	0	3

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 Morais 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	Course Code	Name of the Course	L	T	P	C
B.E	19CS7304	C# and .NET AND PROGRAMMING	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
I	**INTRODUCTION TO C#** 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
II	**OBJECT ORIENTED ASPECTS OF C#** 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
III	**APPLICATION DEVELOPMENT ON .NET** 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
IV	**WEB BASED APPLICATION DEVELOPMENT ON .NET** 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
V	**CLR AND .NET FRAMEWORK** 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., Introducting .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

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
I	**INTRODUCTION** 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
II	**TEST CASE DESIGN** 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
III	**LEVELS OF TESTING** 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
IV	**TEST AMANAGEMENT** 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
V	**TEST AUTOMATION** 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 .Wilev 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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PROFESSIONAL ELECTIVE -5
(FAST TRACK COURSE SYLLABUS)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8306	INFORMATION RETRIEVAL TECHNIQUES	3	0	0	3

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
B.E	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
I	**INTERACTIVE SOFTWARE AND INTERACTION DEVICE** Human–Computer Interface – Characteristics of Graphics Interface – Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.	9
II	**HUMAN COMPUTER INTERACTION** 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
III	**WINDOWS** 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
IV	**MULTIMEDIA** Text for Web Pages – Effective Feedback– Guidance & Assistance– Internationalization– Accessibility– Icons– Image– Multimedia – Coloring- Case Study: Addressing usability in E- Commerce sites.	9
V	**DESIGN PROCESS AND EVALUATION** 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: Wilbent. 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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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8308	VISUALIZATION TECHNIQUES	3	0	0	3

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" Margon 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,"InformationVisualization",Beyondthehorizon,2ndedition,SpringerVerlag,2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8309	DEEP LEARNING	3	0	0	3

Course Objective

1. To learn the foundation of deep networks and optimization algorithms of deep learning
2. To study about the various models for Deep Learning
3. To know the essence of deep learning merging with python
4. To be familiar with Tensor flow for learning Deep networking
5. To study the various applications of Deep Learning Techniques

Unit	Description	Instructional Hours
I	**BASICS** 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
II	**FEEDFORWARD NETWORKS** Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders. **DEEP NEURAL NETWORKS:** Difficulty of training deep neural networks, Greedy layerwise training.	9
III	**BETTER TRAINING OF NEURAL NETWORKS** Newer optimization methods for neural networks (Adagrad, adadelta, 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
IV	**GENERATIVE MODELS** 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
V	**APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION** 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 Zaccone, Md. RezaulKarim, " Deep Learning with TensorFlow:Explore neural networks and build intelligent systems with python", Packt Pulishing,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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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8310	BLOCK CHAIN TECHNOLOGY	3	0	0	3

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
I	**BASICS** 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
II	**BLOCK CHAIN** 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
III	**DISTRIBUTED CONSENSUS** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	9
IV	**CRYPTOCURRENCY** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.	9
V	**CRYPTOCURRENCY REGULATION** 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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Coimbatore - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING

III -CSE

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the 0dd semester

Academic year 2023-2024

(Academic Council Meeting Held on 19.06.2023)

CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (UG)

REGULATION-2019

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

SEMESTER I – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1101	Calculus	BS	3	1	0	4	40	60	100
THEORY & LAB COMPONENT										
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	21CS1151	Python Programming and Practices / ICC1	ES	2	0	2	3	50	50	100
6	21EC1154	Basics of Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
MANDATORY										
8	21MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	21HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
10	21HE1072	Career Guidance – Level I	EEC	2	0	0	0	100	0	100
Total Credits				**16**	**2**	**10**	**20**	**580**	**320**	**900**

SEMESTER II – 22 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	BusinessEnglish for Engineers	HS	2	1	0	3	40	60	100
2	21MA2104	Differential Equations And Linear Algebra	BS	3	1	0	4	40	60	100
THEORY & LAB COMPONENT										
3	21PH2151	Material Science	BS	2	0	2	3	50	50	100
4	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	21CS2152	Essentials of C and C++ Programming / ICC2	ES	2	0	2	3	50	50	100
6	21ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
8	21HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
9	21HE2072	Career Guidance – Level II	EEC	2	0	0	0	100	0	100
Total Credits				**14**	**2**	**16**	**22**	**540**	**360**	**900**

SEMESTER III – 20 Credits

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 / ICC-3	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	0	0	0
9	21HE3072	Career Guidance Level – III	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 – 21 Credits

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	MC	2	0	0	0	0	0	0
9	21HE4072	Career Guidance Level – IV	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**

SEMESTER V – 24 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS5201	Theory of Computing	PC	3	1	0	4	40	60	100
2	21CS5202	Computer Networks	PC	3	0	0	3	40	60	100
3	21EC5231	Principles of Microprocessors and Micro Controllers	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4	21CS5252	Object Oriented Analysis and Design / ICC6	PC	2	0	2	3	50	50	100
5	21CS5253	Data mining and warehousing	PC	2	0	2	3	50	50	100
6	21CS53**	Professional Elective I	PE	2	0	2	3	50	50	100
PRACTICAL										
7	21CS5001	Engineering Clinic	PC	0	0	3	1.5	60	40	100
8	21EC5031	Principles of Microprocessors and Micro-controllers Laboratory	PC	0	0	3	1.5	60	40	100
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
Total Credits				**17**	**1**	**12**	**24**	**590**	**410**	**1000**

SEMESTER VI – 24 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS6181	Principles of Management	HS	3	0	0	3	40	60	100
2	21CS6201	Artificial Intelligence / ICC7	PC	3	1	0	4	40	60	100
3	21CS6202	Mobile Computing	PC	3	0	0	3	40	60	100
4	21**6401	Open Elective I	OE	3	0	0	3	40	60	100
5	21CS63**	Professional Elective II / ICC8	PE	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
6	21CS6251	Compiler Design	PC	2	0	3	3.5	50	50	100
PRACTICAL										
8	21CS6001	Mobile Application Development Laboratory	PC	0	0	3	1.5	60	40	100
9	21HE6071	Soft Skill-II	EEC	1	0	0	1	100	0	100
10	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
11	21CS6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits				**19**	**1**	**6**	**24**	**510**	**490**	**1000**

SEMESTER VII – 20 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS7201	Cryptography and Network Security	PC	3	0	0	3	40	60	100
2	21CS7202	Cloud Computing	PC	3	0	0	3	40	60	100
3	21**7401	Open Elective II	OE	3	0	0	3	40	60	100
4	21CS73**	Professional Elective	PE	3	0	0	3	40	60	100

		III / ICC9								
THEORY & LAB COMPONENT										
5	21CS7251	Machine Learning Techniques	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21CS7001	Cloud Computing Laboratory	PC	0	0	3	1.5	60	40	100
7	21CS7002	Security Laboratory	PC	0	0	3	1.5	60	40	100
8	21CS7901	Project Phase I	EEC	0	0	4	2	50	50	100
Total Credits				**14**	**0**	**12**	**20**	**380**	**420**	**800**

SEMESTER VIII – 14 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS83**	Professional Elective IV	PE	3	0	0	3	40	60	100
2	21CS83**	Professional Elective V	PE	3	0	0	3	40	60	100
PRACTICAL										
3	21CS8901	Project Phase II	EEC	0	0	16	8	100	100	200
Total Credits				**6**	**0**	**16**	**14**	**180**	**220**	**400**

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	21CS5351	Internet and Web Technology	PE	2	0	2	3	50	50	100
2	21CS5352	Advanced Java Programming	PE	2	0	2	3	50	50	100
3	21CS5353	Fundamentals of Open Source Software	PE	2	0	2	3	50	50	100
4	21CS5354	R Programming	PE	2	0	2	3	50	50	100
5	21CS5355	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	21CS6301	Business Intelligence – Data Warehousing and Analytics	PE	3	0	0	3	40	60	100
2	21CS6302	Embedded Systems	PE	3	0	0	3	40	60	100
3	21CS6303	Internet of Things	PE	3	0	0	3	40	60	100
4	21CS6304	Big Data Analytics and Tools	PE	3	0	0	3	40	60	100
5	21CS6305	Soft Computing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE III

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS7301	Multi-core Architecture and Programming	PE	3	0	0	3	40	60	100
2	21CS7302	Cyber Forensics	PE	3	0	0	3	40	60	100
3	21CS7303	Wireless Sensor Networks	PE	3	0	0	3	40	60	100
4	21CS7304	C# and .Net Programming	PE	3	0	0	3	40	60	100
5	21CS7305	Software Testing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE IV

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS8301	Digital Image Processing	PE	3	0	0	3	40	60	100
2	21CS8302	High Speed Networks	PE	3	0	0	3	40	60	100
3	21CS8303	Information Security	PE	3	0	0	3	40	60	100
4	21CS8304	Human Computer Interaction	PE	3	0	0	3	40	60	100
5	21CS8305	Responsive Web Design	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE V

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS8306	Information Retrieval Techniques	PE	3	0	0	3	40	60	100
2	21CS8307	User Interface Design	PE	3	0	0	3	40	60	100
3	21CS8308	Visualization Techniques	PE	3	0	0	3	40	60	100
4	21CS8309	Deep Learning	PE	3	0	0	3	40	60	100
5	21CS8310	Block Chain Technology	PE	3	0	0	3	40	60	100

OPEN ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
OPEN ELECTIVE - I										
1	21CS6401	Introduction to Java Programming	OE	3	0	0	3	40	60	100
2	21CS6402	Green Computing	OE	3	0	0	3	40	60	100
OPEN ELECTIVE - II										
1	21CS7401	Foundation Skills in Information Technology (NASSCOM)	OE	3	0	0	3	40	60	100
2	21CS7402	Multimedia Systems	OE	3	0	0	3	40	60	100

➢ **Following are the Industry Core Courses (ICC) which will be offered as choice based course in the following semesters:**

ICC. No.	Sem. No	Course Code	Name of the Course	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	21CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	21CS2153	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	21CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	21CS6253	Predictive Modeling	3	0	2	4	40	60	100
ICC8	VI	21CS6306	Development of Machine Learning models	3	0	0	3	40	60	100
ICC9	VII	21CS7306	AI Analyst	3	0	0	3	40	60	100

Life Skill Courses									
S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	21LSZ401	General Studies for Competitive Examinations	3	0	0	3	40	60	100
2	21LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	40	60	100
3	21LSZ403	Indian Ethos and Human Values	3	0	0	3	40	60	100
4	21LSZ404	Indian Constitution and Political System	3	0	0	3	40	60	100
5	21LSZ405	Yoga for Human Excellence	3	0	0	3	40	60	100

(Note: Z stands for semester, students can't choose twice the course)

As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Students who will be enrolled his name in HICET NCC are eligible to undergo these subjects. Earned extra credits printed in the Consolidated Mark sheet as per the regulation. NCC course level 1 & Level 2 will be added in the open elective subject in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.

Semester	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	NCC General and National Integration	1	0	0	1	100	0	100
2	Social services and community development	1	0	0	1	100	0	100
3	General awareness, communication and Aero engines	1	0	0	1	100	0	100

NCC COURSES (Only for the students' who have opted NCC subjects in Semester I, II, III & IV are eligible)										
1	21HEZ401	NCC course level 1	OE	3	0	0	3	40	60	100

2	21HEZ402	NCC course level 2	OE	3	0	0	3	40	60	100

Enrollment for B.E. / B. TECH. (HONORS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.
  Note: Each programme should provide verticals for minor degree

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2.	21CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3.	21CS6602	Sem6: Internet Of Things	MDC	3	0	0	3	3
4.	21CS7601	Sem 7: Introduction to Machine Learning	MDC	3	0	0	3	3
5.	21CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6.	21CS8601	Sem 8: Data Analytics for Engineers	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
21CS5602-Financial Management	21BA5601- Foundations of Entrepreneurship	21CE5602- Sustainable infrastructure Development
Fundamentals of Investment	Introduction to Business Venture	Sustainable Agriculture and Environmental Management

Banking, Financial Services and Insurance	Team Building & Leadership Management for Business	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Creativity & Innovation in Entrepreneurship	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Principles of Marketing Management for Business	Green Technology
Introduction to Fintech	Human Resource Management for Entrepreneurs	Environmental Quality Monitoring and Analysis
	Financing New Business Ventures	

Vertical I FINTECH AND BLOCK CHAIN

S No	Course Code	Course Title	Category	Periods Per week			TCP	Credits
				L	T	P		
1	21CS5602	Sem 5:Financial Management	MDC	3	0	0	3	3
2	21XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	21XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	21XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	21XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	21XXXX	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			T C P	Credits
				L	T	P		
1	21BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	21XXXX	Introduction to Business Venture	MDC	3	0	0	3	3
3	21XXXX	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	21XXXX	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	21XXXX	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	21XXXX	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	21XXXX	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			TCP	Credits
				L	T	P		
1	21CE5602	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	21XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	21XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	21XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	21XXXX	Green Technology	MDC	3	0	0	3	3
6	21XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in IOT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	4	40	60	100
2.	21CS6203	Sem 6: IoT Design	PC	3	0	0	3	4	40	60	100
3.	21CS6204	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	4	40	60	100
4.	21CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	4	40	60	100
5.	21CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	4	40	60	100
6.	21CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	4	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in BLOCK CHAIN TECHNOLOGY

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3	40	60	100
2.	21CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3	40	60	100
3.	21CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3	40	60	100

4.	21CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3	40	60	100
5.	21CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3	40	60	100
6.	21CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in FULL STACK DEVELOPMENT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5206	Sem 5: Web Technology	PC	3	0	0	3	3	40	60	100
2.	21CS6207	Sem 6: React JS with Spring boot 2	PC	3	0	0	3	3	40	60	100
3.	21CS6208	Sem 6: Back End Development with NodeJS	PC	3	0	0	3	3	40	60	100
4.	21CS7207	Sem 7: Nosql Databases with Mongo DB	PC	3	0	0	3	3	40	60	100
5.	21CS7208	Sem 7: DevOps	PC	3	0	0	3	3	40	60	100
6.	21CS8203	Sem 8: Web Application Security	PC	3	0	0	3	3	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING IN TECHNICAL COLLABORATION WITH MICROSOFT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5207	Sem 5: Cloud Computing Fundamentals	PC	3	0	0	3	3	40	60	100
2.	21CS6209	Sem 6: Artificial Intelligence Fundamentals	PC	3	0	0	3	3	40	60	100
3.	21CS6210	Sem 6: Data Analysis and Visualization	PC	3	0	0	3	3	40	60	100
4.	21CS7209	Sem 7: Designing and Implementing a Microsoft Azure AI Solution	PC	3	0	0	3	3	40	60	100
5.	21CS7210	Sem 7: Administering Windows Server Hybrid Core Infrastructure	PC	3	0	0	3	3	40	60	100
6.	21CS8204	Sem 8: Project Management	PC	3	0	0	3	3	40	60	100

CREDIT DISTRIBUTION

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5201	THEORY OF COMPUTING	3	1	0	4

Course Objective

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 NDFA-Finite Automaton with Є- 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

TEXT BOOKS:

T1: Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", ThirdEdition, 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
B.E	21CS5202	COMPUTER NETWORKS	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
I	**OVERVIEW & PHYSICAL LAYER** Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission Media – Switching – Circuit-switched Networks – Packet Switching.	9
II	**DATA LINK LAYER** 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
III	**NETWORK AND ROUTING** 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
IV	**TRANSPORT LAYER** 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
V	**APPLICATION LAYER** 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.

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	Course Code	Name of the Course	L	T	P	C
B.E	21EC5231	PRINCIPLES OF MICROPROCESSORS AND MICRO CONTROLLERS	3	0	0	3

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
I	**8086 MICROPROCESSOR** Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming – Modular Programming - Interrupts and interrupt service routines. Case study: I5 and I7 processors	9
II	**8086 SYSTEM BUS STRUCTURE** 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
III	**I/O INTERFACING** Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer Interface – Keyboard /display controller – Interrupt controller – DMA controller.	9
IV	**8051 MICROCONTROLLER** Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.	9
V	**PROGRAMMING/INTERFACING MICROCONTROLLER** 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.

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: Doughlas 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	T	P	C
B.E	21CS5252	OBJECT ORIENTED ANALYSIS AND DESIGN	2	0	2	3

Course Objective

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
I	**UNIFIED PROCESS AND USE CASE DIAGRAMS** 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
II	**STATIC UML DIAGRAMS** 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
III	**DYNAMIC AND IMPLEMENTATION UML DIAGRAMS** 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. *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.*	6+3
IV	**DESIGN PATTERNS** 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. *Experiments: Improve the reusability and maintainability of the software system by applying appropriate design pattern*	5+4
V	**TESTING** Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans *Experiments: Implement the modified system and test it for various scenarios*	6+3
	TOTAL INSTRCTIONAL HOURS	**45**

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 Developmentl, 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 Softwarel, Addison-Wesley, 1995.
R2: Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Languagel, 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	Course Code	Name of the Course	L	T	P	C
B.E	21EC5031	PRINCIPLES OF MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	0	0	3	1.5

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	Name of the Course	L	T	P	C
B.E	21CS5253	DATA MINING AND WAREHOUSING	2	0	2	3

Course Objective

1. To develop skills on data warehouse, OLAP technology.
2. To understand the basic concepts of Data Mining.
3. To understand the concepts of data preprocessing and frequent patterns.
4. To practice various classification tools using mining tool.
5. To learn the concepts of prediction and clustering.

Unit	Description	Instructional Hours
I	**DATA WAREHOUSE,OLAP TECHNOLOGY** Need for Data Warehouse- Data Warehouses - multidimensional data model- Data Warehouse architecture – Data Warehouse Implementation - Data Warehousing to Data mining. ***Program:*** *1. Demonstrate OLAP Cube and its different operations (using OLAPWriter/Tableau/Oracle, etc.)*	(6T+3P)
II	**DATA MINING** Motivation -Steps in Data Mining – Architecture - Data Mining and Databases – Data Warehouses – Data Mining functionalities – Classification – Data Mining Primitives - Integration of a Data Mining System with a Database or Data Warehouse System – Major issues ***Program:*** *1. Explore WEKA Data Mining/Machine Learning Toolkit.* *Study the arff file format.* *Explore the available data sets in WEKA.* *Demonstrate preprocessing on dataset Employee.arff*	(6T+3P)
III	**DATA PREPROCESSING AND MINING FREQUENT PATTERNS** **DATA PREPROCESSING:** Descriptive data summarization –Data Cleaning – Data integration and transformation – Data Reduction. **MINING FREQUENT PATTERNS**: Basic Concepts, Frequent item set Mining Methods. *1.Generate Association Rules using the Apriori algorithm using RapidMiner.*	(6T+3P)
IV	**CLASSIFICATION**: Introduction – Decision trees – Naïve Bayes' classification - Artificial Neural Networks - Support Vector Machines - Issues regarding classification and prediction. ***Program:*** *1. Demonstrate classification process on a given dataset using Naïve Bayesian Classifier using R Programming.*	(6T+3P)

V	**PREDICTION AND CLUSTERING** Prediction-Linear Regression-Nonlinear Regression -Accuracy and error measures – Evaluating the accuracy of classifiers and predictors - Issues regarding classification and prediction.**CLUSTER ANALYSIS**: Types of data – Partitioning Methods: k means and k Medoids. ***Program:*** *1.Cluster the given dataset by using the k-Means algorithm and visualize the cluster mean values and standard deviation of dataset attributes Orange*	(6T+3P)
	Total Instructional Hours	**45**

After completion of course, students would be able to:

Course Outcome

CO1	Explain data warehouse, OLAP technology concepts.
CO2	Discuss the basic concepts of Data Mining.
CO3	Explain the concepts of data preprocessing and frequent patterns.
CO4	Demonstrate various classification algorithms using mining tool.
CO5	Represent concepts of prediction and clustering.

TEXT BOOKS:

T1: HanJiawei, Micheline Kamber and Jian Pei "Data Mining: Concepts and Techniques", Morgan Kaufmann, Ed., 2.

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 Diwakar, 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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MINOR DEGREE IN CSE

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5601	DATA STRUCTURES AND DESIGN	3	0	0	3

Course Objective

1. Understand the fundamental concepts of linear data structures
2. Learn the concept of various linear data structures like Linked list
3. Studythe concept of stack and queue.
4. Summarize the various non-linear data structures like binary tree, binary search tree, AVL, splay tree and red black tree.
5. Implement graph algorithms for solving real world problems

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF DATA STRUCTURES** Introduction – Need for data structures – Types of data structures – Algorithm: Characteristics – Analysis of complexity – time complexity, space complexity, order of growth – Linear List: Array representation and its operations.	8
II	**LINKED LIST** Representation – Basic Operations – Types: Singly linked list – Doubly linked list – Circular linked list – Applications: Polynomial Addition, Sparse Matrices.	9
III	**STACK AND QUEUE** Stack: Array and Linked Stacks – Applications: Balancing Symbols, Expression conversion, Postfix evaluation, Recursion – Queue: Array and Linked Queue, Circular Queue – Double Ended Queue – Applications.	9
IV	**TREE** Tree Terminologies – Binary tree: Representation - Tree traversal: In-order, Pre-order, Post order, Level order – Binary Search Tree: Representation – Operations – AVL Tree – B-Tree – Applications: Expression tree.	9
V	**GRAPH AND HASHING** Graph: Terminologies – Representation of Graph - Graph traversal – Topological sort – Hashing: Hash table – Hash functions – Resolving Collision Techniques: Separate chaining – Open addressing – Double hashing.	10
	Total Instructional Hours	**45**

Course Outcome

CO1: Comprehend the working of linear data structures and identify their applications.

CO2: Apply recursion on specific applications

CO3: Understand the various tree data structures for efficient storage and retrieval of data.

CO4: Employ graph data structure for solving real world problems
CO5: Apply suitable methods for efficient data access through hashing

TEXT BOOKS:

T1: Mark A.Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2010.
T2: Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016.

REFERENCE BOOKS:

R1: Aaron M. Tenenbaum, Yeedidyah 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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HONOURS WITH SPECIALIZATION

(IOT)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5204	FUNDAMENTALS OF IOT	3	0	0	3

Course Objective

1. To introduce the terminology, technology and its applications
2. To study about the concept of M2M(machine to machine)with necessary protocols.
3. To understand the Python Scripting Language which is used in many IoT devices
4. To know about the Raspberry Pi platform, that is widely used in IoT applications
5. To implement of web-based services on IoT devices.

Unit	Description	Instructional Hours
I	**BASICS OF IOT** Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks	9
II	**IOT NETWORK ARCHITECTURE AND DESIGN** Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino	9
III	**DEVELOPING INTERNET OF THINGS** Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.	9
IV	**IMPLEMENTATION** Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN),SDN for IoT, Data Handling and Analytics	9
V	**CASE STUDIES** Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring	9
	Total Instructional Hours	**45**

Course Outcome

- CO1: Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- CO2: Compare and contrast the deployment of smart objects and the technologies to connect them to network
- CO3: Appraise the role of IoT protocols for efficient network communication..
- CO4: Elaborate the need for Data Analytics and Security in IoT.
- CO5: Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry

TEXT BOOKS:

1. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

2. "Make sensors": Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.

3. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti

REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

3. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013

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HONOURS WITH SPECIALIZATION

(BLOCK CHAIN TECHNOLOGY)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5205	PUBLIC KEY INFRASTRUCTURE AND TRUST MANAGEMENT	3	0	0	3

Course Objective

1. To understand about public key technology and a public key infrastructure.
2. To Understand the relationship of identity management to PKI
3. To Understand the components of a public key infrastructure..
4. To Understand the issues related to Trust management mechanisms
5. To Understand Secure Crypto protocols like SSL and so on

Unit	Description	Instructional Hours
I	**INTRODUCTION** Uses of cryptography, the concept devil and Alice. Principle of Cryptography. PKCS standards IEEE P1363, Block cipher modes of operation and data transformation for asymmetrical algorithms, Data transformation for RSA algorithm, Cryptographic Protocols, Protocol properties, Attributes of cryptographic protocols.	9
II	**PUBLIC KEY INFRASTRUCTURE** Crypto Hardware and software, Smart cards, Universal Crypto interface, Real world attacks, Evaluation and certification, Public Key Infrastructure, PKI Works.	9
III	**DEVELOPING PKI** Directory service, Requesting certificate revocation information, Practical Aspects Of PKI Construction- The course of construction of PKI, Basic questions about PKI construction, The most important PKI suppliers.	9
IV	**IMPLEMENTATION** The internet and the OSI model The OSI model, Crypto standards for OSI Layers 1 and 2-Crypto extensions for ISDN (Layer 1), Cryptography in the GSM standard (Layer 1), Crypto extensions for PPP (Layer 2), Virtual private networks	9
V	**SECURE CRYPTO PROTOCOLS** IPsec and IKE, IPsec, IKE, SKIP, Critical assessment of IPsec, Virtu al private network with IPsec, SSL, TLS AND WTLS (Layer 4)SSL working method, SSL protocol operation, Successful SSL, Technical comparison between IPsec and SSL, WTLS.	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Distinguish between public key technology and a public key infrastructure.
	CO2:	Understand the relationship of identity management to PKI
	CO3:	Understand the components of a public key infrastructure..

	CO4:	Understand the issues related to Trust management mechanisms.
	CO5:	Understand Secure Crypto protocols like SSL and so on.

TEXT BOOKS:

1. Klaus schmeh:"Cryptography and public key infrastructure on the internet", 1st Edition, Allied Publishers, 2004.

2.Kaufman, Perlman and Speciner, "Network Security: Private Communication in a public world", Prentice Hall of India/ Pearson Education, New Delhi, 2004.

3.C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd

REFERENCE BOOK:

1. Wenbo Mao: "Modern Cryptography : theory and practice", 1st Edition, Pearson Education, 2005.

2.Behrouz Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill Publishing Company , New Delhi, 2010

3.Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

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HONOURS WITH SPECIALIZATION

(FULL STACK DEVELOPMENT)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5206	WEB TECHNOLOGY	3	0	0	3

Course Objective

1. To understand different Internet Technologies
2. To learn java-specific web services architecture
3. To Develop web applications using frameworks
4. To learn php basics
5. To learn XML and framework

Unit	Description	Instructional Hours
I	**WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0** Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework	9
II	**CLIENT SIDE PROGRAMMING** Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files	9
III	**SERVER SIDE PROGRAMMING** Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.	9
IV	**INTRODUCTION TO PHP and** An introduction to PHP: PHP- Using PHP- Variables- Program control-Built-in functions- Form Validation.	9
V	**INTRODUCTION TO XML** XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Construct a basic website using HTML and Cascading Style Sheets.

CO2: Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.

CO3: Develop server side programs using Servlets and JSP.

CO4: Construct simple web pages in PHP

CO5: Represent data in XML format.

TEXT BOOKS:

Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.

2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.

3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing

REFERENCE BOOK:

1 Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.

2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.

3. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.

4. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

5. Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1st edition, O'Reilly.

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MINOR DEGREE IN FINTECH AND BLOCK CHAIN

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5602	FINANCIAL MANAGEMENT	3	0	0	3

Course Objective

1. To acquire the knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe about capital budgeting and cost of capital
4. To discuss on how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools on Working Capital Management.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FINANCIAL MANGEMENT** Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts	9
II	**SOURCES OF FINANCE** Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc	9
III	**INVESTMENT DECISIONS:** Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital Budgeting — Payback -ARR – NPV – IRR – Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.	9
IV	**FINANCING AND DIVIDEND DECISION** Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure . Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy	9
V	**WORKING CAPITAL DECISION** Working Capital Management: Working Capital Management - concepts - importance - Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Acquire the knowledge of the decision areas in finance.
	CO2:	learn the various sources of Finance
	CO3:	describe about capital budgeting and cost of capital
	CO4:	construct a robust capital structure and dividend policy

	CO5:	develop an understanding of tools on Working Capital Management.

TEXT BOOKS:

1.M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill

2.M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd

REFERENCE BOOK:

1 James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,.

2. Prasanna Chandra, Financial Management,

3. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

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PROFESSIONAL ELECTIVE -1

Programme	Course Code	Course Name	L	T	P	C
B.E	21CS5351	INTERNET AND WEB TECHNOLOGY	2	0	2	3

Course Objective

1. To understand the concepts of object oriented programming paradigm.
2. To learn the basics involved in publishing content on the World Wide Web.
3. To expose students to the basic tools and applications used in Web publishing.
4. To understand how web pages are connected to database through JDBC.
5. To know about server side programming

Unit	Description	Instructional Hours
I	**INTRODUCTION TO OBJECT ORIENTED PROGRAMMING** 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. *Illustrative Programs: Polymorphism and inheritance*	5+2
II	**NETWORKING AND SECURITY** 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. *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.*	6+3
III	**HTML AND CSS** Client Tier using HTML – Basic HTML tags – Look and feel using CSS – Client side scripting using Java Script and Validations - Document Object Model (DOM). *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.*	6+3
IV	**JDBC** Business tier using POJO (Plain Old Java Objects) – Introduction to Frameworks – Introduction to POJO – Multithreaded Programming – Java I/O – Java Database Connectivity (JDBC). *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.*	6+4
V	**SERVLETS** Presentation tier using JSP – Role of Java EE in Enterprise applications – Basics of Servlets - To introduce server side programming with JSP - Standard Tag Library. *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.*	6+4
	Total Instructional Hours	**29+16=45**

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	Course Code	Name of the Course	L	T	P	C
B.E	21CS5352	ADVANCED JAVA PROGRAMMING	2	0	2	3

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. *Illustrative Programs: Calculator using Swing, GUI application with controls menus and event handling using JavaFX*	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. *Illustrative Programs: chat application using TCP/IP, client/server application using UDP Communication, send email from java application.*	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. *Illustrative Programs: simple calculator application using RMI, Client/Server Application (Bank Details) using CORBA*	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. *Illustrative Programs: Login form validation using servlet, implement CURD operations on student database.*	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. *Illustrative Programs: Create Application Helloworld with struts on netbeans, create J2EE Application by integrating Strut+Spring+Hibernate.*	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: Hortsmann & Cornell,"core Java 2 Advanced Feauture, 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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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E	21CS5353	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. *Illustrate Programs: Windows and Linux installation with dual boot, Micro kernel installation like MYSQL, PHP and PYTHON.*	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. *.Illustrate Programs:.DML and DDL command using MYSQL*	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. *Illustrate Programs: Running PHP: Simple applications like login form, File handling ,Exception handling and Database connectivity using PHP*	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. *Illustrate Programs: Database connectivity.*	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.

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	Course Code	Name of the Course	L	T	P	C
B.E	21CS5354	R Programming	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. *Illustrative programs: Take input from the user, Addition of two numbers.*	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. *Illustrative programs: factorial of given number, Prime Number, Sum of natural numbers, Create an array two 3x3 matrices.*	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. *Illustrative programs: Joining column and rows in data frame, Create and read the XML file for employee details.*	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. *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).*	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. *Illustrative programs: height of the probability distribution at each point for a given mean and standard deviation.*	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 Grolemund, First Edition.

T2: Lawrence Leemis. *Learning Base R.* Lightning Source, 2016.

REFERENCE BOOKS:

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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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5355	COMPUTER GRAPHICS AND MULTIMEDIA	2	0	2	3

Course Objective

1. To understand about graphics devices, software and basic algorithms for geometric objects.
2. To understand two dimensional transformation techniques.
3. To understand three dimensional transformation techniques.
4. To gain knowledge about illumination methods, rendering and color models.
5. To understand the fundamental concepts of multimedia.

UNIT	Description	Instructional Hours
I	**INTRODUCTION AND OVERVIEW OF GRAPHICAL SYSTEMS** Video Display Devices -Raster Graphics Systems -Graphics software and standards. Graphics primitives generation algorithms: Line drawing algorithms-Direct method-DDA- Bresenham's line drawing algorithm-Midpoint circle and Ellipse drawing Algorithm. Filling algorithms: Scan-line polygon filling, inside-outside test, boundary and flood-fill. *Illustrative Programs: Implementation of Line, Circle and Ellipse Drawing Algorithms.*	7+2(P)
II	**TWO DIMENSIONAL GRAPHICS** Transformations: Translation, rotation, scaling, reflection and shearing, Homogenous Coordinates, Composition of Transformations. 2D viewing pipeline, Window to viewport transformation. Clipping Algorithms: Point clipping, line clipping and polygon clipping algorithms. *Illustrative Programs: Implementation of 2D Transformation, viewing and Line Clipping Algorithm.*	5+4(P)
III	**THREE DIMENSIONAL GRAPHICS** 3D object Representation-Polygon surfaces- Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces, Blobby objects, Parametric Curves: Cubic Splines, Bezier Curves and B-Splines, Transformations: Translation, rotation, scaling. 3D viewing pipeline, Projection. *Illustrative Programs: Graphics programming using OPENGL - Creating 3D Objects and scenes. Implementation of 3D Transformation.*	5+4(P)
IV	**VISIBLE SURFACE DETERMINATION, ILLUMINATION AND COLOR MODELS** Visible line determination algorithms, Illumination Models: Diffuse, Specular and Ambient Reflection. Polygon-Rendering Methods, Flat Shading, Gouraud Shading and Phong Shading, Ray-Tracing Methods, Adding Surface Detail-texture mapping. Color models: properties of light, XYZ, RGB, YIQ and CMY color models. *Illustrative Programs: Implementation of color models*	7+2(P)
V	**INTRODUCTION TO MULTIMEDIA:** Introduction, applications, Text: Introduction about Fonts and Faces - Using Text in Multimedia – Hypermedia and Hypertext. Images: Making Still Images –Images File Formats. Animation: The Power of Motion, Principles of Animation, Animation by Computer, morphing, tweening. The Internet and Multimedia- Designing for the World Wide Web. *Illustrative Programs: Using Flash/Maya perform different operations (rotation, scaling move etc.) on objects. Create an object using Key frame animation and Path animation.*	5+4(P)
	Total Instructional Hours	**45**

Course Outcome

- CO1: Apply various algorithms to scan, convert the basic geometrical primitives and area filling.
- CO2: Apply two dimensional transformations and clipping techniques to graphics
- CO3: Learn the basic concepts of 3D object representation, transformations and projection.
- CO4: Apply the concepts of color models, lighting and shading models, textures, ray tracing,

hidden surface elimination and rendering to graphics objects.

CO5: Learn about the basics of multimedia concepts.

TEXT BOOKS:

T1: Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007

T2: Tay Vaughan, Multimedia: Makingit Work , 8thEdition, McGraw Hill Education 2011.

REFERENCE BOOKS:

R1: Hearn, Baker, Carithers "Computer Graphics with OpenGL", 4th Edition,Pearson Education, 2014

R2: Francis S Hill, Jr.Stephen M Kelley., "Computer Graphics using OpenGL", 3rd Edition, Pearson Education, 2007.

R3 K.R. Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Prentice Hall, 2014

R4: Ralf Steinmetz, Klara Nahrstedt, Multimedia Systems, 2013, Springer Science & Business Media.

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IBM SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS5251	INTRODUCTION TO DESIGN THINKING	2	0	2	3

Course Objective

1. Expose students to the design process as a tool for innovation.
2. Develop students' professional skills in client management and communication.
3. Students develop a portfolio of work to set them apart in the job market.
4. Provide an authentic opportunity for students to develop teamwork and leadership skills.
5. Demonstrate the value of developing a local network and assist students in making
6. lasting connections with the business community

Unit	Description	Instructional Hours
	DESIGN THINKING HISTORY AND OVERVIEW	
I	Understand what came before Design thinking-Identify who did what to bring it about-Learn how it built upon previous approaches-How design thinking is introduced in an organization-Understand the transformation required-What outcomes are possible-Understand the whole approach to design thinking-Determine what is most important. *Illustrative program: Listening and HMW*	9
	KEY HABITS	
II	Introduction to key habits-types-avoid common anti-patterns-Optimize for success with these habits-Introduction to loop-Importance of iteration-How to observe, Reflect &Make-Drill down. *Illustrative program: USER RESEARCH and PRACTICE MAPPING INSIGHTS FROM USER RESEARCH*	7+2(P)
	USER RESEARCH AND MAKE	
III	Importance of user research-Appreciate empathy through listening-Key methods of user research-How make fits into the loop-Leverage observe information-Ideation, storyboarding, & Prototyping. *Illustrative program: PRACTICE IDEATION AND PRIORITIZATION, COLLABORATIVELY CONSOLIDATE STORYBOARDS*	5+4(P)
	USER FEEDBACK AND TEACHING	
IV	User feedback and the loop-Different types of user feedback-How to carryout getting feedback-Understand the challenges of teaching EDT-Valuable hints and tips-Ready to teach the course. *Illustrative program: DEVELOP A SUMMARY HILL STATEMENT AND BUILD YOUR STORY BOARD AND HILL INTO A PROTOTYPE*	3+6(P)

	LOGISTICS AND APPLICATIONS	
V	Understand what type of room you need-Learn what materials and supplies you need-Learn how to setup the room-Domains that are applicable-Digital versus physical-Explore some technology specialization. *Illustrative program: PRACTICE TEACHING SELECTED SECTION AND USER FEEDBACK*	5+4(P)
	Total Instructional Hours	**(29 + 16) 45**

Course Outcome

CO1: Students develop a strong understanding of the Design Process and how it can be applied in a variety of business settings

CO2: Students learn to build empathy for target audiences from different "cultures"

CO3: Students learn to research and understand the unique needs of a company around specific challenges

CO4: Students learn to develop and test innovative ideas through a rapid iteration cycle

CO4: Students learn how to map insights from user research.

TEXT BOOKS:

T1 :IBM CourseWare

REFERENCE BOOKS:

R1:Creative Confidence-Tom Kelley.,2013

R2:Change by Design-Tim Brown.,2009

R3:Design Thinking-Nigel Cross.,Kindle Edition

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Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	**21HE5072**	**DESIGN THINKING**	**1**	**0**	**0**	**1**

Course Objectives

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
I	**Design Ability:** 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	4
II	**Designing to Win:** Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
III	**Design to Please and Designing Together:** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
IV	DESIGN EXPERTISE: 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.	3

Course Outcome

CO1: Students will be able to develop a strong understanding of the Design Process

CO2: Students will be able to learn to develop and test innovative ideas through a rapid iteration cycle.

CO3: Students will be able to Develop teamwork and leadership skills

Text Book

T1: Nigel Cross, "Design Thinking: Understanding How Designers Think and Work", Berg Publishers, First edition, 2011.

Reference Books:

R1: David Kelley, Tom Kelley, "Creative Confidence: Unleashing the Creative Potential within us All",Crown Business Publisher, 2013.

R2: Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", HarperCollins, 1st edition 2009.

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Programme	Course Code	Course Title	L	T	P	C
BE	21HE5071	Soft Skills - I	1	0	0	1

Course Objectives

1. To employ soft skills to enhance employability and ensure workplace and career success.
2. To enrich students' numerical ability of an individual and is available in technical flavor.
3. To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	**Introduction to Soft Skills:** Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management-Critical Thinking-Reflective thinking and writing- p2p Interaction	3
II	**Art of Communication:** Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types-How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
III	**World of Teams:** Self Enhancement - importance of developing assertive skills-developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	3
IV	**Quantitative Aptitude:** Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	**Logical Reasoning:** Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	2

Course Outcome:

CO1:	Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.
CO2:	Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others
CO3:	Students will understand how teamwork can support leadership skills
CO4:	Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
CO5:	Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.

Reference Books

R1: Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz

R2: How to prepare for data interpretation for CAT by Arun Sharma.

R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.

R4: A New Approach to Reasoning Verbal & Non-Verbal By B.S. Sijwali

R5: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

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Minor Degree in Entrepreneurship

Programme	Course Code	Name of the course	L	T	P	C
BE/B.Tech	21BA5601	Foundations of Entrepreneurship	3	0	0	3

Course Objective	CO1: To enable students gain insights on entrepreneurship. CO2: To make students understand the sources of product & business ideas. CO3: To provide knowledge on business opportunity identification. CO4: To enable students to develop business plan CO5: To enable students to prepare feasibility reports and understand trends in entrepreneurship.

Unit	Description	Instructional Hours
I	**Introduction to Entrepreneurship:** Entrepreneurial growth in India; sources of entrepreneurship in India. Entrepreneurship process; entrepreneurial mindset: concept and impact; Entrepreneurial growth strategies. Characteristics of an Entrepreneur – Qualities of an Entrepreneur. Entrepreneurial success and failure - reasons and remedies.	9
II	**Product Development:** Introduction and Meaning of a Product – Sources of Business or Product Ideas – Criteria for Selecting a Product – Barriers to the successful development of New Products – Why do new products fail. Technology - Considerations in selecting technology.	9
III	**Business Opportunity Identification:** Need and Importance - Steps in identification of Business Opportunity. Techniques of market Survey – Market Research Procedure.	9
IV	**Business Plan Development**: Business modelling: concept, types and functions; Innovation and Entrepreneurship: concept and challenges. The business plan as an entrepreneurial tool, Elements of business planning, Objectives, Market analysis, development of Product/idea, Marketing, Finance, Organization and management, Ownership, Critical risk contingencies of the proposal, Scheduling and milestones.	9
V	**Feasibility Report & trends:** Contents of a feasibility report – Considerations while preparing a feasibility report – Proforma of a feasibility report. Technical, Financial, Marketing, Personnel, and management feasibility reports. Trends in entrepreneurship: Rural, Social and women entrepreneurship.	9
	Total Instructional Hours	**45**

Course Outcome	CO1: Understand the basics of entrepreneurship and its process.
	CO2: Understand the concept of product development and the role of technology.
	CO3: Able to understand and identify business opportunity
	CO4: Able to develop business plan / business model
	CO5: Able to prepare feasibility reports and understand the trends in entrepreneurship.

TEXT BOOKS:

T1- S.Anil Kumar, S.C.Poornima, Mini KAbraham, K.Jayashree "Entrepreneurship Development",New Age International Publishers.

T2- Jasmer singh Sain, Entrepreneurship and small Business" Deep and Deep publication

T3- Shankar Raj, "Entrepreneurship Theory and Practice" Vijay Nicole Imprints Pvt ltd.

T4- Khanka, S.S, "Entrepreneurship Development", S. Chand & company

T5- Vasant Desai, "Fundamentals of Entrepreneurship "Himalaya Publishing House.
REFERENCE BOOKS:
R1- Khanna, S. S., Entrepreneurial Development, S. Chand, New Delhi.
R2- Hisrich D. Robert, Michael P. Peters, Dean A. Sheperd, Entrepreneurship, McGraw-Hill,6 ed.
R3- Zimmerer W. Thomas,Norman M.Scarborough, Essentials of Entrepreneurship and Small Business Management, PHI,4 ed.
R4- Holt H. David, Entrepreneurship: New Venture Creation, Prentice- Hall of India, New Delhi, Latest edition.
R5- Kuratko, F. Donald, Richard M. Hodgetts, Entrepreneurship: Theory, Process, Practice, Thomson, 7ed.
R6- Desai, Vasant, Dynamics of Entrepreneurship: New Venture Creation, Prentice-Hall of India, New Delhi, Latest edition.
R7- Patel, V. G., The Seven Business Crises and How to Beat Them, Tata McGraw-Hill, New Delhi, 1995.
R8- Roberts, Edward B.(ed.), Innovation: Driving Product, Process, and Market Change, San Francisco: Jossey Bass, 2002.

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Minor Degree In Environment And Sustainability

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21CEXXXX	SUSTAINABLE INFRASTRUCTURE DEVELOPMENT	3	0	0	3

Course Objective

1. To gain knowledge on concepts and socio-economic policies of sustainable development.
2. To examine the strategies for implementing sustainable development programmes.
3. To learn the various sustainability and performance indicators, their assessment techniques and constraints
4. To explore the different approaches for resource management for a sustainable urban planning.
5. To understand the principles of urban planning and built-in environment.

Unit	Description	Instructional Hours
	INTRODUCTION TO SUSTAINABLE DEVELOPMENT	
I	Definitions and principles of Sustainable Development - History and emergence of the concept of Sustainable Development - Environment and Development linkages- Globalization and environment – Millennium Development Goals: Status (global and Indian) Impacts on approach to development policy and practice in India, future directions.	9
	ENVIRONMENTAL SUSTAINABILITY	
II	Land, Water and Food production - Moving towards sustainability: Energy powering Sustainable Development - Financing the environment and Sustainable Development.	9
	SUSTAINABILITY INDICATORS	
III	Sustainability indicators – Hurdles to Sustainability-Operational Guidelines-Interconnected prerequisites for sustainable development - Science and Technology for sustainable development – Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.	9
	URBAN PLANNING AND ENVIRONMENT	
IV	Environment and Resources, Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development.	9
	THE BUILT-IN ENVIRONMENT	
V	Urban Form, Land Use, Compact Development, Principles of street design- complete streets, Transport Integrated Urban land use Planning, Guidelines for Environmentally Sound Transportation.	9
	Total Instructional Hours	**45**

Course Outcome

The students will be able to:
CO1: Describe the concepts and socio-economic policies of sustainable development.
CO2: Recognize and identify the strategies for implementing sustainable development programmes.
CO3: Comprehend the various sustainability and performance indicators, their assessment techniques and constraints
CO4: Identify the different approaches for resource management for a sustainable urban planning
CO5: Illustrate the principles of urban planning and built-in environment.

REFERENCE BOOKS:

R1. Gilg A W and Yarwood R," Rural Change and Sustainability-Agriculture, the Environment and Communities", CABI Edited by S J Essex, September 2005.
R2. Ganesha Somayaji and Sakarama Somayaji, "Environmental Concerns and Sustainable development: Some perspectives from India", Editors: publisher TERI Press, ISBN 8179932249.
R3. James H. Weaver, Michael T. Rock, Kenneth Kustere, "Achieving Broad-Based Sustainable Development: Governance, Environment, and Growth with Equity", Kumarian Press, West Hartford, CT. Publication Year,1997.
R4. Kirkby. J, O'Keefe P. and Timberlake, "Sustainable development" Earth Scan Publication, London,1996.
R5. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press,ISBN:1852930039.
R6. Munier N, "Introduction to Sustainability", Springer2005.

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B.E. COMPUTER SCIENCE AND ENGINEERING

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CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the odd semester

Academic year 2023-2024

(Academic Council Meeting Held on 19.06.2023)

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 and 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	2	0	2	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2091/ 22MC2092	தமிழர்மரபு/ *Heritage of Tamils*	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, inanyone of the personality and character development programmes and undergo training for about 80 hours							
			TOTAL	**18**	**1**	**12**	**22**	**29**	**630**	**370**	**1000**

SEMESTER III (Credits – 25)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA3103	Discrete Mathematics and Graph Theory	BSC	3	1	0	4	4	40	60	100
2	22CS3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22CS3202	Operating Systems	PCC	3	1	0	4	4	40	60	100
4	22CS3203	Digital Principles And Computer Organization	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22CS3251/ 22CS3253	Object Oriented Programming Using Java / Clean Coding and Devops	PCC/ICC-3	3	0	2	4	4	50	50	100
PRACTICAL											
6	22CS3001	Digital Principles And Computer Organization Laboratory	ESC	0	0	4	2	4	60	40	100
7	22CS3002	Operating Systems Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -II	SEC	1	0	0	1	1	100	0	100
9	22CS3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
10	22MC3191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	100	0	100
			TOTAL	**18**	**2**	**14**	**25**	**34**	**590**	**410**	**1000**

SEMESTER IV (Credits – 23)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22CS4201	Software Engineering	PCC	3	0	0	3	3	40	60	100
3	22CS4202/ 22CS4204	Foundations of Data Science/ Data Visualization	PCC/ICC-4	3	0	0	3	3	40	60	100
4	22CS4203	Database Management Systems	PCC	3	1	0	4	4	40	60	100
5	22CS4205	Microprocessor and Microcontrollers	PCC	3	0	0	3	3	40	60	100

THEORY WITH LAB COMPONENT											
6	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22CS4002 /22CS4003	Data science Laboratory / Data Visualization Lab	PCC/ICC-5	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
			TOTAL	**17**	**1**	**10**	**23**	**28**	**470**	**430**	**900**

SEMESTER V (Credits – 22)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS5201	Theory Of Computation	PCC	3	1	0	4	4	40	60	100
2	22CS5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22CS53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22CS53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22CS53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22CS5251 /22CS5252	Object Oriented Analysis and Design / Introduction to Design Thinking	PCC/ICC-6	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS5001	Engineering Clinic	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	**18**	**1**	**6**	**22**	**25**	**410**	**390**	**800**

SEMESTER VI (Credits – 24)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22CS6201	Machine Learning Techniques	PCC	3	0	0	3	3	40	60	100
2	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
3	22CS63XX	Professional Elective-4/Development of Machine Learning Models	PEC/ICC-7	3	0	0	3	3	40	60	100
4	22CS63XX	Professional Elective-5/ Predictive Modeling	PEC/ICC-8	3	0	0	3	3	40	60	100
5	22CS64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22CS64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
7	22CY6101	Environmental Studies	BSC	2	0	0	2	3	40	60	100
PRACTICAL											
8	22CS6001	Machine Learning Techniques Lab	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	**22**	**0**	**4**	**24**	**27**	**440**	**460**	**900**

SEMESTER VII (Credits – 20)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22CS7201	Information storage and Management	PCC	3	0	0	3	3	40	60	100
2	22CS7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22CS73XX	Professional Elective-6 / AI Analyst	PEC /ICC-9	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6	22CS7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22CS7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
			TOTAL	**15**	**1**	**4**	**20**	**22**	**360**	**340**	**700**

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII (Credits – 10)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1	22CS8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
			TOTAL	0	0	20	10	20	100	100	200

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extracredits printed in the Consolidated Mark sheet as per the regulation.
2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2022 – 23.

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	3	-	2	-	-	25
3	ESC	6	2	5	-	-	-	-	-	13
4	PCC	-	5	13	17	12	5	9	-	61
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MC	✓	✓							
	Total	19	22	25	23	22	24	20	10	165

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3

6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
3	22CS7401	E-Commerce	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Creative Media	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And Virtual Reality	Vertical VI Artificial Intelligence and Machine Learning
22CS5301 Data Engineering	**22CS5304** Multimedia Data Compression and Storage	**22CS5307** Principles of Cloud Computing	**22CS5310** Ethical Hacking	**22CS5313** Computer Graphics	**22CS5316** Soft Computing
22CS5302 Information Retrieval	**22CS5305** Multimedia and Animation	**22CS5308** Virtualization	**22CS5311** Digital and Mobile Forensics	**22CS5314** Image and video analytics	**22CS5317** Natural Language Processing
22CS5303 Data Security	**22CS5306** Video Creation and Editing	**22CS5309** Cloud Architecture	**22CS5312** Cyber forensics and investigation	**22CS5315** Game Programming	**22CS5318** Quantum Computing
22CS6301 Information Science and Ethics	**22CS6303** UI and UX Design	**22CS6305** Cloud Services Management	**22CS6307** Engineering Secure software systems	**22CS6309** Computer Vision	**22CS6311** Cognitive Science and Analytics
22CS6302 Fuzzy logic and Neural Networks	**22CS6304** Digital marketing	**22CS6306** Cloud Application Development	**22CS6308** Social Network Security	**22CS6310** Introduction to Augmented Reality	**22CS6312** Pattern Recognition

22CS7301 Recommender Systems	**22CS7302** Visual Effects	**22CS7303** Cloud Security	**22CS7304** Data privacy preservation	**22CS7305** Virtual Reality	**22CS7306** Ethics and AI

Note:
Students are permitted to choose all professional electives from any of the verticals.

Vertical I
Data Science

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5301**	Data Engineering	PEC	3	0	0	3	3
2	**22CS5302**	Information Retrieval	PEC	3	0	0	3	3
3	**22CS5303**	Data Security	PEC	3	0	0	3	3
4	**22CS6301**	Information Science and Ethics	PEC	3	0	0	3	3
5	**22CS6302**	Fuzzy logic and Neural Networks	PEC	3	0	0	3	3
6	**22CS7301**	Recommender Systems	PEC	3	0	0	3	3

Vertical II
Creative Media

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5304**	Multimedia Data Compression and Storage	PEC	3	0	0	3	3
2	**22CS5305**	Multimedia andAnimation	PEC	3	0	0	3	3
3	**22CS5306**	Video Creation and Editing	PEC	3	0	0	3	3
4	**22CS6303**	UI and UX Design	PEC	3	0	0	3	3
5	**22CS6304**	Digital marketing	PEC	3	0	0	3	3
6	**22CS7302**	Visual Effects	PEC	3	0	0	3	3

Vertical III
CLOUD COMPUTING

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5307**	Principles of Cloud Computing	PEC	3	0	0	3	3
2	**22CS5308**	Virtualization	PEC	3	0	0	3	3

3	**22CS5309**	Cloud Architecture	PEC	3	0	0	3	3
4	**22CS6305**	Cloud Services Managment	PEC	3	0	0	3	3
5	**22CS6306**	Cloud Application Development	PEC	3	0	0	3	3
6	**22CS7303**	Cloud Security	PEC	3	0	0	3	3

Vertical IV
Cyber Security and Data Privacy

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5310**	Ethical Hacking	PEC	3	0	0	3	3
2	**22CS5311**	Digital and Mobile Forensics	PEC	3	0	0	3	3
3	**22CS5312**	Cyber forensics and investigation	PEC	3	0	0	3	3
4	**22CS6307**	Engineering Secure software systems	PEC	3	0	0	3	3
5	**22CS6308**	Social NetworkSecurity	PEC	3	0	0	3	3
6	**22CS7304**	Data privacy preservation	PEC	3	0	0	3	3

Vertical V
COMPUTER VISION AND VIRTUAL REALITY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5313**	Computer Graphics	PEC	3	0	0	3	3
2	**22CS5314**	Image and video analytics	PEC	3	0	0	3	3
3	**22CS5315**	Game Programming	PEC	3	0	0	3	3
4	**22CS6309**	Computer Vision	PEC	3	0	0	3	3
5	**22CS6310**	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	**22CS7305**	Virtual Reality	PEC	3	0	0	3	3

Vertical VI
Artificial Intelligence and Machine Learning

S	Course	Course Title	Category	Periods Per	Total	Credits

No	Code			week			Contact Periods	
				L	T	P		
1	22CS5316	Soft Computing	PEC	3	0	0	3	3
2	22CS5317	Natural Language Processing	PEC	3	0	0	3	3
3	22CS5318	Quantum Computing	PEC	3	0	0	3	3
4	22CS6311	Cognitive Science and Analytics	PEC	3	0	0	3	3
5	22CS6312	Pattern Recognition	PEC	3	0	0	3	3
6	22CS7306	Ethics And AI	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree. For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For a minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2	22CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3	22CS6602	Sem6: Introduction to Internet Of Things	MDC	3	0	0	3	3
4	22CS7601	Sem 7: Introduction to	MDC	3	0	0	3	3

		Machine Learning						
5	22CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6	22CS8601	Sem 8: Data Analytics	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I

Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Financial Management	MDC	3	0	0	3	3
2	22XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	22XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22XXXX	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II

Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22BA6601	Introduction to Business Venture	MDC	3	0	0	3	3
3	22 BA6602	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	22 BA7601	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	22 BA7602	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	22 BA8601	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	22BA8602	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III
Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5602	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22XXXX	Green Technology	MDC	3	0	0	3	3
6	22XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING

Vertical I IOT	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III FULL STACK DEVELOPMENT
22CS5204 Fundamentals Of IOT	22CS5205 Public Key Infrastructure and Trust Management	22CS5206 Web Technology
22CS6203 IoT Design	22CS6205 Introduction to block chain	22CS6207 React JS with Spring boot 2
22CS6204 Introduction Of Raspberry Pi and Arduino	22CS6206 Cryptocurrency	22CS6208 Back End Development with NodeJS
22CS7203 IoT for smart cities	22CS7205 Smart Contracts and Solidity	22CS7207 No Sql Databases with Mongo DB
22CS7204 Internet Of Medical Things	22CS7206 Block chain and distributed ledger technology	22CS7208 DevOps
22CS8201 Iot Cloud and Data Analytics	22CS8202 Bitcoin Essentials and Use-Cases	22CS8203 Web Application Security

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN IOT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	3
2	22CS6203	Sem 6: IoT Design	PC	3	0	0	3	3
3	22CS6204	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	3
4	22CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	3
5	22CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	3
6	22CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	22CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN FULL STACK DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5206	Sem 5: Web Technology	PC	3	0	0	3	3
2	22CS6207	Sem 6: React JS with Spring boot 2	PC	3	0	0	3	3
3	22CS6208	Sem 6: Back End Development with NodeJS	PC	3	0	0	3	3
4	22CS7207	Sem 7: No Sql Databases with Mongo DB	PC	3	0	0	3	3
5	22CS7208	Sem 7: DevOps	PC	3	0	0	3	3
6	22CS8203	Sem 8: Web Application Security	PC	3	0	0	3	3

The Industry Core Courses (ICC) which will be offered as choice-based course in the semester.

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	22CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	22CS4204	Data Visualization	3	0	0	3	40	60	100
ICC5	IV	22CS4003	Data Visualization Laboratory	0	0	4	2	60	40	100
ICC6	V	22CS5252	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	22CS6352	Predictive Modeling	3	0	0	3	40	60	100
ICC8	VI	22CS6314	Development of Machine Learning Models	3	0	0	3	40	60	100
ICC9	VII	22CS7307	AI Analyst	3	0	0	3	40	60	100

Credit Distribution R2022

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

Chairman BoS

Chairman - BoS
CSE - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

HINDUSTHAN ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22MA3103	DISCRETE MATHEMATICS AND GRAPH THEORY	3	1	0	4

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.

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.

R4 - Jean-Paul Tremblay and R. Manohar – "Discrete Mathematical Structures with Applications to Computer Science" Tata – McGraw Hill Publications – 2008

ACADEMIC COUNCIL * HICET * Chairman

Chairman, Board of Studies

Chairman - BoS
CSE - HiCET

Dean-Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3201	DATA STRUCTURES	3	0	0	3

Course Objective

1. Understand the fundamental concepts of linear data structures
2. Comprehend the concept of various linear data structures like list, stack and queue.
3. Acquire 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. Apply graph algorithms for solving real world problems

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF DATA STRUCTURES AND LINKED LIST** Introduction – Need for data structures – Types of data structures – List ADT-Single Linked List-Doubly Linked List-Circular Linked List- its operations.	9
II	**STACK AND QUEUE** Stack: Array and Linked Stacks – Applications: Balancing Symbols, Expression conversion, Postfix evaluation – Queue: Array implementation of Queue and Linked list implementation of Queue, Circular Queue and its operations.	9
III	**TREES** Tree ADT-Binary Tree-Tree Traversal Algorithms-Search Tree: Binary Search Tree-AVL Tree- B+ trees- Priority Queues- Binary Heap	9
IV	**SEARCHING, SORTING AND HASHING** Searching: Linear search – Binary Search – Sorting: Insertion sort- Bubble sort – Selection sort – Merge sort-Quick sort- Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing – Double Hashing	9
V	**GRAPHS** Definitions – Representation of Graphs – Types of Graph – Depth-first traversal – Breadth-first traversal – Topological Sort – Minimum Spanning Tree-Prim's Algorithm-Kruskal's Algorithms-Dijkstra's Shortest path algorithm	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Comprehend the working of linear data structures and identify their applications.

CO2: Acquire knowledge the most common abstractions for data collections (e.g., stacks, queues, lists).

CO3: Understand the various tree data structures for efficient storage and retrieval of data.

CO4: Apply Algorithms for solving problems like sorting and searching.

CO5: Employ graph data structure for solving real world problems

TEXT BOOKS:

T1: Mark A.Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2010.

T2: Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016.

REFERENCE BOOKS:

R1: Aaron M. Tenenbaum, Yeedidyah 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	Course Code	Name of the Course	L	T	P	C
B.E	22CS3202	OPERATING SYSTEMS	3	1	0	4

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 I/O management and File systems.
5. Learn the Distributed operating systems

Unit	Description	Instructional Hours
I	**OPERATING SYSTEMS OVERVIEW** Computer System Overview - Basic Elements, Instruction Execution, Interrupts- operating systems overview- Evolution of Operating System.- Computer System Organization-Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot	12
II	**PROCESS MANAGEMENT** Processes-Process Concept, Process Scheduling, Interprocess Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Threads Overview, Multicore Programming, Multithreading Models. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; Deadlock-System model, Deadlock-Prevention, Avoidance and Recovery.	12
III	**STORAGE MANAGEMENT** Memory Hierarchy, Cache Memory, Main Memory-Swapping-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory	12
IV	**FILE SYSTEM IMPLEMENTATION & MASS STORAGE STRUCTURE** Mass Storage Structure- Overview, Disk Structure, Disk Scheduling and Management; File System Interface- File Concepts, Access methods, Directory Structure, Organization and implementation, File System Structure - File System Implementation-, File Sharing and Protection; Allocation Methods, Free Space Management- I/O Systems.	12
V	**TYPES OF OPERATING SYSTEMS** Single processor systems – Multiprocessor Systems – Clustered Systems – Real Time Systems – Open source operating system- Distributed Systems –Distributed operating systems – Distributed file systems –Distributed Synchronization. Case study: Linux Systems Virtualization.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Design various Scheduling algorithms.
CO2: Design deadlock, prevention and avoidance algorithms.
CO3: Compare and contrast various memory management schemes.
CO4: Design and Implement a prototype file systems.
CO5: Study the distributed operating systems.

TEXT BOOKS:

T1: Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.

T2: Tom Adelstein, Bill Lubanovic , "Linux System Administration Solve Real-life Linux Problems Quickly", 2007, O'Reilly Media.

REFERENCE BOOKS:

R1: Andrew S. Tanenbaum, "Modern Operating Systems", 4/E, Pearson Publications, Paperback 2019.

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:William Stallings, "Operating Systems –Internals and Design Principles", 9/E, Pearson Publications, 2018.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3251	OBJECT ORIENTED PROGRAMMING USING JAVA	3	0	2	4

Course Objective

1. To conceptualize the basic Java based code for solving low complexity problems.
2. To study the Object Oriented Features in Java for solving medium complexity problems.
3. To understand the polymorphism, abstraction, inheritance and interface concepts
4. To develop Java Applications using Multithreading, Packages and Collections.
5. To familiarize the concepts of data structures using java.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO JAVA and OOP** Object Oriented Programming- First java program Hello World- JVM architecture-JDK-JRE-identifiers-variables-comments-command line arguments-operators in java-control structures- Series and patterns-strings -immutable string-string operations-String Buffer class-StringBuilder class-String Joiner-String Tokenizer. ***Programs:*** *1. Write a program to generate the given pattern.* *if n = 5,* 1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 *2. Petya started to attend programming lessons. On the first lesson, his task was to write a simple program. The program was supposed to do the following: in the given string, consisting of uppercase and lowercase letters, it:* • *Deletes all the vowels.* • *Inserts a character "." before each consonant.* • *Replaces all uppercase consonants with corresponding lowercase ones.*	12
II	**ARRAYS, CLASS AND INHERITANCE** Introduction to Arrays in java-Arrays class-declaration and initialization of an array-2D array declaration and initialization -Multi-dimensional array-Classes and objects-naming convention in java-methods-access modifiers-constructors- copy constructors -singleton class- object class-inner class-abstract class- Throwable class- types of inner class- static and non static nested class-Inheritance-Types of inheritance-Difference between inheritance in C++ and java ***Programs:*** *1. A magic square is an arrangement of numbers (usually integers) in a square grid, where the numbers in each row, and in each column, and the numbers in the forward and backward main diagonals, all add up to the same number. Write a program to find whether a given matrix is a magic square or not.* ***Input Format:*** *The input consists of (n*n+1) integers. The first integer corresponds to the number of rows/columns in the matrix. The remaining integers correspond to the elements in the matrix. The elements are read in row wise order, first row first, then second row and so on. Assume that the maximum value of m and n is 5.*	12

2. *A company maintains a database that has the details of all the employees. There are two levels of employees where level 1 is the top management having salary more than 100 dollars and level 2 is the staffs who are getting a salary less than 100 dollars. Create a class named Employee with empId and salary as attributes. Create another class empLevel that extends employee and categorizes the employee into various levels.*

Input Format: *The input should contain only the employee id and salary of the employee separated by space. Employee id should be of integer type and salary float type.*

Output Format: *The output of the program must display the employee id, salary, and level of the employee one below the other in the same order.*

III ABSTRACTION, POLYMORPHISM AND INTERFACES

Abstraction in java -abstract class-control abstraction-data hiding vs abstraction-encapsulation- Runtime polymorphism-compile time vs run time polymorphism-constructor overloading-constructor chaining-private constructors and singleton class- Methods-different method calls-method overriding-method overloading-method overloading vs method overriding. Interfaces-interfaces and inheritance-class vs interface-Functional interface-nested interface-Marker interface-Comparator interface.

Programs:

1. *Write a Java program to demonstrate method overriding and dynamic method dispatch.*

Create a class named 'Animal' with a method named 'Print' that prints "Animal" to the console. Next, create two subclasses named 'Dog' and 'Cat' that inherit from the 'Animal' class and override the 'Print' method to print "Dog" and "Cat" to the console, respectively.

III *In the 'Main' class, declare a variable 'a' of type 'Animal' and initialize it with a new object of the 'Dog' class. Call the 'Print' method on the 'a' variable and observe that "Dog" is printed to the console. Next, set the 'a' variable to a new object of the 'Cat' class and again call the 'Print' method. Observe that "Cat" is printed to the console this time.* 12

Input Format

No console input.

Output Format

Print the String from subclass named Dog and Cat in seperate lines.

2. *Write a java program to create an interface called "ShapeCalculator" that has a method called "calc(int n)". Then, create two classes called "Square" and "Circle" that implement the "ShapeCalculator" interface and implement the "calc(int n)" method. Your program should calculate the area and perimeter of both squares and circles.*

Input Format: *The input to your program will be a single integer that represents the side of the square and the radius of the circle.*

MULTITHREADING, PACKAGES AND COLLECTIONS

IV Threads-lifecycle and stages of a Thread-Thread priority-main Thread-Runnable interface-naming thread-start () method-Java packages-built in packages-user defined packages-Collections-List interface-Queue interface-Map interface-Set-Iterator-Comparator-JDBC-connectivity with JDBC-DriverManager-Statement-JDBC Exceptions. 12

Programs:

1. *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.*
2. *Simple OPAC system for library using event-driven paradigms with JDBC.*

DATA STRUCTURE IN JAVA

Arrays-Linked list- implementation of linked list-stack-implementation of stack operations-Queue-implementation of queue operations-Tree-Binary search tree implementation-Graphs-shortest path algorithm using java.

V ***Programs:*** 12

1. *Write a program to evaluate an expression entered in "postfix" form using stack concept.*
2. *Write a program to implement single source shortest path algorithm.*

Total Instructional Hours 60

Course Outcome

CO1: Apply Java based code for solving low complexity problems
CO2: Utilize Object Oriented Features in Java for solving medium complexity problems
CO3: Exploit polymorphism, abstraction, inheritance and interfaces in Java.
CO4: Develop Packages, Collections and Multi-Threaded Java Applications.
CO5: Utilize appropriate Java Classes to solve data structure based problems.

TEXT BOOKS:

1. Herbert Schildt, "JAVA The Complete Reference", 10th Edition, McGraw Hill Education, 2017.

2. Cay S. Horstman and Gary Cornell,"Core Java Volume I—Fundamentals", 11th Edition, Prentice Hall, 2018.

REFERENCE BOOKS

1. Cay Horstman, "Big Java: Early Objects", 6th Edition, Wiley Publications, 2016.

2. Ken Arnold, James Gosling, and David Holmes, "The Java Programming Language", 4th edition, Addison-Wesley, 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3203	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	3	0	0	3

Course Objective

1. To study combinational circuits.
2. To learn synchronous sequential circuits.
3. To understand the basic structure and operation of a digital computer.
4. To study the design of data path unit, control unit for processor and to familiarize with the hazards
5. To understand the concept of various memories and I/O interfacing.

Unit	Description	Instructional Hours
I	**COMBINATIONAL CIRCUITS** Circuits for arithmetic operations: adder: Half adder, Full adder, subtractor: Half subtractor, Fullsubtractor-BCD adder-Magnitude comparator-Encoders, Decoders-Multiplexers, Demultiplexers, Code converters: Binary to Gray, Gray to Binary	9
II	**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.	9
III	**COMPUTER FUNDAMENTALS** Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.	9
IV	**PROCESSOR** Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.	9
V	**MEMORY AND I/O SYSTEMS** 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: Design various combinational digital circuits using logic gates
CO2: Design sequential circuits and analyze the design procedures
CO3: State the fundamentals of computer systems and analyze the execution of an instruction.
CO4: Explain the structure of processing architectures
CO5: Demonstrate knowledge about state-of-the-art I/O, memory , Interrupts and Interfaces

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**

T2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

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

R3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

R4. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
BE	22CS3253	CLEAN CODING AND DEVOPS	3	0	2	4

Course Objective

1. Understand about the clean code.
2. Explain the importance of naming conventions.
3. Understand the importance of comments in the applications
4. Understand & install different tools used in DevOps stack
5. Explain the benefits of DevOps and how various industries are benefitting
6. Explain how to automatically rollback a release if it is failed

Unit	Description	Instructional Hours
I	**INTRODUCTION TO CLEANCODING** Coding principles introduction-Bad and Good code-marshalling and unmarshalling-Names and Functions-distinct names-Defining meaningful context-Usage of domain and function names-Usage of exceptions and its error code names/descriptions. Lab Exercises- Write a Fibonacci Program using Clean coding, Exporting multiple variables, Assigning a value to the same thing conditionally using ternary operators, Declaring and assigning variables from array indexes.	9+3(P)
II	**COMMENTS, FORMATTING AND OBJECTS** Right comments and types of formatting- Clean and bad comments-Vertical and horizontal formatting-Objects and data structures-Data abstraction-Data and object antisymmetric-Data transfer objects Lab Exercises- Structural Formatting the code, Eligible to vote using comments, Arithmetic Operator using Horizontal openness and density.	8+2(P)
III	**INTRODUCTION TO DEV-OPS** An overview about DevOps,-Why it is needed? how it is different from traditional IT & Agile - DevOps Principles,- DevOps Lifecycle - An overview about CI/CD pipeline and various tools- setup a complete CI/CD pipeline from scratch using DevOps tools - How DevOps is used in various technologies/industries. Lab Exercises- Set up of Devops, Create a build and release agent	9+4(P)
IV	**ADVANCED DEV-OPS** An overview of advanced DevOps concepts - Automatic Rollback & Provisioning, Scalability, Clustering & Infrastructure as Code Lab Exercises- Import code and create Devops build pipeline, Create the Devops release pipeline	9+4(P)
V	**INTRODUCTION TO DEV-OPS ON CLOUD** An overview of Cloud computing - Introduction to IBM Cloud,-Why DevOps on cloud - IBM Cloud services - Setup a CI/CD pipeline in IBM Cloud Lab Exercises- Continuously deliver to Production, Track functional changes throughout the CI/CD pipeline	9+3(P)
	Total Instructional Hours	**44(T)+16(P)**

Course Outcome

CO1: Understand the importance of comments in the applications.

CO2: Understand the data and object antisymmetric

CO3: Understand Cloud computing concepts

CO4: Explain why DevOps on cloud and various DevOps services available on IBM Cloud

TEXT BOOKS:

T1 :IBM Course Ware

REFERENCE BOOKS:

R1:A hand book of agile software craftsmanship, Robert C Martin

R2: DevOps: A Software Architect's Perspective by Ingo M. Weber, Len Bass, and Liming Zhu

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Programme	Course Code	Name of the Course	L	T	P	C
BE	22CS3003	DATA STRUCTURES LABORATORY	0	0	4	2

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.
4. To Understand the concepts of Sorting, Searching and Hashing techniques
5. To Understand graph algorithms for solving real world problems

S. No.	Description Of the Experiments
1	**Singly Linked List and Doubly Linked List** 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 k^{th} node from the end of linked list d) Reverse a doubly linked list. e) Merge two sorted singly Linked Lists without creating new nodes.
2	**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. 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**
4	**Binary search tree and traversal** a) Insertion, Deletion, Searching in a BST b) Find k'th smallest and k'th largest element in a BST Check if a given sequence represents the in-order, pre-order and post-order traversal of a BST.
5	**Write a program for AVL tree having functions for the following operations:** a) Insert an element (no duplicates are allowed), b) Delete an existing element, c) Traverse the AVL (in-order, pre-order, and post-order)
6	**Heaps using priority queue** 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.**

8 **Write a C program to Implement Sorting Techniques**

a) Merge Sort

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

10 **C)Minimum spanning tree using prim's and kruskal's algorithm.**

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: 60

Course Objective

1. Understand the methodical way of solving problem.
2. comprehend the different methods of organizing large amount of data.
3. Implement the different data structures.
4. Understand the concepts of Sorting, Searching and Hashing techniques
5. Understand graph algorithms for solving real world problems

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3001	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION LABORATORY	0	0	4	2

Course Objective

1. To study combinational circuits.
2. To learn synchronous sequential circuits.
3. To understand the basic structure and operation of a digital computer.
4. To study the design of data path unit, control unit for processor and to familiarize with the hazards
5. To understand the concept of various memories and I/O interfacing.

S. No.	Description of the Experiments
1	Verification of Boolean theorems using logic gates.
2	Design and implementation of combinational circuits using gates for arbitrary functions.
3	Experimental Design and implementation of Half Adder & Half Subtractor.
4	Experimental Design and implementation of Binary to Gray and Gray to Binary Conversion.
5	Implementation of BCD adder, encoder and decoder circuits
6	Experimental Design and implementation of Multiplexers
7	Experimental Design and implementation of Demultiplexers
8	Implementation of the synchronous counters
9	Experimental Design and implementation of Asynchronous Counters
10	Implementation of a Universal Shift register.

Total Practical Hours: 60

Course Outcome

CO1: Design various combinational digital circuits using logic gates
CO2: Design sequential circuits and analyze the design procedures
CO3: State the fundamentals of computer systems and analyze the execution of an instruction.
CO4: Explain the structure of processing architectures
CO5: Demonstrate knowledge about state-of-the-art I/O, memory , Interrupts and Interfaces

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3002	OPERATING SYSTEMS LABORATORY	0	0	4	2

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

S. No.	Description of the Experiments
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

Total Practical Hours: 60

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 updation of software packages in Linux Operating system

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Programme	Course code	Name of the course	L	T	P	C
B.E	22MC3191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

Course Objective

The student should be able

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.
3. To impart basic principles of thought process, It has and Dharma Shastra and connecting society and nature.
4. To understand the concept of Intellectual and intellectual property rights with special Reference.
5. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and Indian philosophy.

Unit	Description	Instructional Hours
I	**Introduction to traditional knowledge:** Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vs indigenous knowledge, traditional knowledge vs western knowledge	9
II	**Protection of traditional knowledge:** The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	9
III	**Itihas and Dharma**-Shastra **Itihas**: The Mahabharata - The Puranas - The Ramayana Dharma-Shastra: Manu Needhi - The Tirukkural – Thiru Arutpa	9
IV	**Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	9
V	**Indian philosophy** Jain – Buddhist – Charvaka – Samkhya - Yoga - Nyaya - Vaisheshika - Saiva *Siddhanta*	9
	Total Instructional Hours	45

Course Outcome

- CO1 Identify the concept of Traditional knowledge and its importance.
- CO2 Explain the need and importance of protecting traditional knowledge.
- CO3 Explain the need and importance of Itihas and Dharma Shastra.
- CO4 Interpret the concepts of Intellectual property to protect the traditional knowledge.
- CO5 Interpret the concepts of indian philosophy to protect the traditional knowledge.

REFERENCES:

- R1 Traditional Knowledge System in India, by Amit Jha, 2009.
- R2 Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
- R3 "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.
- R4 V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
- R5 V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am.

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Programme	Course Code	Course Title	L	T	P	C
B.E	22HE3071	Soft Skills and Aptitude - II	1	0	0	1

Course Objectives:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level
4. Display good writing skills while dealing with essays

Unit	Description	Instructional Hours
I	**Logical Reasoning** Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	9
II	**Quantitative Aptitude** Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages - Time, Speed and Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, - Profit and loss, Basic terminologies in profit and loss - Averages - Weighted average	12
III	**Verbal Ability** Sentence Correction: Subject-Verb Agreement, Modifiers, Parallelism, Pronoun-Antecedent Agreement, Verb Time Sequences, Comparisons, Prepositions, Determiners - Sentence Completion and Para-jumbles: Pro-active thinking, Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues), Fixed jumbles, Anchored jumbles.	7
IV	**Writing skills for placements** Essay writing: Idea generation for topics, Best practices, Practice and feedback	2
	Total Instructional Hours	30

Course Outcome:

CO1: Students will avoid the various fallacies that can arise through the misuse of logic.

CO2: Students would opt for alternate methods to solve the problems rather than conventional methods.

CO3: Students will heighten their awareness of correct usage of English grammar in writing and speaking

CO4: Students will be concise and clear, using professional language for placements.

REFERENCE BOOKS:

R1: A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali

R2: How to prepare for data interpretation for CAT by Arun Sharma.

R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.

R4: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

R5: Word Power Made Easy by Norman Lewis

R:6 Six weeks to words of power by Wilfred Funk

Chairman, Board of Studies

Chairman - BoS
CSE - HiCET

Dean-Academics

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman
VAIGAI COLLEGE OF ENGG & TECH

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 - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

I - Year - CSE

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the odd semester

Academic year 2023-2024

(Academic Council Meeting Held on 19.06.2023)

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 2023-2024 and onwards

SEMESTER I (Credit : 18)											
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	22HE1073	Introduction To Soft Skills (Common To All Branches)	SEC	1	0	0	0	1	100	0	100
7	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
8	22MC1093/ 22MC1094	தமிழர்மரபு /HERITAGE OF TAMIL	MC	2	0	0	1	2	100	0	100
9	22MC1095	Universal Human Values (Common to all branches)	AEC	2	0	0	0	2	40	60	100
			TOTAL	**17**	**1**	**8**	**18**	**26**	**580**	**320**	**900**

SEMESTER II (Credits – 23)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22MA2103	Differential Equations and 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	2	0	2	2	2	100	0	100
9	22HE2073	SOFT SKILLS AND APTITUDE-I	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2094/ 22MC2095	□□□□□□□□ □□□□□□□□□□□□□□□ / TAMILS AND TECHNOLOGY	MC	2	0	0	1	2	100	0	100
11	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, inanyone of the personality and character development programmes and undergo training for about 80 hours							
			TOTAL	**18**	**1**	**13**	**23**	**29**	**640**	**360**	**1000**

SEMESTER III (Credits – 25)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22MA3103	Discrete Mathematics and Graph Theory	BSC	3	1	0	4	4	40	60	100
2	22CS3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22CS3202	Operating Systems	PCC	3	1	0	4	4	40	60	100
4	22CS3203	Digital Principles And Computer Organization	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22CS3251/ 22CS3253	Object Oriented Programming Using Java / Clean Coding and Devops	PCC/ICC-3	3	0	2	4	4	50	50	100
PRACTICAL											
6	22CS3001	Digital Principles And Computer Organization Laboratory	ESC	0	0	4	2	4	60	40	100
7	22CS3002	Operating Systems Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -II	SEC	1	0	0	1	1	100	0	100
9	22CS3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
10	22MC3191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	100	0	100
			TOTAL	**17**	**2**	**14**	**25**	**34**	**590**	**410**	**1000**

SEMESTER IV (Credits – 23)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22CS4201	Software Engineering	PCC	3	0	0	3	3	40	60	100
3	22CS4202/ 22CS4204	Foundations of Data Science/ Data Visualization	PCC/ICC-4	3	0	0	3	3	40	60	100
4	22CS4203	Database Management Systems	PCC	3	1	0	4	4	40	60	100
5	22CS4205	Microprocessor and Microcontrollers	PCC	3	0	0	3	3	40	60	100

THEORY WITH LAB COMPONENT											
6	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22CS4002 /22CS4003	Data science Laboratory / Data Visualization Lab	PCC/ICC-5	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
			TOTAL	**17**	**1**	**10**	**23**	**28**	**470**	**430**	**900**

SEMESTER V (Credits – 22)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS5201	Theory Of Computation	PCC	3	1	0	4	4	40	60	100
2	22CS5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22CS53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22CS53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22CS53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22CS5251 /22CS5252	Object Oriented Analysis and Design / Introduction to Design Thinking	PCC/ICC-6	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS5001	Engineering Clinic	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	**18**	**1**	**6**	**22**	**25**	**410**	**390**	**800**

SEMESTER VI (Credits – 24)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS6201	Machine Learning Techniques	PCC	3	0	0	3	3	40	60	100
2	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
3	22CS63XX	Professional Elective-4/Development of Machine Learning Models	PEC/ICC-7	3	0	0	3	3	40	60	100
4	22CS63XX	Professional Elective-5/ Predictive Modeling	PEC/ICC-8	3	0	0	3	3	40	60	100
5	22CS64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22CS64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
7	22CY6101	Environmental Studies	BSC	2	0	0	2	3	40	60	100
PRACTICAL											
8	22CS6001	Machine Learning Techniques Lab	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	**22**	**0**	**4**	**24**	**27**	**440**	**460**	**900**

SEMESTER VII (Credits – 20)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS7201	Information storage and Management	PCC	3	0	0	3	3	40	60	100
2	22CS7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22CS73XX	Professional Elective-6 / AI Analyst	PEC /ICC-9	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6	22CS7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22CS7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
			TOTAL	**15**	**1**	**4**	**20**	**22**	**360**	**340**	**700**

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII (Credits – 10)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1	22CS8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
			TOTAL	**0**	**0**	**20**	**10**	**20**	**100**	**100**	**200**

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extracredits printed in the Consolidated Mark sheet as per the regulation.
2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2022 – 23.

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	**11**
2	BSC	7	9	4	3	-	2	-	-	**25**
3	ESC	6	2	5	-	-	-	-	-	**13**
4	PCC	-	5	13	17	12	5	9	-	**61**
5	PEC	-	-	-	-	9	6	3	-	**18**
6	OEC	-	-	-	-	-	6	6	-	**12**
7	EEC	3	3	3	1	1	2	2	10	**25**
8	MC	✓	✓							
	Total	**19**	**22**	**25**	**23**	**22**	**24**	**20**	**10**	**165**

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3

6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
3	22CS7401	E-Commerce	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Creative Media	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And Virtual Reality	Vertical VI Artificial Intelligence and Machine Learning
22CS5301 Data Engineering	**22CS5304** Multimedia Data Compression and Storage	**22CS5307** Principles of Cloud Computing	**22CS5310** Ethical Hacking	**22CS5313** Computer Graphics	**22CS5316** Soft Computing
22CS5302 Information Retrieval	**22CS5305** Multimedia and Animation	**22CS5308** Virtualization	**22CS5311** Digital and Mobile Forensics	**22CS5314** Image and video analytics	**22CS5317** Natural Language Processing
22CS5303 Data Security	**22CS5306** Video Creation and Editing	**22CS5309** Cloud Architecture	**22CS5312** Cyber forensics and investigation	**22CS5315** Game Programming	**22CS5318** Quantum Computing
22CS6301 Information Science and Ethics	**22CS6303** UI and UX Design	**22CS6305** Cloud Services Management	**22CS6307** Engineering Secure software systems	**22CS6309** Computer Vision	**22CS6311** Cognitive Science and Analytics
22CS6302 Fuzzy logic and Neural Networks	**22CS6304** Digital marketing	**22CS6306** Cloud Application Development	**22CS6308** Social Network Security	**22CS6310** Introduction to Augmented Reality	**22CS6312** Pattern Recognition

22CS7301 Recommender Systems	22CS7302 Visual Effects	22CS7303 Cloud Security	22CS7304 Data privacy preservation	22CS7305 Virtual Reality	22CS7306 Ethics and AI

Note:

Students are permitted to choose all professional electives from any of the verticals.

Vertical I

Data Science

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5301	Data Engineering	PEC	3	0	0	3	3
2	22CS5302	Information Retrieval	PEC	3	0	0	3	3
3	22CS5303	Data Security	PEC	3	0	0	3	3
4	22CS6301	Information Science and Ethics	PEC	3	0	0	3	3
5	22CS6302	Fuzzy logic and Neural Networks	PEC	3	0	0	3	3
6	22CS7301	Recommender Systems	PEC	3	0	0	3	3

Vertical II

Creative Media

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5304	Multimedia Data Compression and Storage	PEC	3	0	0	3	3
2	22CS5305	Multimedia andAnimation	PEC	3	0	0	3	3
3	22CS5306	Video Creation and Editing	PEC	3	0	0	3	3
4	22CS6303	UI and UX Design	PEC	3	0	0	3	3
5	22CS6304	Digital marketing	PEC	3	0	0	3	3
6	22CS7302	Visual Effects	PEC	3	0	0	3	3

Vertical III

CLOUD COMPUTING

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5307	Principles of Cloud Computing	PEC	3	0	0	3	3
2	22CS5308	Virtualization	PEC	3	0	0	3	3

3	**22CS5309**	Cloud Architecture	PEC	3	0	0	3	3
4	**22CS6305**	Cloud Services Managment	PEC	3	0	0	3	3
5	**22CS6306**	Cloud Application Development	PEC	3	0	0	3	3
6	**22CS7303**	Cloud Security	PEC	3	0	0	3	3

Vertical IV
Cyber Security and Data Privacy

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5310**	Ethical Hacking	PEC	3	0	0	3	3
2	**22CS5311**	Digital and Mobile Forensics	PEC	3	0	0	3	3
3	**22CS5312**	Cyber forensics and investigation	PEC	3	0	0	3	3
4	**22CS6307**	Engineering Secure software systems	PEC	3	0	0	3	3
5	**22CS6308**	Social NetworkSecurity	PEC	3	0	0	3	3
6	**22CS7304**	Data privacy preservation	PEC	3	0	0	3	3

Vertical V
COMPUTER VISION AND VIRTUAL REALITY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5313**	Computer Graphics	PEC	3	0	0	3	3
2	**22CS5314**	Image and video analytics	PEC	3	0	0	3	3
3	**22CS5315**	Game Programming	PEC	3	0	0	3	3
4	**22CS6309**	Computer Vision	PEC	3	0	0	3	3
5	**22CS6310**	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	**22CS7305**	Virtual Reality	PEC	3	0	0	3	3

Vertical VI
Artificial Intelligence and Machine Learning

S	Course	Course Title	Category	Periods Per	Total	Credits

No	Code			week			Contact Periods	
				L	T	P		
1	22CS5316	Soft Computing	PEC	3	0	0	3	3
2	22CS5317	Natural Language Processing	PEC	3	0	0	3	3
3	22CS5318	Quantum Computing	PEC	3	0	0	3	3
4	22CS6311	Cognitive Science and Analytics	PEC	3	0	0	3	3
5	22CS6312	Pattern Recognition	PEC	3	0	0	3	3
6	22CS7306	Ethics And AI	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree. For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For a minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2	22CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3	22CS6602	Sem6: Introduction to Internet Of Things	MDC	3	0	0	3	3
4	22CS7601	Sem 7: Introduction to	MDC	3	0	0	3	3

		Machine Learning						
5	22CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6	22CS8601	Sem 8: Data Analytics	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I

Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Financial Management	MDC	3	0	0	3	3
2	22XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	22XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22XXXX	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II

Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22BA6601	Introduction to Business Venture	MDC	3	0	0	3	3
3	22 BA6602	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	22 BA7601	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	22 BA7602	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	22 BA8601	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	22BA8602	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III
Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5602	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22XXXX	Green Technology	MDC	3	0	0	3	3
6	22XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING

Vertical I IOT	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III FULL STACK DEVELOPMENT
22CS5204 Fundamentals Of IOT	22CS5205 Public Key Infrastructure and Trust Management	22CS5206 Web Technology
22CS6203 IoT Design	22CS6205 Introduction to block chain	22CS6207 React JS with Spring boot 2
22CS6204 Introduction Of Raspberry Pi and Arduino	22CS6206 Cryptocurrency	22CS6208 Back End Development with NodeJS
22CS7203 IoT for smart cities	22CS7205 Smart Contracts and Solidity	22CS7207 No Sql Databases with Mongo DB
22CS7204 Internet Of Medical Things	22CS7206 Block chain and distributed ledger technology	22CS7208 DevOps
22CS8201 Iot Cloud and Data Analytics	22CS8202 Bitcoin Essentials and Use-Cases	22CS8203 Web Application Security

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN IOT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	3
2	22CS6203	Sem 6: IoT Design	PC	3	0	0	3	3
3	22CS6204	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	3
4	22CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	3
5	22CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	3
6	22CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	22CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN FULL STACK DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5206	Sem 5: Web Technology	PC	3	0	0	3	3
2	22CS6207	Sem 6: React JS with Spring boot 2	PC	3	0	0	3	3
3	22CS6208	Sem 6: Back End Development with NodeJS	PC	3	0	0	3	3
4	22CS7207	Sem 7: No Sql Databases with Mongo DB	PC	3	0	0	3	3
5	22CS7208	Sem 7: DevOps	PC	3	0	0	3	3
6	22CS8203	Sem 8: Web Application Security	PC	3	0	0	3	3

The Industry Core Courses (ICC) which will be offered as choice-based course in the semester.

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	22CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	22CS4204	Data Visualization	3	0	0	3	40	60	100
ICC5	IV	22CS4003	Data Visualization Laboratory	0	0	4	2	60	40	100
ICC6	V	22CS5252	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	22CS6352	Predictive Modeling	3	0	0	3	40	60	100
ICC8	VI	22CS6314	Development of Machine Learning Models	3	0	0	3	40	60	100
ICC9	VII	22CS7307	AI Analyst	3	0	0	3	40	60	100

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	18	23	25	23	22	24	20	10	**165**

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SYLLABUS
I SEMESTER

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	**22MA1101**	**MATRICES AND CALCULUS (Common to all Branches)**	3	1	0	4

The learner should be able to

Course Objective

1. Construct the characteristic polynomial of a matrix and use it to identify eigen values and Eigenvectors
2. Impart the knowledge of sequences and series.
3. Analyseanddiscussthemaximaandminimaofthefunctionsofseveralvariables.
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

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

CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.

CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.

CO3: Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.

CO4: Evaluate multiple integral and its applications in finding area, volume.

CO5: Apply the concept of vector calculus in two and three dimensional spaces.

TEXTBOOKS:

T1:G.B.ThomasandR.L.Finney,"CalculusandAnalyticalGeometry",9thEditionAddisonWesleyPublishing Company,2016.

T2:ErwinKreyszig,"AdvancedEngineeringMathematics",JohnWiley&Sons,2019.

T3:K.P.UmaandS.Padma,"EngineeringMathematicsI(MatricesandCalculus) ",PearsonLtd,2022.

REFERENCEBOOKS:

R1-JerroldE.Marsden,AnthonyTromba,"VectorCalculus",W.H.Freeman,2003

R2-StraussM.J,G.L.BradleyandK.J.Smith,"Multivariablecalculus",PrenticeHall,2002.

R3-VeerarajanT,"EngineeringMathematics",McGrawHillEducation(India)PvtLtd,NewDelhi,2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CY1151	**Chemistry for Circuit Engineering** (ECE, EEE, EIE, BME,CSE, IT, AIML)	2	0	2	3

The learner should be able to

Course Objective

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" DhanpatRai Pub, Co., New Delhi (2018).

T2 -O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

R1 - ShikhaAgarwal "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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B.E./B.Tech/ I	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	L	T	P	C
			2	0	2	3

The student should be able

Course Objective

1. To improve the communicative proficiency of learners.
2. To help learners use language effectively in professional writing.
3. To advance the skills of maintaining the suitable one of communication.
4. To introduce the professional life skills.
5. 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, **Reading-** Purpose of Reading - Churning & Assimilation, Interpreting Ideas - Interpreting Graphs in Technical Writing.	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 **Reading** - Skimming – Scanning – Reading Scientific Texts – Literary Texts .	7+2
III	**Language Proficiency:** Prepositions, phrasal verbs. **Writing:** Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. **Vocabulary –** words on tools. **PracticalComponent:Listening-**Listen to songs and answer the questions **Speaking-** Justaminute **Reading-** Reading feature articles (from newspapers and magazines) -Reading to identify point of view and perspective (opinion pieces, editorials etc.)	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. **Reading-** Reading Comprehension - Techniques for Good Comprehension - - Sequencing of Sentences.	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 **Reading-** Biographies,travelogues,technical blogs.	6+3
	Total Instructional Hours	**45**

Course Outcome

After completion of the course the learner will be able

CO1:Tocommunicateinaprofessional forum

CO2:Tospeakorwriteacontentintheproficientlanguage

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"-4thedition CambridgeUniversityPress,2004.

R3-KamaleshSadanan"AFoundationCoursefortheSpeakersofTamil-Part-I&II",Orient Blackswan,2010.

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Programme	CourseCode	Name of the Course	L	T	P	C
B.E./B.Tech I	22IT1152	Introduction to Web Application Development (IT/CSE/AIML)	2	0	2	3

The learner should be able to

Course Objective

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:Developingan web application using CSS Positioning.	(6+4)
	TotalInstructionalHours	45

Course Outcome

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

COI : Basic understanding of development of software life cycle.
CO2: Understanding the basic HTML Tags.
CO3:Designing a simple web application using HTML.
CO4: Understanding about the usage of Cascading Style Sheet.
CO5: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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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22CS1151	PROBLEM SOLVING USING C PROGRAMMING (EEE, EIE, CSE, IT)	2	0	2	3

The learner should be able

Course Objective

1. To develop simple algorithms for arithmetic and logical problems.
2. To understand and implement the fundamental concepts in a program.
3. To enable how to implement conditional branching, iteration and recursion.
4. 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.
5. To understand the use files to perform read and write operations

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPUTERS** Computer Systems – Computing Environments – Computer Language – Creating and Running programs – Computer Numbering System – Storing Integers and Real Numbers – Algorithms - Flowchart. **INTRODUCTION TO C LANGUAGE** Character set - C Tokens, Identifiers and Keywords - Constants, Variables - Data types – Text Input / Output – Operators - Expressions – Precedence and Associativity – Evaluating Expressions – Type Conversions. 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. (Wipro 2022) **Input Format:** • 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. **Output Format:** Print a positive integer representing the minimum price at which Josh can buy the apples. 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. (Cognizant) Note : The input other than 4 digit positive number[includes negative and 0] is considered as invalid.	7
II		10
III	**DECISION MAKING, ARRAYS, STRINGS AND POINTERS** Two-way collection – Multi-way Collection – 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. 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. (Wipro 2022) **Input** • The first line of the input consists of an integer numbers, 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 **Output** Print N space-separated integers such that all the odd numbers of the list come after the even numbers 2) Given an integer matrix of size N x N. Traverse it in a spiral form. (Wipro 2022) 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. Output: A single line containing integers with space, representing the desired traversal. Constraints: $0 < N < 500$ 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. (Wipro 2022) **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. **Output**	10

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Print an integer representing the length of the maximum signal.

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. (TCS NQT 2022)

Note : The output will be a positive or negative integer based on number of '*' and '#' in the input string.

(*>#): positive integer

(#>*): negative integer

(#=*): 0

IV	**FUNCTIONS, STRUCTURES AND UNION** 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. 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 keyy =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. (TCS NQT 2022) Enter your PlainText: All the best Enter the Key: 1 The encrypted Text is: BmmuifCftu	9
V	**BINARY INPUT / OUTPUT** 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. 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.	9
	Total Instructional Hours	**45**

Course Outcome

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

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.

CO5: Use files to perform read and write operations.

TEXT BOOKS:

T1: 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: YashvantKanetkar, "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	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22CS1152	OBJECT ORIENTED PROGRAMMING USING PYTHON (CSE, IT, ECE & AIML)	2	0	2	3

The learner should be able

Course Objective

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and call them.
4. To understand OOP concepts and write programs using classes and objects.
5. 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 acard 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,dicionary,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 aPython 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 lamda 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 s um of the digits of a given n umber, 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. Thecharges 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 thesame, 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 andupdated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS:

R1: Charles Dierbach, —Introduction to Computer Science using Python: A ComputationalProblem-Solving Focus, Wiley India Edition, 2013.
R2: Timothy A. Budd, —Exploring Pythonl, Mc-Graw Hill Education (India) Private Ltd., 2015.
R3: Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

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MANDATORY COURSES

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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22MC1095	UNIVERSAL HUMAN VALUES (COMMON TO ALL BRANCHES)	2	0	0	0

Course Objectives

Thestudentshould bemade

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. TofacilitatethedevelopmentofaHolisticperspectiveamongstudentstowardslifeandprofession 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.
3. To highlight plausible implication sofsuchaHolisticunderstanding Interms ofethicalhumanconduct, 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 RightEvaluation 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 CaseStudiesStrategies 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, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

R2.Teachers'ManualforAFoundationCourseinHumanValuesandProfessionalEthics,RRGaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2

R3.JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak,1999.

R4.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

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rogramme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22HE1072	ENTREPRENEURSHIP & INNOVATION (Common for all Branches)	1	0	0	1

The student should be made

Course Objectives

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
5. 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

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

Course Outcome

CO1: Understandthenatureofbusinessopportunities,resources,andindustriesincriticalandcreative aspects.
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
CO3:Remember effectively and efficiently the potential of new business opportunities.
CO4:Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..
CO5:Developabusiness model for a new venture, including revenue. Margins, operations, Working capital, and investment

TEXTBOOKS

T1:AryaKumar"Entrepreneurship–CreatingandleadinganEntrepreneurialOrganization",Pearson,SecondEdition(2012).
T2:EmrahYayici"DesignThinkingMethodology", Artbiztech,FirstEdition(2016).

REFERENCEBOOKS

R1: Christopher Golis "Enterprise & Venture Capital", Allen &Unwin Publication, Fourth Edition (2007).
R2: ThomasLockWood&EdgerPapke"InnovationbyDesign",Career Press.com,SecondEdition(2017).
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, FirstEdition(2010).

WEBRESOURCES

W1:https://blof.forgeforward.in/tagged/startup-lessons
W2:https://blof.forgeforward.in/tagged/entrepreurship
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	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22MC1094	**HERITAGE OF TAMIL**	2	0	0	1

The learner should be able to

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
I	**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
II	**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
III	**Folk and Martial Arts** Therukoothu, Karagattem, Villupattu, Kaniyan koothu, Oyilattam, Leather puppertry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.	6
IV	**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 – Exporot and Import during Sangam age – Overseas conquest of Cholas.	6
V	**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
	Total Instructional Hours	**30**

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

Course Outcome

CO1: Learn about the works pertaining to Sangam age
CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.
CO3Appreciate 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).

REFERENCEBOOKS:

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 Bookand Educational Services Corporation, Tamil Nadu)
R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE1073	INTRODUCTION TO SOFT SKILLS	1	0	0	1

Course Objectives:

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	2
V	**Verbal Ability** Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement - Punctuations	4
	Total Instructional Hours	30

Course Outcome:

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.

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SUBJECT CODE – 22MC1093

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GE3152	தமிழர் மரபு	L T P C 1 0 0 1

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 திருவள்ளுவர் 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, கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

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1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – 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 ofArchaeology & 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) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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CO'S, PO'S & PSO'S MAPPING

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 – III

Course Code & Name: 22MA3103 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: 22CS3201 / 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: 22CS3202 / Operating 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: 22CS3251/Object Oriented Programming Using Java

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	3	2
CO2	3	3	2	2	2	2	0	1	0	1	0	1	3	2
CO3	3	3	2	2	2	2	0	1	0	1	0	2	3	2
CO4	3	3	2	2	2	2	0	1	0	1	1	1	3	2
CO5	3	3	2	2	2	2	0	1	0	1	1	1	2	2
Avg	**3**	**3**	**2**	**2**	**2**	**2**	**0**	**1**	**0**	**1**	**1**	**2**	**2.8**	**2**

Course Code & Name: 22CS3203/Digital Principles And Computer Organization

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: 22CS3253/Clean Coding and Devops

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	3	2
CO2	3	3	2	2	2	2	0	1	0	1	0	1	3	2
CO3	3	3	2	2	2	2	0	1	0	1	0	2	3	2
CO4	3	3	2	2	2	2	0	1	0	1	1	1	3	2
CO5	3	3	2	2	2	2	0	1	0	1	1	1	2	2
Avg	**3**	**3**	**2**	**2**	**2**	**2**	**0**	**1**	**0**	**1**	**1**	**2**	**2.8**	**2**

Course Code & Name: 22CS3001/Digital Principles And Computer Organization 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	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: 22CS3002 /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	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	1	0	0	1	1	1	1	2	2
CO4	1	1	3	1	1	1	0	0	1	2	1	2	2	3
CO5	1	2	2	1	3	1	1	0	1	3	2	2	2	3
Avg	**3**	**2**	**2.8**	**0**	**1**	**1**	**1**	**0**	**1**	**2**	**1.2**	**1.4**	**2**	**2.4**

Course Code & Name: 22CS3003 /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**	**0.4**

Semester – V

Course Code & Name: 21CS5201/ 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: 21CS5202/ Computer 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: 21EC5231 / 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: 21CS5253 / Data Mining and warehousing

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: 21CS5252/ 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
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: 21EC5031 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**

Course Code & Name: 21CS5351 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: 21CS5352 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: 21CS5353 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: 21CS5354 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: 21CS5355 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: 21CS5001/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 – 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 Work - 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
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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2022 & 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
I	I	22MA1101 - Matrices and Calculus	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2
		22HE1151- English for Engineers	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2
		22CY1151 - Chemistry for Circuit Engineers	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	0	1
		22CS1151- Problem solving using C Programming	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
		22CS1152 - Object Oriented Programming using Python	2	3	3	-	2	-	-	-	2	-	-	2	2	2
		22IT1152- Introduction to Web Application Development	3	2.8	3	1.2	1	0.6	2		0.6		0.8	2	1.8	2
		22HE1073- Introduction To Soft Skills														
		22HE1072Entrepreneurship & Innovation														
		22MC1093/ 22MC1094 - தமிழர்மரபு /HERITAGE OF TAMIL														
		22MC1095 - Universal Human Values														

II	III	22MA3103 – Discrete Mathematics and Graph Theory	2.8	2.8	2.8	2.8	2.8	-	-	-	-	-	-	2.6	2.4	2.6
		22CS3201 - Data Structures	2.8	2.6	2.2	1.6	1.4	0	1	0.8	0.4	1.2	1.8	1.8	1.2	1.4
		22CS3202 - Operating Systems	2	1.6	2.8	1	1.6	1.6	0.2	0	2	1.6	1.4	2	2.4	2
		22CS3251 – Object Oriented Programming Using Java	3	3	2	2	2	2	0	1	0	1	1	2	2.8	2
		22CS3203 – Digital Principles And Computer Organization	3	3	2	2	2	2	0	1	0	1	1	2	0	1
		22CS3253 / Clean Coding and Devops	3	3	2	2	2	2	0	1	0	1	1	2	2.8	2
		22CS3001 – Digital Principles And Computer Organization Laboratory	3	3	2	2	2	2	0	1	0	1	1	2	0	1
		22CS3002 – Operating Systems Laboratory	3	2	2.8	0	1	1	1	0	1	2	1.2	1.4	2	2.4
		22CS3003 – Data Structures Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0.4
		22MC3191- Essence of Indian Traditional Knowledge														
		22HE3071 - Soft Skills And Aptitude -II														
III	V	21CS5201 – Theory of Computing	3	3	2.8	2.8	0.4	1	0	0	2	2	0.6	3	2	1.2
		21CS5202 – Computer Networks	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		21CS5253 – Data Mining and warehousing	3	2.8	3	2	3	0	0	3	1	0	2	2	2	3

		21EC5231 –Principles of Microprocessors and Micro Controllers	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		21CS5252 – Object Oriented Analysis and Design	2	1.6	2	2.3	3	3	3				2	2		
		19CS53XX -Professional Elective I														
		21CS5001 – Engineering Clinic	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		21EC5031 - Principles of Microprocessors and Microcontrollers Laboratory	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		21HE5071-Soft Skills - I														
		21HE5072-Design Thinking														
IV	VII	19CS7201 - Cryptography and Network Security	2	1.2	2.2	1	0	0.4	0	0	0	0	0	0.8	1.2	2.6
		19CS7202 – Cloud Computing	3	2	3	1.2	0	0	2	2	1	0	1.2	2	2	3
		19XX7401 -Open Elective – II														
		19CSXXXX - Professional Elective-III														
		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

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	21CS5351 – Internet and Web Technology	3	3	3	3	2	1.4	0.6	0	1	3	0	3	1.2	1.4
		21CS5352 – Advanced Java Programming	3	1	2	0	2	0	0	0	0	0	1	2	1	1
		21CS5353 – Fundamentals of Open Source Software	3	2	2	0	2	0	0	0	0	0	1	2	1	1
		21CS5354 – R Programming	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		21CS5355 – Computer Graphics and Multimedia	1.7	2.3	3	3	2	0	0	0	0	2	2	2	2.3	2.8
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	0
		19CS7303 – Wireless Sensor Networks	2	2	1	0	1	1	0	1	0	0	2	1	2	1
		19CS7304 - C# and .NetProgramming	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19CS7305 – Software Testing	3	2	1	1	0	0	0	0	0	2	2	2	2	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 **Dean – Academics**

Chairman - BoS
CSE - HiCET

Dean (Academics)
HiCET

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 - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the even semester

Academic year 2023-2024

(Academic Council Meeting Held on 26.12.2023)

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 and 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	2	0	2	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2091/ 22MC2092	தமிழர்மரபு/ *Heritage of Tamils*	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, inanyone of the personality and character development programmes and undergo training for about 80 hours							
			TOTAL	**18**	**1**	**12**	**22**	**29**	**630**	**370**	**1000**

SEMESTER III (Credits – 25)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22MA3103	Discrete Mathematics and Graph Theory	BSC	3	1	0	4	4	40	60	100
2	22CS3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22CS3202	Operating Systems	PCC	3	1	0	4	4	40	60	100
4	22CS3203	Digital Principles And Computer Organization	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22CS3251/ 22CS3253	Object Oriented Programming Using Java / Clean Coding and Devops	PCC/ICC-3	3	0	2	4	4	50	50	100
PRACTICAL											
6	22CS3001	Digital Principles And Computer Organization Laboratory	ESC	0	0	4	2	4	60	40	100
7	22CS3002	Operating Systems Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -II	SEC	1	0	0	1	1	100	0	100
9	22CS3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
10	22MC3191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	100	0	100
			TOTAL	**17**	**2**	**14**	**25**	**34**	**590**	**410**	**1000**

SEMESTER IV (Credits – 23)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22CS4201	Database ManagementSystems	PCC	3	0	0	3	3	40	60	100
3	22CS4202/ 22CS4204	Microprocessor and Microcontrollers / Data Visualization	PCC/ICC-4	3	0	0	3	3	40	60	100
4	22CS4203	Software Design with UML	PCC	3	0	0	3	3	40	60	100

THEORY WITH LAB COMPONENT											
5	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
6	22CS4251	Design and Analysis of Algorithms	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
7	22CS4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22CS4002 /22CS4003	Microprocessor and Microcontrollers Laboratory / DataVisualization Lab	PCC/ICC-5	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
			TOTAL	**17**	**1**	**12**	**23**	**28**	**480**	**420**	**900**

SEMESTER V (Credits – 22)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS5201	Theory Of Computation	PCC	3	1	0	4	4	40	60	100
2	22CS5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22CS53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22CS53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22CS53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22CS5251 /22CS5252	Object Oriented Analysis and Design / Introduction to Design Thinking	PCC/ICC-6	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS5001	Engineering Clinic	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	**18**	**1**	**6**	**22**	**25**	**410**	**390**	**800**

SEMESTER VI (Credits – 24)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS6201	Machine Learning Techniques	PCC	3	0	0	3	3	40	60	100
2	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
3	22CS63XX	Professional Elective-4/Development of Machine Learning Models	PEC/ICC-7	3	0	0	3	3	40	60	100
4	22CS63XX	Professional Elective-5/ Predictive Modeling	PEC/ICC-8	3	0	0	3	3	40	60	100
5	22CS64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22CS64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
7	22CY6101	Environmental Studies	BSC	2	0	0	2	3	40	60	100
PRACTICAL											
8	22CS6001	Machine Learning Techniques Lab	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	**22**	**0**	**4**	**24**	**27**	**440**	**460**	**900**

SEMESTER VII (Credits – 20)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS7201	Information storage and Management	PCC	3	0	0	3	3	40	60	100
2	22CS7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22CS73XX	Professional Elective-6 / AI Analyst	PEC /ICC-9	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6	22CS7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22CS7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
			TOTAL	**15**	**1**	**4**	**20**	**22**	**360**	**340**	**700**

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII (Credits – 10)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1	22CS8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
			TOTAL	**0**	**0**	**20**	**10**	**20**	**100**	**100**	**200**

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extracredits printed in the Consolidated Mark sheet as per the regulation.
2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2022 – 23.

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	**11**
2	BSC	7	9	4	3	-	2	-	-	**25**
3	ESC	6	2	5	-	-	-	-	-	**13**
4	PCC	-	5	13	17	12	5	9	-	**61**
5	PEC	-	-	-	-	9	6	3	-	**18**
6	OEC	-	-	-	-	-	6	6	-	**12**
7	EEC	3	3	3	1	1	2	2	10	**25**
8	MC	✓	✓							
	Total	**19**	**22**	**25**	**23**	**22**	**24**	**20**	**10**	**165**

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3

6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
3	22CS7401	E-Commerce	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Creative Media	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And Virtual Reality	Vertical VI Artificial Intelligence and Machine Learning
22CS5301 Data Engineering	**22CS5304** Multimedia Data Compression and Storage	**22CS5307** Principles of Cloud Computing	**22CS5310** Ethical Hacking	**22CS5313** Computer Graphics	**22CS5316** Soft Computing
22CS5302 Information Retrieval	**22CS5305** Multimedia and Animation	**22CS5308** Virtualization	**22CS5311** Digital and Mobile Forensics	**22CS5314** Image and video analytics	**22CS5317** Natural Language Processing
22CS5303 Data Security	**22CS5306** Video Creation and Editing	**22CS5309** Cloud Architecture	**22CS5312** Cyber forensics and investigation	**22CS5315** Game Programming	**22CS5318** Quantum Computing
22CS6301 Information Science and Ethics	**22CS6303** UI and UX Design	**22CS6305** Cloud Services Management	**22CS6307** Engineering Secure software systems	**22CS6309** Computer Vision	**22CS6311** Cognitive Science and Analytics
22CS6302 Fuzzy logic and Neural Networks	**22CS6304** Digital marketing	**22CS6306** Cloud Application Development	**22CS6308** Social Network Security	**22CS6310** Introduction to Augmented Reality	**22CS6312** Pattern Recognition

22CS7301 Recommender Systems	22CS7302 Visual Effects	22CS7303 Cloud Security	22CS7304 Data privacy preservation	22CS7305 Virtual Reality	22CS7306 Ethics and AI

Note:

Students are permitted to choose all professional electives from any of the verticals.

Vertical I

Data Science

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5301	Data Engineering	PEC	3	0	0	3	3
2	22CS5302	Information Retrieval	PEC	3	0	0	3	3
3	22CS5303	Data Security	PEC	3	0	0	3	3
4	22CS6301	Information Science and Ethics	PEC	3	0	0	3	3
5	22CS6302	Fuzzy logic and Neural Networks	PEC	3	0	0	3	3
6	22CS7301	Recommender Systems	PEC	3	0	0	3	3

Vertical II

Creative Media

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5304	Multimedia Data Compression and Storage	PEC	3	0	0	3	3
2	22CS5305	Multimedia andAnimation	PEC	3	0	0	3	3
3	22CS5306	Video Creation and Editing	PEC	3	0	0	3	3
4	22CS6303	UI and UX Design	PEC	3	0	0	3	3
5	22CS6304	Digital marketing	PEC	3	0	0	3	3
6	22CS7302	Visual Effects	PEC	3	0	0	3	3

Vertical III

CLOUD COMPUTING

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5307	Principles of Cloud Computing	PEC	3	0	0	3	3
2	22CS5308	Virtualization	PEC	3	0	0	3	3

3	**22CS5309**	Cloud Architecture	PEC	3	0	0	3	3
4	**22CS6305**	Cloud Services Managment	PEC	3	0	0	3	3
5	**22CS6306**	Cloud Application Development	PEC	3	0	0	3	3
6	**22CS7303**	Cloud Security	PEC	3	0	0	3	3

Vertical IV

Cyber Security and Data Privacy

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5310**	Ethical Hacking	PEC	3	0	0	3	3
2	**22CS5311**	Digital and Mobile Forensics	PEC	3	0	0	3	3
3	**22CS5312**	Cyber forensics and investigation	PEC	3	0	0	3	3
4	**22CS6307**	Engineering Secure software systems	PEC	3	0	0	3	3
5	**22CS6308**	Social NetworkSecurity	PEC	3	0	0	3	3
6	**22CS7304**	Data privacy preservation	PEC	3	0	0	3	3

Vertical V

COMPUTER VISION AND VIRTUAL REALITY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5313**	Computer Graphics	PEC	3	0	0	3	3
2	**22CS5314**	Image and video analytics	PEC	3	0	0	3	3
3	**22CS5315**	Game Programming	PEC	3	0	0	3	3
4	**22CS6309**	Computer Vision	PEC	3	0	0	3	3
5	**22CS6310**	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	**22CS7305**	Virtual Reality	PEC	3	0	0	3	3

Vertical VI

Artificial Intelligence and Machine Learning

S	Course	Course Title	Category	Periods Per	Total	Credits

No	Code			week			Contact Periods	
				L	T	P		
1	22CS5316	Soft Computing	PEC	3	0	0	3	3
2	22CS5317	Natural Language Processing	PEC	3	0	0	3	3
3	22CS5318	Quantum Computing	PEC	3	0	0	3	3
4	22CS6311	Cognitive Science and Analytics	PEC	3	0	0	3	3
5	22CS6312	Pattern Recognition	PEC	3	0	0	3	3
6	22CS7306	Ethics And AI	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree. For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For a minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2	22CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3	22CS6602	Sem6: Introduction to Internet Of Things	MDC	3	0	0	3	3
4	22CS7601	Sem 7: Introduction to	MDC	3	0	0	3	3

		Machine Learning						
5	22CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6	22CS8601	Sem 8: Data Analytics	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I

Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Financial Management	MDC	3	0	0	3	3
2	22XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	22XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22XXXX	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II

Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22BA6601	Introduction to Business Venture	MDC	3	0	0	3	3
3	22 BA6602	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	22 BA7601	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	22 BA7602	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	22 BA8601	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	22BA8602	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III
Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5602	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22XXXX	Green Technology	MDC	3	0	0	3	3
6	22XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING

Vertical I IOT	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III FULL STACK DEVELOPMENT
22CS5204 Fundamentals Of IOT	22CS5205 Public Key Infrastructure and Trust Management	22CS5206 Web Technology
22CS6203 IoT Design	22CS6205 Introduction to block chain	22CS6207 React JS with Spring boot 2
22CS6204 Introduction Of Raspberry Pi and Arduino	22CS6206 Cryptocurrency	22CS6208 Back End Development with NodeJS
22CS7203 IoT for smart cities	22CS7205 Smart Contracts and Solidity	22CS7207 No Sql Databases with Mongo DB
22CS7204 Internet Of Medical Things	22CS7206 Block chain and distributed ledger technology	22CS7208 DevOps
22CS8201 Iot Cloud and Data Analytics	22CS8202 Bitcoin Essentials and Use-Cases	22CS8203 Web Application Security

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN IOT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	3
2	22CS6203	Sem 6: IoT Design	PC	3	0	0	3	3
3	22CS6204	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	3
4	22CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	3
5	22CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	3
6	22CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	22CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN FULL STACK DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5206	Sem 5: Web Technology	PC	3	0	0	3	3
2	22CS6207	Sem 6: React JS with Spring boot 2	PC	3	0	0	3	3
3	22CS6208	Sem 6: Back End Development with NodeJS	PC	3	0	0	3	3
4	22CS7207	Sem 7: No Sql Databases with Mongo DB	PC	3	0	0	3	3
5	22CS7208	Sem 7: DevOps	PC	3	0	0	3	3
6	22CS8203	Sem 8: Web Application Security	PC	3	0	0	3	3

The Industry Core Courses (ICC) which will be offered as choice-based course in the semester.

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	22CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	22CS4204	Data Visualization	3	0	0	3	40	60	100
ICC5	IV	22CS4003	Data Visualization Laboratory	0	0	4	2	60	40	100
ICC6	V	22CS5252	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	22CS6352	Predictive Modeling	3	0	0	3	40	60	100
ICC8	VI	22CS6314	Development of Machine Learning Models	3	0	0	3	40	60	100
ICC9	VII	22CS7307	AI Analyst	3	0	0	3	40	60	100

Credit Distribution R2022

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

Chairman BoS

Chairman - BoS
CSE - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS4201	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Course Objective

1. To learn the fundamentals of data models, and to represent a database system using ER diagrams
2. To understand the relational algebra and SQL and to learn normalization techniques
3. To understand the fundamental concepts of transaction, concurrency and recovery processing
4. To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
5. To have an introductory knowledge about NOSQL and database

Unit	Description	Instructional Hours
I	**INTRODUCTION TO DATABASES** Purpose of Database - Database System Architecture - Views of Data– Schema architecture – Data Independence – Schema and instance- Data Models– Benefits of Data Model – Phases of Data Model.ER Diagram - Extended ER Diagram – Examples.	9
II	**RELATIONAL DATABASE AND DESIGN** Relational Data Model – Keys - Relational Algebra - SQL Fundamentals – Advanced SQL Features - Embedded SQL - Dynamic SQL. Normalization - Functional Dependency - First, Second, Third Normal Form - BCNF, Non Loss Decomposition - 4NF - Multi valued Dependency - 5NF - Join Dependency	9
III	**TRANSACTION AND CONCURRENCY CONTROL** Transaction processing - ACID Properties - failure and recovery – Schedules – Serializability - Concurrency Control - Lock based protocol - Two Phase Commit - Isolation levels - SQL Facilities for concurrency and recovery - Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm -Database integrity and security	9
IV	**IMPLEMENTATION TECHNIQUES** RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files– Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection,Sorting and join operations – Query optimization using Heuristics - Cost Estimation.	9
V	**ADVANCED TOPICS** NO SQL Databases: Need for NO SQL – Characteristics of NOSQL - Comparison of relational databases to new NoSQL stores - CAP Theorem – Key-value database - Apache Cassandra – Columnar Databases – MongoDB – CRUD operations with MongoDB - Document Databases – Graph Databases. Database Security: Security issues –Access control based on privileges – Role Based access control - SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges	9
	Total Instructional Hours	45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Design database using ER model
CO2 Construct SQL Queries using relational algebra and normalize the database
CO3: Construct queries to handle transaction processing and maintain consistency of the database
CO4: Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database.
CO5: Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.

2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017

REFERENCE BOOKS::

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

PO&PSO	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
CO1	3	-	-	-	-	-	-	-	-	-	2	-	2	-
CO2	3	-	2	-	3	-	-	-	1	-	1	-	2	2
CO3	3	3	3	2	3	-	-	-	1	-	2	-	2	2
CO4	3	3	3	2	2	-	-	-	1	-	3	-	2	-
CO5	3	3	3	2	2	-	-	-	1	-	1	-	2	2

Chairman, Board Of Studies

Dean-Academics

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CSE - HiCET

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS4203	SOFTWARE DESIGN WITH UML	3	0	0	3

Course Objective

1.To understand the basic concepts of software engineering, life cycle models and project management concepts
2.To understand in detail about the requirement analysis and requirement engineering processes
3. Learn the basics of OO analysis and design skills..
4. Learn the UML design diagrams.
5. Learn to map design to code.

Unit	Description	Instructional Hours
I	**SOFTWARE PROCESS AND PROJECT MANAGEMENT** Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis - Risk Management.	9
II	**REQUIREMENTS ANALYSIS AND SPECIFICATION** 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	9
III	**UML DIAGRAMS** Introduction to OOAD – Unified Process – UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams	9
IV	**DESIGN PATTERNS** GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller – Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral – Strategy – observer.	9
V	**CASE STUDY** Case study – the Next Gen POS system, Inception -Use case Modeling – Relating Use cases – include, extend and generalization – Elaboration – Domain Models – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand and gain knowledge to implement projects using OO concepts.
CO2: Understand the functional requirements of UML analysis and design diagrams.
CO3: Apply the UML diagrams to understand the conceptual classes and class hierarchies
CO4: Apply appropriate design patterns.
CO5: Understand the concepts of use case modeling.

TEXT BOOKS:

T1 Roger S. Pressman, –Software Engineering – A Practitioner"s Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.

T2 Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.

REFERENCE BOOKS:

R1: Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
R2: Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", Fourth Edition, Mc-Graw Hill Education, 2010.
R3: Erich Gamma, and Richard Helm, Ralph Johnson, John Glissades, "Design patterns-Addison-Wesley, 1995.
R4: Stephen R.Schach, —Software Engineering‖, Tata McGraw-Hill Publishing Company Limited,2007.

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

Chairman

Chairman, Board Of Studies

Dean-Academics

Chairman - BoS
CSE - HiCET

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22MA4152	Applied Statistics with R Programming and Queuing theory	3	0	2	4

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**
		60

Total(45+15)

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.

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS4251	DESIGN AND ANALYSIS OF ALGORITHM	3	0	2	4

Course Objective

- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To illustrate brute force and divide and conquer design techniques.
- To explain dynamic programming and greedy techniques for solving various problems.
- To apply iterative improvement technique to solve optimization problems
- To examine the limitations of algorithmic power and handling it in different problems.

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 ***Program:*** *1.* Implement recursive and non-recursive algorithms and study the order of growth from log2n to n!.	7+2(P)
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. ***Program:*** *1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.* *2. Implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.* *3. Strassen's Matrix Multiplication*	9+4(P)
III	**DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE** Dynamic programming – Principle of optimality - Coin changing problem – Warshall's and Floyd's algorithms – Optimal Binary Search Trees - Multi stage graph - Knapsack Problem and Memory functions. Greedy Technique – Prim's algorithm and Kruskal's Algorithm -Dijkstra's algorithm - Huffman Trees and codes - 0/1 Knapsack problem. ***Program:*** *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	**LIMITATIONS OF ALGORITHM POWER** The General Method – n-Queens Problem- Subset Sum Problem - Hamiltonian Cycle- Graph coloring - Branch and Bound- LIFO Search and FIFO search – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Lower - Bound Arguments - P, NP, NP-Complete and NP Hard Problems. ***Program:*** *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 = {s1, s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions*	9+5(P)

{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.

TOTAL HOURS 60 (43+17)

Course Outcome

CO1: Analyze the efficiency of recursive and non-recursive algorithms mathematically

CO2: Analyze the efficiency of brute force, divide and conquer, decrease and conquer, Transform and conquer algorithmic techniques

CO3: Implement and analyze the problems using dynamic programming and greedy algorithmic techniques.

CO4: Solve the problems using iterative improvement techniques for optimization.

CO5: Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound techniques.

TEXT BOOKS:

T1- Anany Levitin, "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.

R4 - Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.

R5 - Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.

PO & PSO	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
CO1	2	3	3	2	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	2	-	-	-	-	1	-	1	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	2	-	2	2
CO4	3	3	3	2	1	-	-	-	1	-	3	-	2	-
CO5	3	3	3	2	1	-	-	-	1	-	1	-	2	2

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Programme	Course Code	Name of the Course	L	T	P	C
BE	22CS4001	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	4	2

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

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)

Sex (Check constraint for accepting either M of F)

5.

Busdiv	**Journey**
Buscode (primary key)	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
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

PO&PSO	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
CO1	2	3	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	3	3	2	3	3	3	1	2	3	3
CO3	3	3	3	2	3	2	2	3	1	3	2	2	3	3
CO4	3	3	3	2	2	3	2	3	2	3	3	2	3	3
CO5	3	3	3	2	2	1	2	3	3	3	1	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS4204	DATA VISUALIZATION	3	0	0	3

Course Objective

1. Design and create data visualization.
2. Conduct exploratory data analysis using visualization.
3. Craft visual presentation of data for effective communication.
4. Design and evaluate color palettes for visualization design alternative.
5. Apply data transformation such as aggregation and filtering for visualization.
6. Identify opportunities for application of data visualization in various domains

Unit	Description	Instructional Hours
I	**INTRODUCTION TO STATISTICS** Data collection methods, Descriptive Statistics Mean, Median, Mode, Inferential Statistics, Random Variables, Probability Distributions, Normal Distribution, Sampling and Sampling Distribution.	9
II	**VISUALIZATION USING R** Overview of R, Descriptive data analysis using R, Data manipulation with R Data visualization with R, R studio installation, Data manipulation with R (dplyr, data. table, reshape2package, tidyr package, Lubricate package) ,Data Visualization with R (working with Graphics,ggplot2).	9
III	**WATSON STUDIO** Data visualization in Watson studio, Adding data to data refiner, Visualization of data in Watson studio.	9
IV	**DATA ANALYSIS USING PYTHON** Introduction to python, Python scripting basics, Data types - Introduction to Jupyter notebook, Numpy and Pandas, Python and Anaconda installation , Pandas (text data, date time columns, indexing and selecting data, group by Merge/join datasets).	9
V	**VISUALIZATION USING PYTHON** Data Visualization tools in python ,Basic plots using Matplotlib ,Specialized Visualization tools using Matplotlib ,Advanced Visualization tools using Matplotlib-Seaborn functionalities ,Spatial visualization and analysis in python in folium ,Usage of Seaborn functionalities ,Case studies.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Know the history of data visualization and its connection with computer graphics.

CO2: Students understand the foundations and characteristics of data, which forms the beginning of the visualization pipeline.

CO3: Understand the role of user interaction within visualizations, understand the visualization design process.

CO4: Students know some commercial data visualization packages with functionality.

TEXT BOOKS:

T1 :IBM CE-Data visualization.

REFERENCE BOOKS:

R1: Information Dashboard Design: Displaying Data for At-a-glance Monitoring
R2: The Big Book of dash board by Steve Wexler.
R3: Mastering python data Visualization.

PO&PSO	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
CO1	2	3	3	3	3	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	3	3	2	2	2	2	1	2	3	3
CO3	2	2	2	2	3	2	2	3	1	3	2	2	2	3
CO4	3	3	3	2	2	3	2	3	2	3	3	2	3	3
CO5	3	2	2	2	2	1	2	3	3	3	1	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B. E	22CS4003	**DATA VISUALIZATION LABORATORY**	0	0	4	2

Course Objective

1. Design and create data visualization.
2. Conduct exploratory data analysis using visualization.
3. Craft visual presentation of data for effective communication.
4. Design and evaluate color palettes for visualization design alternative.
5. Apply data transformation such as aggregation and filtering for visualization.
6. Identify opportunities for application of data visualization in various domains

Description of the Experiments

1. Data manipulation using dplyr package in R programming
2. Data manipulation using tidyr package in R programming
3. Data analysis using data. table package in R programming
4. Data Visualization using R programming
5. Pandas – Indexing and selecting operations
6. Pandas -Merging operations
7. Exploratory data analysis for loan prediction dataset
8. Creating a data frame from dictionary and accessing the data using pandas packages
9. Data analysis and visualization for COVID19 dataset
10. Creating different types of visualizations using python(matplotlib package) programming

Total Practical Hours 45

Course Outcome

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

CO1: Know the history of data visualization and its connection with computer graphics

CO2: Students understand the foundations and characteristics of data, which forms the beginning of the visualization pipeline

CO3: Understand the role of user interaction within visualizations, understand the visualization design process

CO4: Students know some commercial data visualization packages with functionality

PO&PSO	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
CO1	2	3	1	3	3	2	2	2	2	2	2	2	2	2
CO2	3	2	2	3	1	3	2	2	3	1	1	2	3	3
CO3	2	2	3	1	2	3	1	3	2	3	1	2	2	3
CO4	3	3	3	2	2	3	2	3	2	3	2	3	1	3
CO5	3	2	3	1	2	1	2	3	1	3	1	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS4202	MICROPROCESSORS AND MICRO CONTROLLERS	3	0	0	3

Course Objective

1. Study the Architecture of 8085 and 8086 microprocessor.
2. Learn the design aspects and interrupt service in 8086.
3. Study about communication and bus interfacing.
4. Study the various I/O interfacing devices.
5. Study the Architecture of 8051 microcontroller

Unit	Description	Instructional Hours
I	**8085 MICROPROCESSOR** Introduction to 8085 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming.	9
II	**8086 MICROPROCESSOR** Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming – Modular Programming - Interrupts and interrupt service routines.	9
III	**8086 SYSTEM BUS STRUCTURE** 8086 signals – Basic configurations – System bus timing –System design using 8086 – Introduction to Multiprogramming – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations.	9
IV	**I/O INTERFACING** Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer Interface – Keyboard /display controller – Interrupt controller – DMA controller.	9
V	**8051 MICROCONTROLLER** Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.	9

Course Outcome

CO1: Design and implement programs on 8085AND 8086 microprocessor.
CO2: Apply the concepts to implement ALP using 8086.
CO3: Design Memory Interfacing circuits and bus structure
CO4: Design various interfacing and its programming methodologies
CO5: Evaluate the architecture of 8051.

TEXT BOOKS:

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

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

T3 Microprocessor Architecture, Programming and Applications with 8085/8080A – Ramesh S. Gaonkar, Wiley Eastern Limited.

REFERENCE BOOKS:

R1: Doughlas 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.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	2	1	0	1	2	1	2	0	1	0
CO2	2	2	3	2	2	3	0	1	2	1	2	1	1	1
CO3	2	2	3	2	2	3	0	1	2	1	2	2	1	1
CO4	2	2	3	2	2	3	0	1	1	1	2	2	1	1
CO5	2	2	2	2	2	1	0	1	2	1	2	2	1	1

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS4002	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	0	0	4	2

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.	Matrix operations
3.	Searching
4.	Sorting
	Using 8085 microprocessor and MASM software
5	Basic arithmetic and logical operations.
6	Matrix operation
7	Searching
8	Sorting
	Using 8086 Micro processor and Interfacing
9	Parallel interface
10	Serial interface
11	Key board and Display interface
	Using 8051 Micro controller
12.	Basic arithmetic and Logical operations.
13.	Find 2"s complement of a number

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: Explain the difference between simulator and Emulator
CO5: Execute Programs in 8051

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	2	1	2	1	2	1	2	0	2	1
CO2	2	2	3	2	2	3	3	2	2	1	2	1	3	2
CO3	3	2	3	2	3	2	1	1	2	1	2	2	1	1
CO4	2	3	2	2	2	3	3	2	1	1	2	2	3	2
CO5	3	2	2	2	2	1	2	1	2	1	2	2	2	1

Chairman, Board Of Studies

Dean-Academics

Chairman - BoS
CSE - HiCET

Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL OF HINDUSTHAN COLLEGE OF ENGINEERING
Chairman

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 - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the EVEN semester

Academic year 2023-2024

(Academic Council Meeting Held on 26.12.2023)

CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (UG)

REGULATION-2019

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

SEMESTER I – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1101	Calculus	BS	3	1	0	4	40	60	100
THEORY & LAB COMPONENT										
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	21CS1151	Python Programming and Practices / ICC1	ES	2	0	2	3	50	50	100
6	21EC1154	Basics of Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
MANDATORY										
8	21MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	21HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
10	21HE1072	Career Guidance – Level I	EEC	2	0	0	0	100	0	100
Total Credits				**16**	**2**	**10**	**20**	**580**	**320**	**900**

SEMESTER II – 22 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	BusinessEnglish for Engineers	HS	2	1	0	3	40	60	100
2	21MA2104	Differential Equations And Linear Algebra	BS	3	1	0	4	40	60	100
THEORY & LAB COMPONENT										
3	21PH2151	Material Science	BS	2	0	2	3	50	50	100
4	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	21CS2152	Essentials of C and C++ Programming / ICC2	ES	2	0	2	3	50	50	100
6	21ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
8	21HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
9	21HE2072	Career Guidance – Level II	EEC	2	0	0	0	100	0	100
Total Credits				**14**	**2**	**16**	**22**	**540**	**360**	**900**

SEMESTER III – 20 Credits

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 / ICC-3	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	0	0	0
9	21HE3072	Career Guidance Level – III	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 – 21 Credits

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	MC	2	0	0	0	0	0	0
9	21HE4072	Career Guidance Level – IV	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**

SEMESTER V – 24 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS5201	Theory of Computing	PC	3	1	0	4	40	60	100
2	21CS5202	Computer Networks	PC	3	0	0	3	40	60	100
3	21EC5231	Principles of Microprocessors and Micro Controllers	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4	21CS5252	Object Oriented Analysis and Design / ICC6	PC	2	0	2	3	50	50	100
5	21CS5253	Data mining and warehousing	PC	2	0	2	3	50	50	100
6	21CS53**	Professional Elective I	PE	2	0	2	3	50	50	100
PRACTICAL										
7	21CS5001	Engineering Clinic	PC	0	0	3	1.5	60	40	100
8	21EC5031	Principles of Microprocessors and Micro-controllers Laboratory	PC	0	0	3	1.5	60	40	100
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
Total Credits				**18**	**1**	**10**	**24**	**580**	**420**	**1000**

SEMESTER VI – 24 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS6181	Principles of Management	HS	3	0	0	3	40	60	100
2	21CS6201	Artificial Intelligence / ICC7	PC	3	1	0	4	40	60	100
4	21**6401	Open Elective I	OE	3	0	0	3	40	60	100
5	21CS63**	Professional Elective II / ICC8	PE	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
6	21CS6251	Compiler Design	PC	3	0	2	3.5	50	50	100
7	21CS6252	Mobile Computing and Application Development	PC	2	0	2	3	50	50	100
PRACTICAL										
8	21IT6003	Project Based Learning	PC	0	0	3	1.5	50	50	100
9	21HE6071	Soft Skill-II	EEC	1	0	0	1	100	0	100
10	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
11	21CS6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits				**19**	**1**	**7**	**24**	**510**	**575**	**1000**

SEMESTER VII – 20 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS7201	Cryptography and Network Security	PC	3	0	0	3	40	60	100
2	21CS7202	Cloud Computing	PC	3	0	0	3	40	60	100
3	21**7401	Open Elective II	OE	3	0	0	3	40	60	100

4	21CS73**	Professional Elective III / ICC9	PE	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
5	21CS7251	Machine Learning Techniques	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21CS7001	Cloud Computing Laboratory	PC	0	0	3	1.5	60	40	100
7	21CS7002	Security Laboratory	PC	0	0	3	1.5	60	40	100
8	21CS7901	Project Phase I	EEC	0	0	4	2	50	50	100
Total Credits				**14**	**0**	**12**	**20**	**380**	**420**	**800**

SEMESTER VIII – 14 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS83**	Professional Elective IV	PE	3	0	0	3	40	60	100
2	21CS83**	Professional Elective V	PE	3	0	0	3	40	60	100
PRACTICAL										
3	21CS8901	Project Phase II	EEC	0	0	16	8	100	100	200
Total Credits				**6**	**0**	**16**	**14**	**180**	**220**	**400**

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	21CS5351	Internet and Web Technology	PE	2	0	2	3	50	50	100
2	21CS5352	Advanced Java Programming	PE	2	0	2	3	50	50	100
3	21CS5353	Fundamentals of Open Source Software	PE	2	0	2	3	50	50	100
4	21CS5354	R Programming	PE	2	0	2	3	50	50	100
5	21CS5355	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	21CS6301	Business Intelligence – Data Warehousing and Analytics	PE	3	0	0	3	40	60	100
2	21CS6302	Embedded Systems	PE	3	0	0	3	40	60	100
3	21CS6303	Internet of Things	PE	3	0	0	3	40	60	100
4	21CS6304	Big Data Analytics and Tools	PE	3	0	0	3	40	60	100
5	21CS6305	Soft Computing	PE	3	0	0	3	40	60	100
6	21IT6308	Web Development - I	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE III

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS7301	Multi-core Architecture and Programming	PE	3	0	0	3	40	60	100
2	21CS7302	Cyber Forensics	PE	3	0	0	3	40	60	100
3	21CS7303	Wireless Sensor Networks	PE	3	0	0	3	40	60	100
4	21CS7304	C# and .Net Programming	PE	3	0	0	3	40	60	100
5	21CS7305	Software Testing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE IV

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS8301	Digital Image Processing	PE	3	0	0	3	40	60	100
2	21CS8302	High Speed Networks	PE	3	0	0	3	40	60	100
3	21CS8303	Information Security	PE	3	0	0	3	40	60	100
4	21CS8304	Human Computer Interaction	PE	3	0	0	3	40	60	100
5	21CS8305	Responsive Web Design	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE V

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS8306	Information Retrieval Techniques	PE	3	0	0	3	40	60	100
2	21CS8307	User Interface Design	PE	3	0	0	3	40	60	100
3	21CS8308	Visualization Techniques	PE	3	0	0	3	40	60	100
4	21CS8309	Deep Learning	PE	3	0	0	3	40	60	100
5	21CS8310	Block Chain Technology	PE	3	0	0	3	40	60	100

OPEN ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
OPEN ELECTIVE - I										
1	21CS6401	Introduction to Java Programming	OE	3	0	0	3	40	60	100
2	21CS6402	Green Computing	OE	3	0	0	3	40	60	100
OPEN ELECTIVE - II										
1	21CS7401	Foundation Skills in Information Technology (NASSCOM)	OE	3	0	0	3	40	60	100
2	21CS7402	Multimedia Systems	OE	3	0	0	3	40	60	100

➢ **Following are the Industry Core Courses (ICC) which will be offered as choice based course in the following semesters:**

ICC. No.	Sem. No	Course Code	Name of the Course	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	21CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	21CS2153	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	21CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	21CS6253	Predictive Modeling	3	0	2	4	40	60	100
ICC8	VI	21CS6306	Development of Machine Learning models	3	0	0	3	40	60	100
ICC9	VII	21CS7306	AI Analyst	3	0	0	3	40	60	100

Life Skill Courses									
S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	21LSZ401	General Studies for Competitive Examinations	3	0	0	3	40	60	100
2	21LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	40	60	100
3	21LSZ403	Indian Ethos and Human Values	3	0	0	3	40	60	100
4	21LSZ404	Indian Constitution and Political System	3	0	0	3	40	60	100
5	21LSZ405	Yoga for Human Excellence	3	0	0	3	40	60	100

(Note: Z stands for semester, students can't choose twice the course)

As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Students who will be enrolled his name in HICET NCC are eligible to undergo these subjects. Earned extra credits printed in the Consolidated Mark sheet as per the regulation. NCC course level 1 & Level 2 will be added in the open elective subject in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.

Semester	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	NCC General and National Integration	1	0	0	1	100	0	100
2	Social services and community development	1	0	0	1	100	0	100
3	General awareness, communication and Aero engines	1	0	0	1	100	0	100

NCC COURSES

(Only for the students' who have opted NCC subjects in Semester I, II, III & IV are eligible)

1	21HEZ401	NCC course level 1	OE	3	0	0	3	40	60	100
2	21HEZ402	NCC course level 2	OE	3	0	0	3	40	60	100

Enrollment for B.E. / B. TECH. (HONORS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.
  Note: Each programme should provide verticals for minor degree

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2.	21CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3.	21CS6602	Sem6: Principles of Internet Of Things	MDC	3	0	0	3	3
4.	21CS7601	Sem 7: Introduction to Machine Learning	MDC	3	0	0	3	3
5.	21CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6.	21CS8601	Sem 8: Data Analytics for Engineers	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
21CS5602-Financial Management	21BA5601- Foundations of Entrepreneurship	21CE5602- Sustainable infrastructure Development
Fundamentals of Investment	Introduction to Business Venture	Sustainable Agriculture and

		Environmental Management
Banking, Financial Services and Insurance	Team Building & Leadership Management for Business	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Creativity & Innovation in Entrepreneurship	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Principles of Marketing Management for Business	Green Technology
Introduction to Fintech	Human Resource Management for Entrepreneurs	Environmental Quality Monitoring and Analysis
	Financing New Business Ventures	

Vertical I FINTECH AND BLOCK CHAIN

S No	Course Code	Course Title	Category	Periods Per week			TCP	Credits
				L	T	P		
1	21CS5602	Sem 5:Financial Management	MDC	3	0	0	3	3
2	21XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	21XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	21XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	21XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	21XXXX	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			T C P	Credits
				L	T	P		
1	21BA5601	Foundations of Entreprencurship	MDC	3	0	0	3	3
2	21XXXX	Introduction to Business Venture	MDC	3	0	0	3	3
3	21XXXX	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	21XXXX	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	21XXXX	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	21XXXX	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	21XXXX	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			TCP	Credits
				L	T	P		
1	21CE5602	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	21CE6602	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	21CE6603	Sustainable Bio Materials	MDC	3	0	0	3	3
4	21XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	21XXXX	Green Technology	MDC	3	0	0	3	3
6	21XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in IOT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	4	40	60	100
2.	21CS6203	Sem 6: IoT Design	PC	3	0	0	3	4	40	60	100
3.	21CS6204	Sem 6: Privacy and Security in IoT	PC	3	0	0	3	4	40	60	100
4.	21CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	4	40	60	100
5.	21CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	4	40	60	100
6.	21CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	4	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in BLOCK CHAIN TECHNOLOGY

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3	40	60	100
2.	21CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3	40	60	100
3.	21CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3	40	60	100

4.	21CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3	40	60	100
5.	21CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3	40	60	100
6.	21CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in FULL STACK DEVELOPMENT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5206	Sem 5: Web Technology	PC	3	0	0	3	3	40	60	100
2.	21CS6207	Sem 6: Front End Development with REACT and TYPESCRIPT	PC	3	0	0	3	3	40	60	100
3.	21CS6208	Sem 6: Back End Development with NodeJS	PC	2	0	2	3	3	50	50	100
4.	21CS7207	Sem 7: Nosql Databases with Mongo DB	PC	3	0	0	3	3	40	60	100
5.	21CS7208	Sem 7: DevOps	PC	3	0	0	3	3	40	60	100
6.	21CS8203	Sem 8: Web Application Security	PC	3	0	0	3	3	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING IN TECHNICAL COLLABORATION WITH MICROSOFT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5207	Sem 5: Cloud Computing Fundamentals	PC	3	0	0	3	3	40	60	100
2.	21CS6209	Sem 6: Artificial Intelligence Fundamentals	PC	3	0	0	3	3	40	60	100
3.	21CS6210	Sem 6: Data Analysis and Visualization	PC	3	0	0	3	3	40	60	100
4.	21CS7209	Sem 7: Designing and Implementing a Microsoft Azure AI Solution	PC	3	0	0	3	3	40	60	100
5.	21CS7210	Sem 7: Administering Windows Server Hybrid Core Infrastructure	PC	3	0	0	3	3	40	60	100
6.	21CS8204	Sem 8: Project Management	PC	3	0	0	3	3	40	60	100

CREDIT DISTRIBUTION

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

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CREDIT DISTRIBUTION

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

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Programme	Course Code	Course Name	L	T	P	C
BE	21CS6181	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
I	**INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS** 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
II	**PLANNING** 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
III	**ORGANISING** 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
IV	**DIRECTING** 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
V	**CONTROLLING** 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.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS6201	ARTIFICIAL INTELLIGENCE	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
I	**INTRODUCTION TO ARTIFICIAL INTELLIGENC** 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
II	**SOLVING PROBLEMS BY SEARCHING** Problem - Solving Agents - Example Problems - Searching for Solutions - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions. **BEYOND CLASSICAL SEARCH:** Local Search Algorithms and Optimization Problems - Local Searching Continuous Spaces - Searching with Non-deterministic Actions - Searching with Partial Observations. **ADVERSARIAL SEARCH:** Stochastic Games.	13
III	**KNOWLEDGE AND REASONING** 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
IV	**PLANNING AND ACTING IN THE REAL WORLD** 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
V	**APPLICATIONS** 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:

T1: S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.

T2: I. Bratko, —Prolog: Programming for Artificial Intelligencel, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCE BOOKS:

R1: M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science)ll, Jones and Bartlett Publishers, Inc.; First Edition, 2008

R2: Nils J. Nilsson, —The Quest for Artificial Intelligencel, Cambridge University Press, 2009.

R3: William F. Clocksin and Christopher S. Mellish,l Programming in Prolog: Using the ISO Standardll, Fifth Edition, Springer, 2003.

R4: Gerhard Weiss, —Multi Agent Systemsl, Second Edition, MIT Press, 2013.

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

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Programme	Course Code	Name of the Course	L	T	P	C
BE	**21CS6251**	**COMPILER DESIGN**	**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
I	**INTRODUCTION TO COMPILERS** 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. *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'.*	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. *Illustrative programs: Implementation of Lexical Analyzer using JLex, flex or other lexical analyser generating tools*	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. *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 }*	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-*Illustrative programs: Implement type checking: Implement any one storage allocation strategies(Heap,Stack,Static).*	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.*Illustrative programs: Implementation of Simple Code Optimization Techniques (Constant Folding, Constant Propagation, Common Sub-Expression Elimination, Code Movement, Dead Code Elimination, Strength Reduction)*	3+6
	Total Instructional Hours	54

Course Outcome

CO1: Learn the design principles of a Compiler.
CO2: Learn about the Lexical analysis.

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: Randy 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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6252	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
	INTRODUCTION	
I	Introduction to Mobile Computing – Applications of Mobile Computing- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA. *Illustrative programs: Develop an application that uses GUI components, Font , Colours, Layout Managers and event listeners.*	(6+3)
	MOBILE TELECOMMUNICATION SYSTEM	
II	Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Localization and calling - Handover – Security –GPRS - Services & Architecture – Protocols - UMTS – Architecture – Handover – Security. *Illustrative programs: a) Write an application that draws basic graphical primitives on the screen b) Develop a native application that uses GPS location information*	(6+3)
	MOBILE NETWORK LAYER	
III	Mobile IP – DHCP – Mobile AdHoc Networks – Routing, DSDV, DSR, AODV , Vehicular Ad Hoc networks (VANET) –MANET Vs VANET. *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*	(6+3)
	MOBILE TRANSPORT LAYER	
IV	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. *Illustrative programs: a) Create an android application using Fragments b)Develop an Android Application that creates Alarm Clock.*	(6+3)
	MOBILE APPLICATION LAYER	
V	WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.Illustrative programs: Develop a Mobile application for simple needs (Mini *Project)*	(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 Communications‖, PHI, Second Edition, 2003.

T2: Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing‖, 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 Computing‖, Springer, 2003.

R3: William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems‖, Second Edition,TataMcGraw Hill Edition ,2006.

R4: C.K.Toh, —AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002.

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

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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS6306	DEVELOPMENT OF MACHINE LEARNING MODELS	3	0	0	3

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)I, The MIT Press 2004.

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS6253	PREDICTIVE MODELING	3	0	2	4

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 advice on when and how to use each model. Also learn how to combine two or more models to improve prediction

Unit	Description	Instructional Hours
I	INTRODUCTION TO PREDICTIVE MODELLING 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). *Illustrative program: Collect and understand the data*	9+2(p)
II	INTRODUCTION TO SPSS MODELER 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. *Illustrative program: Set the unit of analysis for the data* *Remove duplicate records* *Aggregate transactional data* *Create flag fields and aggregate the data* *Integrate data* *Appending Report* *Merge field*	9+4(p)
III	USING FUNCTIONS IN SPSS 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. *Illustrative program: Identify relationships in the data* *Examine the relationship between categorical fields* *Examine the relationship between a categorical and continuous field* *Predict customer churn in telecom dataset* *Build Model using CHAID* *Examine the CHAID Model* *Apply the model to new data*	9+3(p)
IV	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.*	9+3(p)

Using functions in IBM SPSS Modeler

Date and Time Functions
String Functions
Statistical Functions

Missing Value Function
Add fields to the data
Derive fields as formula
Derive fields as flag or nominal
Reclassify categorical fields
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

TEXT BOOKS:

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

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

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	0	0	1	0	0	2	2	1	0
CO5	3	1	2	1	0	0	0	0	0	0	2	3	1	0

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.Tech	21IT6003	**Project Based Learning (Common to CSE, IT, AIML)**	0	0	3	1.5

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. Workbookreport 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 computercontrolled 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 Expoat 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 Avaition 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.	Corportate 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 Managment 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	Rctails & 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

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

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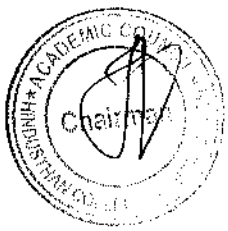

Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS6301	BUSINESS INTELLIGENCE – DATA WAREHOUSING AND ANALYTICS	3	0	0	3

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

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS6302	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
I	**INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS** 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
II	**EMBEDDED COMPUTING PLATFORM DESIGN** 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
III	**PROCESSES AND OPERATING SYSTEMS** 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
IV	**SYSTEM DESIGN TECHNIQUES AND NETWORKS** Design methodologies- Design flows – Requirement Analysis – Specifications- System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.	9
V	**CASE STUDY** 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.

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.

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

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Programme	Course Code	Name of the Course	L	P	T	C
BE	21CS6303	INTERNET OF THINGS	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 Rasperry 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 Madisetti, "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, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, 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 CunoPfister ,2011

R4: Adrian McEwen &Hakim Cassimally ,"Designing the Internet of Things"- (Nov 2013) .

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

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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS6304	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. *Case Study: Enterprise Integration- Exercises*	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. *Case Studies – Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics*	9
V	**NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION:** NoSQL Databases : Schema-less Modelsl: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases *Case Study: Google's Big Table and its security.*	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.

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.

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

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Programme	Course Code	Name of the Course	L	T	P	C
BE	21CS6305	SOFT COMPUTING	3	0	0	3

Course Objective

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.

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

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

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.

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.

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

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MINOR DEGREE IN CSE

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6601	Databases and SQL	3	0	0	3

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
I	**INTRODUCTION TO DATABASE SYSTEMS** 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
II	**RELATIONAL DATABASE** 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
III	**CONCEPTUAL DATA MODELING** 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
IV	**NORMALIZATION THEORY** 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
V	**TRANSACTION MANAGEMENT** 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.

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.

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6602	Principles of Internet Of Things	3	0	0	3

Course Objective

1. To infer the basics of Internet of Things (IoT) and its architecture.
2. To understand the architecture and networking in IoT
3. To study the various IoT communication protocols.
4. To gain insights about the fog and cloud computing in IoT framework
5. To study the real-life applications of IoT.

Unit	Description	Instructional Hours
I	**IoT Introduction and Fundamentals** Basics of networking (types of networks, layered models, addressing, TCP/IP transport layer), Introduction to the architecture of wireless sensor networks, Machine-to-Machine (M2M) communication and cyber physical systems. Introduction to IoT and its comparison with M2M, WSN and CPS. IoT networking components, Addressing strategies in IoT.	8
II	**IoT Architecture and Networking** Introduction to IoT Sensors and their characteristics, Sensing types and their considerations,Introduction to IoT Actuators, their types and characteristics, IoT processing topologies,their types and its importance, Data formatting, Processing topologies, IoT device design and selection considerations, Processing offloading, IoT connectivity technologies	10
III	**IoT Communication Technologies** Introduction to nodes, Constrained nodes and network, and the type of devices, Low power and lossy networks, Infrastructure protocols, Discovery protocols, Data protocols, Identification protocols, Device management protocols, Sematic protocols, IoT interoperability standards and frameworks.	9
IV	**Cloud and Fog Computing in IoT** Introduction to cloud computing, Virtualization, Cloud Models, SLA in cloud computing,Cloud implementation in Sensor Cloud, Introduction to fog computing and its architecture,Fog computing in IoT, Application of fog computing in IoT, Edge computing in IoT	9
V	**IoT Applications and Data Analytics** IoT applications in agriculture, vehicular networks and healthcare, IoT analytics, Uses of machine learning in IoT, Advantages and challenges of ML in IoT, ML algorithms for IoT applications, Performance metrices for evaluating ML algorithms	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Associate and classify the architecture of various communication systems
CO2: Elaborate the IoT infrastructure and data processing methodologies
CO3: Interpret the various networking protocols used in IoT
CO4: Acquire the concepts of fog and cloud computing in IoT
CO5: Illustrate the various real-life applications of IoT

TEXT BOOKS:

T1: Misra, S., Mukherjee, A. and Roy, A. Introduction to IoT. Cambridge University Press, 2021

T2: Serpanos, D. and Wolf, M. Internet-of-things (IoT) systems: architectures, algorithms, methodologies. Springer, 2017.

REFERENCE BOOKS:

R1: Xiao, P. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed. John Wiley and Sons, 2018

R2: Hersent, O., Boswarthick D., and Elloumi, O., The Internet of Things: Key Applications and Protocols. John Wiley and Sons, 2011.

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

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HONOURS WITH SPECIALIZATION

(BLOCK CHAIN TECHNOLOGY)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6205	Introduction to block chain	3	0	0	3

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
I	**BASICS** 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
II	**BLOCK CHAIN** 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
III	**DISTRIBUTED CONSENSUS** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	9
IV	**CRYPTOCURRENCY** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.	9
V	**CRYPTOCURRENCY REGULATION** 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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6206	Cryptocurrency	3	0	0	3

Course Objective

1. To understand the basics of Blockchain
2. To learn Different protocols and consensus algorithms in Blockchain
3. To learn the Blockchain implementation frameworks
4. To understand the Blockchain Applications
5. To experiment the Hyperledger Fabric, Ethereum networks

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BLOCKCHAIN** Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, TransactionsThe Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree	9
II	**BITCOIN AND CRYPTOCURRENCY** A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay	9
III	**BITCOIN CONSENSUS** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases	9
IV	**HYPERLEDGER FABRIC & ETHEREUM** Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.	9
V	**BLOCKCHAIN APPLICATIONS** Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study .	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand emerging abstract models for Blockchain Technology

CO2: Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.

CO3: It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application

CO5: Understand the applications of block chain technologies.

TEXT BOOKS:

T1: Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.

T2: Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014..

REFERENCE BOOKS:

R1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
R2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
R3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
R4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing

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

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HONOURS WITH SPECIALIZATION

(FULL STACK DEVELOPMENT)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6258	Back End Development with NodeJS	2	0	2	3

Course Objective

1. To Understand the basics of javascript and Node JS
2. To learn and architect the server side of the web application
3. To Develop Connection to database
4. To Architect RESTful APIs , Express.js and Testing.
5. To Implement a full-stack Single Page Application using React, NodeJS and MongoDB and deploy on Cloud.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO JAVASCRIPT AND NODEJS** Introduction to JavaScript - Introduction to Node JS - Asynchronous Programming in Node.js –Event loop in Node JS - Architecture of Node JS - Examples of Node JS Illustrative Program 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.	7+2
II	**SERVER SIDE PROGRAMMING WITH NODE JS** Introduction to Web Servers – Javascript in the Desktop with NodeJS – NPM – Serving files with the http module – Introduction to the Express framework – Server-side rendering with Templating Engines – Static Files - async/await - Fetching JSON from Express.js Illustrative Program 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 Node.js deep dive In this module students start building their first application and learn how to use closure to emulate private methods.	5+4
III	**ADVANCED NODE JS AND CONNECTION TO DATABASE** Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS - CRUD operations with Node.js and databases Illustrative Program 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+3

IV	**RESTful APIs , Express.js and Testing** Designing RESTful APIs - Building RESTful APIs with Express.js - Consuming APIs with Node.js Testing - Writing unit tests with frameworks like Mocha and Chai - Debugging techniques in Node.js- Code quality tools Illustrative Program 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. 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	5+4
V	**APP IMPLEMENTATION IN CLOUD** Cloud providers Overview – Virtual Private Cloud – Scaling (Horizontal and Vertical) – Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes	9
	Total Instructional Hours	45

Course Outcome	CO1:	Understand the basics of javascript and Node JS
	CO2:	Implement and architect the server side of the web application
	CO3:	Develop Connection to database
	CO4:	Architect RESTful APIs , Express.js and Testing.
	CO5:	Implement a full-stack Single Page Application using React, NodeJS and MongoDB and deploy on Cloud.

TEXT BOOKS:

T1."Node.js Design Patterns" by Mario Casciaro

T2.Learning Node.js: A Hands-On Guide to Building Web Applications in JavaScript" by Marc Wandschneider

T3. "Node.js Web Development" by David Herron

T4. "Professional Node.js: Building Javascript Based Scalable Software" by Pedro Teixeira

REFERENCE BOOKS:

1. David Flanagan, "Java Script: The Definitive Guide", O'Reilly Media, Inc, 7th Edition, 2020

2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019

3. Alex Banks, Eve Porcello, "Learning React", O'Reilly Media, Inc, 2nd Edition, 2020

4. Marc Wandschneider, "Learning Node", Addison-Wesley Professional, 2nd Edition, 2016

5. Joe Beda, Kelsey Hightower, Brendan Burns, "Kubernetes: Up and Running", O'Reilly Media, 1st edition, 2017

6. Paul Zikopoulos, Christopher Bienko, Chris Backer, Chris Konarski, Sai Vennam, "Cloud Without Compromise", O'Reilly Media, 1st edition, 2021.

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6207	FRONT END DEVELOPMENT WITH REACT AND TYPESCRIPT	3	0	0	3

Course Objective

1. To understand the fundamental concepts of React
2. To learn React Properties and Components.
3. To analyze the Redux and GraphQL.
4. To explore TypeScript functions.
5. To learn TypeScript and interaction with React.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO REACT** Introduction to React – Java script for React – React DOM – Components – Virtual DOM – Constructing Elements with Data –React Components – React. create Class –React. Component –Stateless Functional Components–DOM Rendering – Factories – React with JSX– Wep Pack – Web Pack Loaders	9
II	**REACT STATE AND COMPONENTS** React State Management – Building a Star Rating Component – The use State Hook – Refactoring for Advanced Reusability – State in Component Trees – Building Forms – Using Refs – Controlled Components – Creating Custom Hooks – Adding Colours to State – React Context– Enhancing Components with Hooks– Introducing use Effect – The Dependency Array – Deep Checking Dependencies – use Layout Effect – Rules to Follow with Hooks – Improving Code with use Reducer – use Reducer to Handle Complex State – Improving Component Performance	9
III	**REDUX AND GRAPHQL** Redux – State – Actions – Reducers – Colour Reducer – Sort Reducer – Store – Action Creators – Middleware –Explicitly passing the Store –Passing the Store via Context – Presentational Versus Container Components –GraphQL – GraphQL with React	9
IV	**INTRODUCTION TO TYPESCRIPT** Introduction – Basic Types – Functions – Declaring and Invoking Functions – Optional and Default Parameters– Rest Parameters – call, apply, and bind – Generator Functions – Iterators – Call Signatures –Contextual Typing – Overloaded Function Types – Polymorphism– Generic Type Inference – Generic Type Aliases – Bounded Polymorphism	9
V	**TYPESCRIPT CLASSES AND INTEROPERATING WITH JAVASCRIPT** TypeScript Classes – Inheritance – Interfaces –Advanced Types : Sub Type and Super Type–Type Widening -Refinement – Totality – Advanced Object Types– Advanced Function Types – Interoperating with JavaScript – Gradually Migrating from JavaScript to TypeScript –Type Lookup for JavaScript – Using Third-Party JavaScript Running TypeScript on the Server – Running TypeScript in the Browser – Publishing Your TypeScript Code to NPM	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Explore the fundamental concepts of React
	CO2:	Develop applications in React Framework.
	CO3:	Develop applications using Redux and GraphQL.
	CO4:	Design Programs using TypeScript.
	CO5:	Implement applications using Typescript and React.

Text Books:

1. Alex Banks and Eve Porcello, "Learning React – Modern Patterns for Developing React Apps" , O'Reilly, 2020,Second Edition

2. Boris Cherny, "Programming TypeScript Making Your JavaScript Applications Scale", O'Reilly,2019, First Edition

3. Nate Murray, "Fullstack React with TypeScript", 2019, Learn Publishing

Reference Books:

1. Frank Zammetti Pottstow , "Modern Full-Stack Development - Using TypeScript, React, Node.js, Webpack, and Docker", 2020 , Apress

2. David Choi , "Full-Stack React, TypeScript, and Node", Packt Publishing, 2020

3. Stoyan Stefanov, "React: Up & Running Building Web Applications", O'Reilly,Second Edition,2022

Extensive Reading:

- https://react.dev/
- https://legacy.reactjs.org/
- https://www.typescriptlang.org/

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

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HONOURS WITH SPECIALIZATION

(IOT)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6203	IOT Design	3	0	0	3

Course Objective

1.To learn how to design and implement IoT applications that manage big data, streaming data, and/or distributed data
2.To understand Smart Objects and IoT Architectures
3.To learn about various IOT-related protocols
4.To build simple IoT Systems using Arduino and Raspberry Pi.
5.To understand data analytics and cloud in the context of IoT
6.To develop IoT infrastructure for popular applications

Unit	Description	Instructional Hours
I	**Fundamentals of IoT** Evolution of Internet of Things, Enabling Technologies, IoT Architectures:oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and CoreIoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors,Actuators, Smart Objects and Connecting Smart Objects	9
II	**IoT Protocols** IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN, Zigbee protocol, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT	9
III	**Design and Development:** Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino–Board details, IDE programming, Raspberry Pi and Interfaces	9
IV	**Data Analytics and Supporting Services** Structured Vs Unstructured Data and Data in Motion Vs Datain Rest, Role of Machine Learning-No SQL Databases, Hadoop Ecosystem, Apache Kafka, ApacheSpark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web ApplicationFramework, Django, AWS for IoT, System Management with NETCONF-YANG, Kibana, Faulttolerant data processing on devices	9
V	**Case Studies/Industrial Applications** Cisco IoT system, IBM Watson IoT platform, Manufacturing,Converged Plantwide Ethernet Model (CPwE), Power Utility Industry, GridBlocks Reference Model,Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control	9
	Total Instructional Hours	45

Course Outcome	CO1:	Describe the term IoT in different contexts.

	CO2:	Analyze various protocols for IoT..
	CO3:	Design a PoC of an IoT system using Rasperry Pi/Arduino
	CO4:	Apply data analytics and use cloud offerings related to IoT.
	CO5:	Analyze applications of IoT in real time scenario

Text Book:

1. 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

2. Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015

Reference Book:

1. Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things – Key applications and Protocols, Wiley, 2012

2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, DavidBoyle, From Machine-to-Machine to the Internet of Things –Introduction to a New Age of Intelligence, Elsevier, 2014.

3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011.

4. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6204	Privacy and Security in IoT	3	0	0	3

Course Objective

1. To impart knowledge on the state-of-the-art methodologies and Security in Internet of Things (IoT).
2. To understand the Privacy Preservation and Trust Models in Internet of Things (IoT).
3. To study the Internet of Things (IoT) Security protocols and Security framework.

Unit	Description	Instructional Hours
I	**Security in IoT** IoT security: Vulnerabilities, Attacks and Countermeasures - Security Engineering for IoT development - IoT security lifecycle.	9
II	**Network Robustness and Malware Propagation Control in IoT** Network Robustness - Fusion Based Defense Scheme - Sequential Defense Scheme -Location Certificate Based Scheme - Sybil node detection scheme - Formal Modeling and Verification -Sybil Attack Detection in Vehicular Networks - Performance evaluation of various Malware Dynamics Models - Analysis of Attack Vectors on Smart Home Systems.	9
III	**Privacy Preservation in IoT** Privacy Preservation Data Dissemination: Network Model, Threat Model – Problem formulation and definition - Baseline data dissemination - Spatial Privacy Graph based data dissemination -Experiment Validation - Smart building concept-Privacy Threats in Smart Building - Privacy Preserving Approaches in Smart Building - Smart Meter Privacy Preserving Approaches.	9
IV	**Trust Models for IoT** Trust Model Concepts - Public Key Infrastructures Architecture Components - Public Key Certificate Formats - Design Considerations for Digital Certificates - Public Key Reference Infrastructure for the IoT - Authentication in IoT - Computational Security for IoT.	9
V	**Security Protocols for IoT Access Networks** Time Based Secure Key Generation -Security Access Algorithm: Unidirectional, Bidirectional Transmission - Cognitive Security - IoT Security Framework - Secure IoT Layers – Secure Communication Links in IoT - Secure Resource Management, Secure IoT Databases	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Identify different Internet of Things technologies and their applications.
	CO2:	Assess the need for Privacy and security model for the Internet of Things
	CO3:	Explore various Trust Model for IoT and customize real time data for IoT applications
	CO4:	Design security framework and solve IoT security issues.
	CO5:	Analyze Security of IoT in real time scenario

Text Book:

Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.

Reference Book:

1 Russell, Brian and Drew Van Duren. Practical Internet of Things Security, 2016,1st edition, PACKT Publishing Ltd, UK

2 Kim, S., Deka, G. C., & Zhang, P. (2019). Role of blockchain technology in IoT applications. Academic Press.

3 Whitehouse O Security of things: An Implementers' guide to cyber-security for internet of things devices and beyond, 2014, 1st edition, NCC Group, UK.

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

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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 - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the even semester

Academic year 2023-2024

(Academic Council Meeting Held on 26.12.2023)

CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (UG)

REGULATION-2019

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

SEMESTER I – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1101	Calculus	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	19EC1154	Basics of Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
MANDATORY										
8	19MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	19HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
10	19HE1072	Career Guidance – Level I	EEC	2	0	0	0	100	0	100
Total Credits				**16**	**2**	**10**	**20**	**550**	**350**	**900**

SEMESTER II – 22 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	BusinessEnglish for Engineers	HS	2	1	0	3	25	75	100
2	19MA2104	Differential Equations And Linear Algebra	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	19PH2151	Material Science	BS	2	0	2	3	50	50	100
4	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	19CS2152	Essentials of C and C++ Programming	ES	2	0	2	3	50	50	100
6	19ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
9	19HE2072	Career Guidance – Level II	EEC	2	0	0	0	100	0	100
Total Credits				**14**	**2**	**16**	**22**	**500**	**400**	**900**

SEMESTER III – 20 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3104	Discrete Mathematics and Graph Theory	BS	3	1	0	4	25	75	100
2	19CS3201	Data Structures	PC	3	0	0	3	25	75	100
3	19CS3202	Database Management Systems	PC	3	0	0	3	25	75	100
4	19CS3203	Computer Architecture	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19CS3251	Digital Principles and System Design / ICC-3	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19CS3001R	Data Structures Laboratory	PC	0	0	3	1.5	50	50	100
7	19CS3002R	Database Management Systems Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY										
8	19MC3191	Indian Constitution	MC	2	0	0	0	0	0	0
9	19HE3072	Career Guidance Level – III	EEC	2	0	0	0	100	0	100
10	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total Credits				**20**	**1**	**8**	**20**	**450**	**450**	**900**

SEMESTER IV – 21 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CS4201	Java Programming / ICC4	PC	3	0	0	3	25	75	100
2	19CS4202	Software Engineering	PC	3	1	0	4	25	75	100
3	19CS4203	Operating Systems	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4	19MA4151	Probability, Statistics and Queuing Theory	BS	3	0	2	4	50	50	100
5	19CS4251R	Design and Analysis of Algorithms	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19CS4001R	Java Programming Laboratory / ICC5	PC	0	0	3	1.5	50	50	100
7	19CS4002R	Operating Systems Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY										
8	19MC4191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	0	0	0
9	19HE4072	Career Guidance Level – IV	EEC	2	0	0	0	100	0	100
10	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total Credits				**19**	**1**	**10**	**21**	**375**	**425**	**800**

SEMESTER V – 24 Credits

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	Object Oriented Analysis and Design / ICC6	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
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 – 24 Credits

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
3	19**6401	Open Elective I	OE	3	0	0	3	25	75	100
4	19CS63**	Professional Elective II	PE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19CS6251R	Compiler Design	PC	2	0	3	3.5	50	50	100
6	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
8	19HE6071	Soft Skill-II	EEC	1	0	0	1	100	0	100
9	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
10	19CS6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits					**1**	**6**	**24**	**425**	**575**	**1000**

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	19CS73**	Professional Elective III / ICC9	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**

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

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	19IT7307	Web Development - II	PE	3	0	0	3	25	75	100

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	19CS8311	Introduction to Internet of Things / NPTEL	PE	3	0	0	3	25	75	100
6	19IT8314	Web Development - III	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

S. 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
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

➢ **Following are the Industry Core Courses (ICC) which will be offered as choice based course in the following semesters:**

ICC. No.	Sem. No	Course Code	Name of the Course	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	19CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	19CS2153	Java Fundamentals	2	0	2	3	50	50	100
ICC3	III	19CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	19CS4204	Data Visualization	3	0	0	3	25	75	100
ICC5	IV	19CS4003	Data Visualization Laboratory	0	0	3	1.5	50	50	100
ICC6	V	19CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	19CS6253	Predictive Modeling	3	0	2	4	25	75	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

Life Skill Courses									
S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	21LSZ401	General Studies for Competitive Examinations	3	0	0	3	25	75	100
2	21LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	25	75	100
3	21LSZ403	Indian Ethos and Human Values	3	0	0	3	25	75	100
4	21LSZ404	Indian Constitution and Political System	3	0	0	3	25	75	100
5	21LSZ405	Yoga for Human Excellence	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

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

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PROFESSIONAL ELECTIVE -5

Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8306	INFORMATION RETRIEVAL TECHNIQUES	3	0	0	3

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
B.E	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
I	**INTERACTIVE SOFTWARE AND INTERACTION DEVICE** Human–Computer Interface – Characteristics of Graphics Interface – Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.	9
II	**HUMAN COMPUTER INTERACTION** 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
III	**WINDOWS** 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
IV	**MULTIMEDIA** Text for Web Pages – Effective Feedback– Guidance & Assistance– Internationalization– Accessibility– Icons– Image– Multimedia – Coloring- Case Study: Addressing usability in E- Commerce sites.	9
V	**DESIGN PROCESS AND EVALUATION** 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: Wilbent. 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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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8308	VISUALIZATION TECHNIQUES	3	0	0	3

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" Margon 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, 201

R4: ChaomeiChan,"InformationVisualization:Beyondthehorizon,2ndedition,SpringerVerlag,2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8309	DEEP LEARNING	3	0	0	3

Course Objective

1. To learn the foundation of deep networks and optimization algorithms of deep learning
2. To study about the various models for Deep Learning
3. To know the essence of deep learning merging with python
4. To be familiar with Tensor flow for learning Deep networking
5. To study the various applications of Deep Learning Techniques

Unit	Description	Instructional Hours
I	**BASICS** 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
II	**FEEDFORWARD NETWORKS** Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders. **DEEP NEURAL NETWORKS:** Difficulty of training deep neural networks, Greedy layerwise training.	9
III	**BETTER TRAINING OF NEURAL NETWORKS** Newer optimization methods for neural networks (Adagrad, adadelta, 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
IV	**GENERATIVE MODELS** 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
V	**APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION** 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 Zaccone, Md. RezaulKarim. " Deep Learning with TensorFlow:Explore neural networks and build intelligent systems with python", Packt Pulishing,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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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS8310	BLOCK CHAIN TECHNOLOGY	3	0	0	3

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
I	**BASICS** 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
II	**BLOCK CHAIN** 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
III	**DISTRIBUTED CONSENSUS** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	9
IV	**CRYPTOCURRENCY** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.	9
V	**CRYPTOCURRENCY REGULATION** 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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PROFESSIONAL ELECTIVE -4

Programme	Course Code	Name of the Course	L	T	P	C
BE	19CS8301	DIGITAL IMAGE PROCESSING	3	0	0	3

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	Course Code	Name of the Course	L	T	P	C
BE	19CS8302	HIGH SPEED NETWORKS	3	0	0	3

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	Course Code	Name of the Course	L	T	P	C
BE	19CS8303	INFORMATION SECURITY	3	0	0	3

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
I	**INTRODUCTION** 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
II	**SECURITY INVESTIGATION** 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
III	**SECURITY ANALYSIS** Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem.	9
IV	**LOGICAL DESIGN** 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
V	**PHYSICAL DESIGN** 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 CRCPress 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	Course Code	Name of the Course	L	T	P	C
BE	19CS8304	HUMAN COMPUTER INTERACTION	3	0	0	3

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	Course Code	Name of the Course / NPTEL	L	P	T	C
B.E.	19CS8311	INTRODUCTION TO INTERNET OF THINGS	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 Rasperry 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 Madisetti, "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, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, 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 CunoPfister ,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/B.Tech (Minor Degree)	21BA6602	Team Building & Leadership Management for Business	3	0	0	3

Course Objective

1. To provide a framework for the students to understand the importance of Leadership and team effectiveness in organizations.
2. To develop an understanding of the interpersonal processes and group dynamics.
3. To provide a theoretical understanding of leadership practices in organizations.
4. To provide an understanding of factors influencing teamwork and team leadership.
5. To evaluate the role of leadership in the development of an institution.

Unit	Description	Instructional Hours
I	**Introduction to Leadership & Team Management;** Leadership Myths; Interactional Framework for analysing leadership; Leadership Development Leader Development- The Action-Observation-Reflection Model ,LMX Theory and Normative Decision Model; Situational Leadership Model; Contingency Model and Path Goal Theory; Emotional Approach Charismatic and Transformational Leadership; Leadership for Tomorrow	9
II	Leadership Attributes; Personality Traits and Leadership; Personality Types and Leadership; Intelligence and Leadership; Emotional Intelligence and Leadership, Power and Leadership; The art of influence in leadership; Leadership and "Doing the Right Things; Character-Based Approach to Leadership; Role of Ethics and Values in Organisational Leadership	9
III	Leadership Behaviour; Leadership Pipeline; Assessing Leadership Behaviours: Multi-rater Feedback Instruments; The Dark Side of; Leadership- Destructive Leadership; Managerial Incompetence and Derailment Conflict Management Negotiation and Leadership; Leadership under a crisis situation; The Situation and the Environment; Culture and Leadership; Global Leadership	9
IV	**Team Management:** Meaning, Types of team, Understand the stages of Team Development skills required for team development, Delegation and Empowerment; Leading teams: Enhancing teamwork within a group; The leader's role in team-based organizations; Leader actions that foster Teamwork Effectiveness; Offsite training and team development	9
V	**Understanding Team processes and Team coaching;** Team decision making and conflict management; Virtual teams; Managing Multicultural teams; Building great teams; Development Planning: GAP Analysis; Coaching and Mentoring; Building Effective Relationship with subordinates and peers; Fostering Followers satisfaction; The Art of Communication; Setting Goals and Providing Constructive Feedback; Enhancing Creativity problem solving skills Building High-Performance Teams	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To understand the concept and the importance of Leadership and team
CO2: To understanding of the interpersonal processes and group dynamics
CO3: To learn the leadership practices in organizations
CO4: To gain knowledge about factors influencing teamwork and team leadership
CO5: To gain knowledge on leadership in the development of an institution

Books & Reference

1. Leadership: Enhancing the lessons of experience by Hughes, R.L., Ginnett, R.C., & Curphy, G.J. (2019), 9th Edition, McGraw Hill Education, Chennai, India.
2. Team Building: The Ultimate Guide to Build & Manage Winning Teams (Team Building Activities, Business Management, Leadership Books, Managing) Kindle Edition By Sylvia Reyes (Author)
3. The five dysfunctions of a team- Patrick Lencioni 228 pages, Paperback First published April 11, 2002
4. Icon Team. (2014). Constructive communication in international teams an experience based guide. Münster, DE: Waxmann

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Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech (Minor Degree)	21BA6601	Introduction to New Business Venture	3	0	0	3

Course Objective

1. To create awareness toward development of business idea
2. To develop value proposing and market segmentation
3. To demonstrate the benefits of marketing mix
4. To explore operations management in business
5. To demonstrate financial forecast for small business units

Unit	Description	Instructional Hours
I	**Business Idea** New venture typologies-Creating and identifying opportunities-Techniques for exploring change-Techniques for exploring product inadequacies. Defining the market / industry-concentration and geographic spread-Estimating market size-SWOT analysis-selecting appropriate option	9
II	**Value proposition and market segmentation** New venture creation framework-Generic business models and competitive advantage-Niche business model-Internet business model-Characteristics of good business model-Low cost market testing. Identifying target customers-value proposition-Differentiation through branding-Sustainable entrepreneurship-Mission statement	9
III	**Developing marketing mix** Product features and benefits-Channels of distribution-Cost, price and volume; pricing decisions-Sales force planning and allocation. Communicating the value proposition-Communications media-Social networks-Guerilla marketing-Publicity, PR and advertising-CRM.	
IV	**Managing operations** Marketing activities-Retail activities-Internet business activities-Internet business activities. Managing and leading people-Attracting the right people-Using professional advisors-Team building-Organizational structure, design and control-Leadership and management	9
V	**Preparing and using financial forecasts** Forecast sales turnover, income statement and costs-Forecast breakeven point-SMART Performance metrics-Valuing the business. Business Plan-Difference between business model and business plan-Purpose of a business plan-Structure and components of a business plan-Using the business plan to seek finance-Harvesting the business-	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Awareness on business idea generation
CO2: Develop value proposition and market segmentation for business
CO3: Marketing mix for various business ventures
CO4: Able to manage business operations
CO5: Able to make financial forecast for new business

Text and References

1. Paul Burns, New Venture Creation: A Framework for Entrepreneurial Start-ups, MacMillan, 2023
2. A Sahay, V Sharma, Entrepreneurship and new Venture Creation, Excel, 2023
3. Inge Hill, Start-Up: A Practice Based Guide For New Venture Creation, MacMillan, 2023
4. Arya Kumar, Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Pearson, 2023
5. Kathleen R. Allen, Launching New Ventures: An Entrepreneurial Approach, Cengage, 2023

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6604	BANKING, FINANCIAL SERVICES AND INSURANCE	3	0	0	3

Course Objective

1. To Understand the Banking system in India
2. To Grasp how banks raise their sources and how they deploy it
3. To Understand the development in banking technology
4. To Understand the financial services in India
5. To Understand the insurance Industry in India

Unit	Description	Instructional Hours
	INTRODUCTION TO INDIAN BANKING SYSTEM	
I	Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.	9
	MANAGING BANK FUNDS/ PRODUCTS	
II	Liquid Assets - Investment in securities - Advances - Loans.Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes.Designing deposit schemes– Asset and Liability Management –NPA's – Current issues on NPA's – M&A's of banks into securities market.	9
	DEVELOPMENT IN BANKING TECHNOLOGY	
III	Payment system in India – paper based – e payment –electronic banking –plastic money – e-money–forecasting of cash demand at ATM's –The Information Technology Act, 2000 in India – RBI's Financial Sector Technology vision document – security threats in e-banking & RBI's Initiative.	9
	FINANCIAL SERVICES	
IV	Introduction – Need for Financial Services – Financial Services Market in India – NBFC — Leasing and Hire Purchase — mutual funds. Venture Capital Financing –Bill discounting – factoring –Merchant Banking	9
	INSURANCE	
V	Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 – IRDA –Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival –settlement of claim	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the Banking system in India

CO2: Grasp how banks raise their sources and how they deploy it

CO3: Understand the development in banking technology

CO4: Understand the financial services in India

CO5: Understand the insurance Industry in India

TEXT BOOKS:

T1: 1. Padmalatha Suresh and Justin Paul, "Management of Banking and Financial Services, Pearson, Delhi, 2017.

T2: Meera Sharma, "Management of Financial Institutions – with emphasis on Bank and Risk Management", PHI Learning Pvt. Ltd., New Delhi 2010

REFERENCE BOOKS:

R1: Peter S. Rose and Sylvia C. and Hudgins, "Bank Management and Financial Services", Tata McGraw Hill, New Delhi, 2017

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS6603	FUNDAMENTALS OF INVESTMENT	3	0	0	3

Course Objective

1. Describe the investment environment in which investment decisions are taken.
2. Explain how to Value bonds and equities
3. Explain the various approaches to value securities
4. Describe how to create efficient portfolios through diversification
5. Discuss the mechanism of investor protection in India.

Unit	Description	Instructional Hours
	THE INVESTMENT ENVIRONMENT	
I	The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.	9
	FIXED INCOME SECURITIES	
II	Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk And credit rating.	9
	APPROACHES TO EQUITY ANALYSIS	
III	Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.	9
	PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES	
IV	Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India	9
	INVESTOR PROTECTION	
V	Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Associate and classify the the investment environment in which investment decisions are taken.

CO2: Elaborate the how to Value bonds and equities

CO3: Interpret the the various approaches to value securities

CO4: Acquire how to create efficient portfolios through diversification

CO5: Illustrate how to create efficient portfolios through diversification

TEXT BOOKS:

T1: Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14TH Edition, 2019

T2: Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill education, 5th, Edition, 2017.

REFERENCE BOOKS:

R1: Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.

R2: ZviBodie, Alex Kane, Alan J Marcus, Pitabus Mohanty, Investments, McGraw Hill Education(India), 11 Edition(SIE), 2019

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21CE6604	SUSTAINABLE BIOMATERIALS	3	0	0	3

Course Objective	1. To Impart knowledge of biomaterials and their properties 2. To learn about Fundamentals aspects of Biopolymers and their applications 3. To learn about bioceramics and biopolymers 4. To introduce the students about metals as biomaterials and their usage as implants 5. To make the students understand the significance of bionanomaterials and its applications.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BIOMATERIALS** Introduction: Definition of biomaterials, requirements & classification of biomaterials - Types of Biomaterials - Degradable and resorbable biomaterials - engineered natural materials – Biocompatibility – Hydrogels - pyrolitic carbon for long term medical implants-textured and porous materials-Bonding types - crystal structure-imperfection in crystalline structure-surface properties and adhesion of materials – strength of biological tissues - performance of implants-tissue response to implants - Impact and Future of Biomaterials	9
II	**BIO POLYMERS** Molecular structure of polymers - Molecular weight - Types of polymerization techniques – Types of polymerization reactions - Physical states of polymers - Common polymeric biomaterials - Polyethylene - Polymethylmethacrylate (PMMA) - Polylactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers – Polyurethan- reactions polymers for medical purposes - Collagens-Elastin - Cellulose and derivatives-Synthetic polymeric membranes and their biological applications	9
III	**BIO CERAMICS AND BIOCOMPOSITES** General properties - Bio ceramics -Silicate glass - Alumina (Al2O3) - Zirconia (ZrO2) – Carbon - Calcium phosphates (CaP) - Resorbable Ceramics - surface reactive ceramics - Biomedical Composites- Polymer Matrix Compsite (PMC) - Ceramic Matrix Composite (CMC) - Metal Matrix Composite (MMC) – glass ceramics - Orthopedic implants - Tissue engineering scaffolds	9
IV	**METALS AS BIOMATERIALS** Biomedical metals - types and properties - stainless steel - Cobalt chromium alloys - Titanium alloys – Tantalum - Nickel titanium alloy (Nitinol) – magnesium based biodegradable alloys - surface properties of metal implants for osteointegration - medical application - corrosion of metallic implants – biological tolerance of implant metals	9
V	**NANOBIOMATERIALS** Meatllic nano biomaterials – Nanopolymers – Nanoceramics - Nanocomposites – Carbon based nanobiomaterials - transport of nanoparticles - release rate - positive and negative effect of nanosize – nanofibres - Nano and micro features and their importance in implant performance - Nanosurface and coats - Applications nanoantibiotics – Nanomedicines - Biochips – Biomimetics - BioNEMs - Biosensor-Bioimaging / Molecular Imaging - challenges and future perspective.	9
	Total Instructional Hours	45

Course Outcome	CO1 Students will gain familiarity with Biomaterials and understand their importance. CO2 Students will get an overview of different biopolymers and their properties CO3 Students gain knowledge on the important Bioceramics and Biocomposite materials CO4 Students gain knowledge on metals as biomaterials CO5 Students gain knowledge on the importance of nanobiomaterials in engineering applications.

TEXT BOOKS:

T1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani "Introduction to Biomaterials Basic Theory with Engineering Applications" Cambridge University Press, 2014.
T2. Donglu shi "Introduction to Biomaterials" Tsinghua University press, 2006.
T3. Joon Park, R.S.Lakes "Biomaterials An Introduction" third edition, Springer 2007.
T4. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh "Characterization of Biomaterials" Wood head publishing, 2013.

REFERENCE BOOKS:

R1.VasifHasirci, NesrinHasirci "Fundamentals of Biomaterials" Springer, 2018
R2. Leopoido Javier Rios Gonzalez. "Handbook of Research on Bioenergy and Biomaterials: Consolidated and green process" Apple academic press, 2021.
R3. Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad "Functional Bionanomaterials" springer, 2020.
R4. Sujata.V.Bhat Biomaterials; Narosa Publishing house, 2002.

Chairman - BoS
CSE - RMKCET

Chairman

Dean (Academics)
RMKCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21CE6603	SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT	3	0	0	3

Course Objective

1. To introduce the concepts of agroecology, agroecosystem and sustainable agriculture.
2. To educate about the issues related to soil health, nutrient and pest management.
3. To outline the significance of sustainable water management and irrigation.
4. To explore the concepts and plans for energy and waste management.
5. To learn about the methods and approaches for evaluating sustainability in agroecosystems.

Unit	Description	Instructional Hours
I	**AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS** Ecosystem definition - Biotic *Vs.* abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems	9
II	**SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT** Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control	9
III	**WATER MANAGEMENT** Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use	9
IV	**ENERGY AND WASTE MANAGEMENT** Types and sources of agricultural wastes - Composition of agricultural wastes – Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture	9
V	**EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS** Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies	9
	Total Instructional Hours	45

Course Outcome

On completion of the course, the student is expected to be able to:
CO1 Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture
CO2 Discuss the sustainable ways in managing soil health, nutrients, pests and diseases
CO3 Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources
CO4 Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas
CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

TEXT BOOKS:

T1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
T2. Natural bioactive products in sustainable agriculture, Singh, J. & Yadav, A.N., Springer, 2020
T3. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016

REFERENCE BOOKS:

R1. Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. & Fereres, E., Springer, 2016
R2. Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press, 2021
R3. Sustainable Energy Solutions in Agriculture, Bundschuh, J. & Chen, G., CRC Press, 2014

Chairman - BoS
CSE - KIOT

Chairman

Dean (Academic)
KIOT

Programme	Course code	Name of the course	L	T	P	C
B.E.	22HE4101	IPR AND START-UPS	2	0	0	2

Course Objective

The student should be able

1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right,
3. To learn about the trademarks in our country and foreign countries of their invention.
4. To know the designs and information Technology Act of IPR
5. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO IPR** Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights Introduction to Trade-Related of Intellectual Property Rights (TRIPS) and World Trade Organization (WTO). - Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge.	6
II	**PATENT RIGHTS AND COPY RIGHTS** Origin, Meaning of Patent, Types, Procedure to follow the methods of IP agents, Inventions, which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties. COPY RIGHT- Origin, Definition &Types of Copy Right, Patent Ethics, Registration procedure, Assignment & licence, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software.	9
III	**TRADE MARKS** Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing off, Penalties. Domain Names on cyber space.	6
IV	**DESIGN** Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000.	6
V	**BASIC TENENTS OF INFORMATION TECHNOLOGY ACT-2000** IT Act – Introduction, Latest Amendments, E-Commerce and legal provisions, E-Governance and legal provisions, Digital signature and Electronic Signature, Cybercrimes.	3
	Total Instructional Hours	30

Course Outcome

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

CO1: To understand IPR and aware the invention rights.

CO2:The students once they complete their academic projects, they get awareness of acquiring the patent

CO3: They also learn to have copyright for their innovative works.

CO4: To understand the designs and information Technology Act of IPR

CO5: They also get the knowledge of plagiarism in their innovations which can be questioned legally.

TEXT BOOK:

T1. Intellectual Property Rights (IPR) by M.K Bhandari 2021

T2. Law relating to Intellectual Property Rights, by V.K Ahuja 2017

T3. Intellectual Property Rights (IPR) for Start-ups by Vinay Vaish 2016

T4. Intellectual Property - Patents, Copyright, Trade Marks and Allied Rights (South Asian Edition) by W Cornish and D Llewelyn and T Pain 8th South Asian Edition 2016

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CSE - HiCET

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

Course Objective

The student should be able

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
3. To disseminate knowledge on copyrights and its related rights and registration aspects.
4. To disseminate knowledge on trademarks and registration aspects.
5. To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO INTELLECTUAL PROPERTY** Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	3
II	**PATENTS** Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non - Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	3
III	**COPYRIGHTS** Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	3
IV	**TRADEMARKS** Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks -Registration of Trademarks.	3
V	**DESIGN AND GEOGRAPHICAL INDICATION** Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration.	3
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.

CO2: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.

CO3: Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.

CO4: Identify different types of trademarks and procedure for registration

CO5: Recognize the concept of design, geographical indication and procedure for registration.

TEXT BOOK:

T1 Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
T2 Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCES:

R1 Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
R2 Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

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Chairman - BoS
MECH - HiCET

Dean – Academics
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HiCET

HICET – Department of Corporate Relations

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE4072	Soft Skills and Aptitude III	0	0	0	1

Course Objectives:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level
4. Display good writing skills while dealing with essays

Unit	Description	Instructional Hours
I	**Logical Reasoning** Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency - Syllogism	10
II	**Quantitative Aptitude** Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages - Time, Speed and Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, Problems based on races - Profit and loss, Partnerships and averages: Basic terminologies in profit and loss - Partnership - Averages - Weighted average Permutation, Combination: Fundamental Counting Principle, Permutation and Combination, Computation of Permutation, Circular Permutations, Computation of Combination - Probability	12
III	**Verbal Ability** Sentence Correction: Subject-Verb Agreement, Modifiers, Parallelism, Pronoun-Antecedent Agreement, Verb Time Sequences, Comparisons, - Sentence Completion and Para-jumbles- Critical Reasoning: Argument – Identifying the Different Parts (Premise, assumption, conclusion), Strengthening statement, Weakening statement, Mimic the pattern	6
IV	**Recruitment Essentials** Cracking interviews - demonstration through a few mocks - Sample mock interviews to demonstrate how to crack the: HR interview, MR interview, Technical interview - Cracking other kinds of interviews: Skype/ Telephonic interviews, Panel interviews, Stress interviews - Resume building – workshop: A workshop to make students write an accurate resume- Essay Writing	2
	Total Instructional Hours	30

Course Outcome:

CO1:	Students will avoid the various fallacies that can arise through the misuse of logic.
CO2:	Students would opt for alternate methods to solve the problems rather than conventional methods.
CO3:	Students will heighten their awareness of correct usage of English grammar in writing and speaking
CO4:	Students will be concise and clear, using professional language for placements.

REFERENCE BOOKS:

R1:	A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali
R2:	How to prepare for data interpretation for CAT by Arun Sharma.
R3:	How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.
R4:	Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand
R5:	Word Power Made Easy by Norman Lewis
R:6	Six weeks to words of power by Wilfred Funk

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CSE - HICET

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HICET – Department of Corporate Relations

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE2072	Soft Skills and Aptitude - II	0	0	0	1

Course Objectives:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level

Unit	Description	Instructional Hours
I	**Logical Reasoning** Word group categorization questions - Cryptarithmetic - Data arrangements - Blood relations	8
II	**Quantitative Aptitude** Ratio and Proportion: Ratio, Proportion, Variation, Simple equations, Problems on Ages, Mixtures and alligations - Percentages, Simple and Compound Interest: Percentages as Fractions and Decimals, Percentage Increase / Decrease, Simple Interest, Compound Interest, Relation Between Simple and Compound Interest - Number System	12
III	**Verbal Ability** Essential grammar for placements: Prepositions, Adjectives and Adverbs, Tenses, Forms and Speech and Voice, Idioms and Phrasal Verbs, Collocations, Gerund and Infinitives - Reading Comprehension for placements: Types of questions, Comprehension strategies - Articles, Prepositions and Interrogatives: Definite and Indefinite Articles, Omission of Articles, Prepositions, Compound Prepositions and Prepositional Phrases, Interrogatives - Vocabulary for placements: Exposure to solving questions of Synonyms, Antonyms, Analogy, Confusing words and Spelling correctness	10
	Total Instructional Hours	30

Course Outcome:

CO1:	Students will analyze and critique logical reasoning, including situations for which the student will recognize underlying assumptions and make reasonable assumptions.
CO2:	Students will be able to make decisions with mathematical, statistical, and quantitative information.
CO3:	Students would have obtained a multitude of opportunities resulting in the refinement of his/her language skills and the ability to use the skills for effective communication.

REFERENCE BOOKS:

R1:	How to Prepare for Quantitative Aptitude for the CAT- Arun Sharma
R2:	How to Prepare for Logical Reasoning for CAT
R3:	Objective General English – S.P.Bakshi

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SEMESTER - II
SYLLABUS

SEMESTER II

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E/B.TECH/ II	22MA2103	DIFFERENTIALEQUATIONSAND LINEAR ALGEBRA (AIML,CSE,IT)	3	1	0	4

Course Objective

The learner should be able to

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
I	**ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER** Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation.	12
II	**LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER** Second order linear differential equations with constant with RHS of the form e^{ax},x^n , sinax, cosax- – Cauchy's linear equations– Method of variation of parameters.	12
III	**PARTIAL DIFFERENTIAL EQUATIONS** 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
IV	**VECTOR SPACES** 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
V	**INNER PRODUCT SPACES** 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

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

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 BOOKS:

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,2022.

REFERENCE BOOKS:

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/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.Tech II	22PH2101	**BASICS OF MATERIAL SCIENCE (Common to all branches except MCT)**	2	0	0	2

Course Objective

The student should be able to

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 Hystersis. Applications of SMA. Nanomaterials preparation (bottom up and top down approaches) – various techniques - pulsed laser deposition - Chemical vapor deposition	6
	Total Instructional Hours	**30**

Course Outcome

After completion of the course the learner will be able to

CO1: Understand the Crystal systems and crystal structures in the field of Engineering
CO2: Illustrate the fundamental of electrical properties of materials
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 BOOKS:

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 Delhi 2022

REFERENCE BOOKS:

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/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ II	22HE2151	EFFECTIVE TECHNICAL COMMUNICATION (Common to all Branches)	2	0	2	3

Course Objective

The learner 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

At the end of the course, learners will be able

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 BOOKS:

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

REFERENCE BOOKS :

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.

Chairman, Board of Studies

Dean–Academics

BE/B.Tech/ II	22PH2151	PHYSICS FOR CIRCUIT ENGINEERING PROGRAMME (AIML,CSE,ECE,EEE,EIE,IT & BME)	2	0	2	3

Course Objective

The student should be able to

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 Theory Hours
I	**LASER AND FIBER OPTICS** 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
II	**PROPERTIES OF MATTER** 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
III	WAVE OPTICS 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
IV	**QUANTUM PHYSICS** 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
V	**ULTRASONICS** Production – Piezoelectric generator – Properties of Ultrasonic waves. Determination of velocity using acoustic grating – Cavitation. Industrial applications – Drilling and welding – Non destructive 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

After completion of the course the learner will be able to

CO1: Understand the advanced technology of LASER and optical communication in the field of engineering

CO2: Illustrate the fundamental properties of matter

CO3: Discuss the Oscillatory motions of particles

CO4: Understand the dual nature of matter and the Necessity of quantum mechanics.

CO5: Develop the Ultrasonics technology and its applications in NDT.

Chairman, Board of Studies

Chairman - BoS
CSE - HiCET

Dean–Academics

TEXT BOOKS:

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

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

REFERENCE BOOKS:

R1 - M.N Avadhanulu and PG Kshirsagar"A Text Book of Engineering physics"S.Chand and Company ltd., NewDelhi 2016

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

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech/ II	22IT2251	PYTHON PROGRAMMING AND PRACTICES (IT, CSE)	2	0	2	3

Course Objective

The student should be able

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
I	**ALGORITHMIC PROBLEM SOLVING** 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)
II	**DATA, STATEMENTS, CONTROL FLOW** 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)
III	**FUNCTIONS, STRINGS** 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)
IV	**LISTS, TUPLES, DICTIONARIES** 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)
V	**FILES, MODULES, PACKAGES** 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

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	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.
Course Outcome	At the end of the course, the learner will be able to CO1: Develop algorithmic solutions to simple computational problems CO2: Read, write, execute by hand simple Python programs 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 BOOKS:

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

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

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.Tech/B.E/II	22IT2253	DYNAMIC WEB DESIGN (IT, CSE & AIML)	2	0	2	2

Course Objective

The student should be able

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
I	**INTRODUCTION TO JAVASCRIPT** Introduction-History of JavaScript -Simple Program: Displaying a dynamic Line of Text in a Web Page-Modifying Our First Program Obtaining –DataTip- Identifiers-Operators. *Conversion of Celsius to Fahrenheit using JavaScript. Java Script to perform Arithmetic Operations-Calculation of diameter, circumference and area of the circle.*	7+2
II	**DIALOG BOX AND FUNCTIONS** User Input with prompt Dialogs (alert, prompt, confirm) -Arithmetic operations using prompt(Detail)-Display Date and Time with Greeting -Functions-Function Expression-Arrow Function. *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.*	7+2
III	**CONTROL STATEMENTS** 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. *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.*	7+2
IV	**ARRAYS AND OBJECT** Arrays-Declaring and Allocation Arrays-Array Methods-Built in Object-Math –String-Date – Boolean – documents – window-using cookies. *Random Image Generator Using Arrays - Display current Date and Time in a Web page.*	7+2
V	**EVENT HANDLING AND REGULAR EXPRESSION** 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. *Form validation-Design Job Skills web page-what happens for a failing applicant and a successful applicant.*	7+2
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

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 BOOKS:

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.

REFERENCE BOOKS:

R1: Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
R2: John Dean "WEB PROGRAMMING with HTML5, CSS, and JavaScript", Bartlett Learning, LLC 2019.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E/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, planning 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:

- Fabricate wooden components and pipe connections including plumbing works.
- Fabricate simple weld joints.
- Fabricate different electrical wiring circuits and understand the AC Circuits.

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TECH II	22HE2071	DESIGN THINKING	2	0	0	2

The student should be able to

Course Objective

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
I	**DESIGN ABILITY** 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
II	**DESIGNING TO WIN** Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	5
III	**DESIGN TO PLEASE AND DESIGNING TOGETHER** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	6
IV	**DESIGN EXPERTISE** 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
V	**DESIGN THINKING TOOLS AND METHODS** 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**

After completion of the course the learner will be able to

Course Outcome

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

TEXT BOOKS:

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCE BOOKS:

R1 - Tom Kelley, "Creative Confidence", 2013.
R2 - 3. Tim Brown, "Change by Design", 2009.

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TECH II	22HE2072	SOFT SKILLS AND APPTITUDE I	1	0	0	1

The student should be able to

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**

After completion of the course the learner will be able to

Course Outcome

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

REFERENCE BOOKS:

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