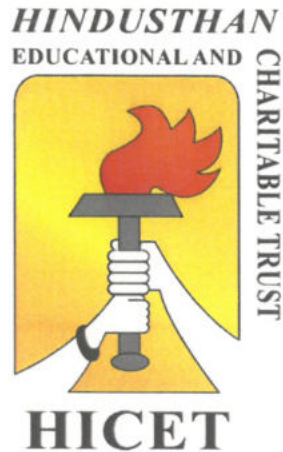


**HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY**  
(An Autonomous Institution Affiliated to Anna University, Chennai)  
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)  
Coimbatore - 641 032.

**B.E. COMPUTER SCIENCE AND ENGINEERING**



**CHOICE BASED CREDIT SYSTEM**

**Revised Curriculum and Syllabus for the 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.



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## VISION AND MISSION OF THE DEPARTMENT

### VISION

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

### MISSION

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

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

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



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## PROGRAM OUTCOMES (POs)

**Engineering Graduates will be able to:**

	<b>Graduate attributes</b>	<b>Descriptions</b>
<b>PO1</b>	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO2</b>	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO3</b>	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.
<b>PO4</b>	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.
<b>PO5</b>	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.
<b>PO6</b>	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
<b>PO7</b>	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.
<b>PO8</b>	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO9</b>	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO10</b>	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.

<b>PO11</b>	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
<b>PO12</b>	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)**

<b>PSO1</b>	An ability to apply, design and develop principles of software engineering, networking and database concepts for computer-based systems in solving engineering problems.
<b>PSO2</b>	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
<b>THEORY</b>										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1101	Calculus	BS	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
7	19HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
<b>MANDATORY</b>										
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
<b>Total Credits</b>				<b>16</b>	<b>2</b>	<b>10</b>	<b>20</b>	<b>550</b>	<b>350</b>	<b>900</b>

**SEMESTER II – 22 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
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
<b>Total Credits</b>				<b>14</b>	<b>2</b>	<b>16</b>	<b>22</b>	<b>500</b>	<b>400</b>	<b>900</b>



**SEMESTER III – 20 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
5	19CS3251	Digital Principles and System Design / ICC-3	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
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
<b>MANDATORY</b>										
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
<b>Total Credits</b>				<b>20</b>	<b>1</b>	<b>8</b>	<b>20</b>	<b>450</b>	<b>450</b>	<b>900</b>

**SEMESTER IV – 21 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
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
<b>MANDATORY</b>										
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
<b>Total Credits</b>				<b>19</b>	<b>1</b>	<b>10</b>	<b>21</b>	<b>375</b>	<b>425</b>	<b>800</b>

**SEMESTER V – 24 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
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
<b>Total Credits</b>				<b>18</b>	<b>1</b>	<b>10</b>	<b>24</b>	<b>500</b>	<b>500</b>	<b>1000</b>

**SEMESTER VI – 24 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
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
<b>Total Credits</b>				<b>19</b>	<b>1</b>	<b>6</b>	<b>24</b>	<b>425</b>	<b>575</b>	<b>1000</b>

**SEMESTER VII – 20 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
5	19CS7251	Machine Learning Techniques	PC	2	0	2	3	50	50	100
<b>PRACTICAL</b>										
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
<b>Total Credits</b>				<b>14</b>	<b>0</b>	<b>12</b>	<b>20</b>	<b>300</b>	<b>500</b>	<b>800</b>

#### SEMESTER VIII – 14 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>PRACTICAL</b>										
3	19CS8901	Project Phase II	EEC	0	0	16	8	100	100	200
<b>Total Credits</b>				<b>6</b>	<b>0</b>	<b>16</b>	<b>14</b>	<b>150</b>	<b>250</b>	<b>400</b>

#### LIST OF PROFESSIONAL ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>PROFESSIONAL ELECTIVE I</b>										
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
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**OPEN ELECTIVE - I**

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

**OPEN ELECTIVE - II**

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

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

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> 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.	
I	<b>SYMMETRIC KEY CRYPTOGRAPHY</b> 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
II	<b>PUBLIC KEY CRYPTOGRAPHY</b> 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
III	<b>MESSAGE AUTHENTICATION AND INTEGRITY</b> 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
IV	<b>SECURITY PRACTICE AND SYSTEM SECURITY</b> Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	9
V		
<b>Total Instructional Hours</b>		<b>45</b>

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

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>INTRODUCTION</b>	
I	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
	<b>CLOUD SERVICES AND SOLUTIONS</b>	
II	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
	<b>CLOUD OFFERINGS AND CLOUD MANAGEMENT</b>	
III	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
	<b>CLOUD ENABLING TECHNOLOGIES</b>	
IV	Data center Technology – Virtualization Technology – Web Technology – Multitenant Technology – case study in AWS.	8
	<b>CLOUD VIRTUALIZATION</b>	
V	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
<b>Total Instructional Hours</b>		<b>45</b>

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



**TEXT BOOKS**

- T1: Dr.Kumar Saurabh, Cloud Computing, Second Edition, Wiley-India,2012
- T2: Thomas Erl, Zaigham Mahmood, Ricardo Puttini, —Cloud Computing: Concepts,Technology and Architecture, Prentice Hall Service Technology Series

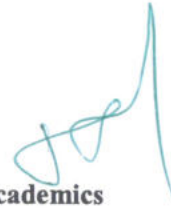
**REFERENCE BOOKS:**

- R1: David Marshall, Wade A. Reynolds, - Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006
- R2: Chris Wolf, Erick M. Halter, - Virtualization: From the Desktop to the Enterprise, Apress 2005.
- R3: Danielle Ruest, Nelson Ruest - Virtualization: A Beginner's Guide, TMH, 2009.



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**Programme**

**Course Code**

**Name of the Course**

**L T P C**



- Course** CO2: Construct algorithms to learn linear and non-linear models  
**Outcome** 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 Data, AML Book Publishers, 2012.  
T2: P. Flach, —Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press, 2012.

**REFERENCE BOOKS:**

- R1: K. P. Murphy, —Machine Learning: A probabilistic perspective, MIT Press, 2012.  
R2: M. Mohri, A. Rostamizadeh, and A. Talwalkar, —Foundations of Machine Learning, MIT Press, 2012.  
R3: C. M. Bishop, —Pattern Recognition and Machine Learning, Springer, 2007.  
R4: D. Barber, —Bayesian Reasoning and Machine Learning, 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.     | <p>Implement the following SUBSTITUTION &amp; TRANSPOSITION TECHNIQUES concepts:</p> <ol style="list-style-type: none"> <li>a. Caesar Cipher</li> <li>b. Playfair Cipher</li> <li>c. Hill Cipher</li> <li>d. Vigenere Cipher</li> <li>e. Rail fence – row &amp; Column</li> <li>f. Transformation</li> </ol> <p>Transformation Implement the following algorithms</p> |
| 2.     | <ol style="list-style-type: none"> <li>a. DES</li> <li>b. RSA Algorithm</li> <li>c. Diffie-Hellman</li> <li>d. MD5</li> <li>e. SHA-1.</li> </ol>                                                                                                                                                                                                                      |
| 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, autonomies 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
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**AI LANDSCAPES:**

I	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
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**INTRODUCTION TO MACHINE LEARNING:**

II	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
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**NATURAL LANGUAGE PROCESSING:NLP**

III	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
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**COMPUTER VISION & DEEP LEARNING:**

IV	Computer Vision Overview- AI Vision through Deep Learning - Computer Vision for the Enterprise - Deep Learning Explained - Deep learning ecosystem	9
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**FUTURE TRENDS FOR AI:**

V	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
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**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**



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

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>MULTI-CORE PROCESSORS</b>	
I	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
	<b>PARALLEL PROGRAM CHALLENGES</b>	
II	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
	<b>SHARED MEMORY PROGRAMMING WITH Open MP</b>	
III	Open MP Execution Model – Memory Model – Open MP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.	9
	<b>DISTRIBUTED MEMORY PROGRAMMING WITH MPI</b>	
IV	MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation.	9
V	<b>PARALLEL PROGRAM DEVELOPMENT:</b> Case studies – n-Body solvers – Tree Search – Open MP and MPI implementations and comparison.	9
<b>Total Instructional Hours</b>		<b>45</b>

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

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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



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

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

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

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

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

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
I	<b>INTRODUCTION</b> 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	<b>AD HOC NETWORKS – INTRODUCTION</b> 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	<b>WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS</b> 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	<b>WSN ROUTING PROTOCOLS</b> 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	<b>QOS AND ENERGY MANAGEMENT</b> 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
<b>Total Instructional Hours</b>		<b>45</b>

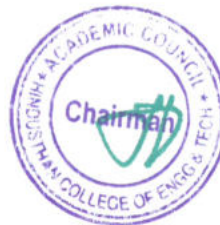
- Course Outcome**
- CO1: Explain the concepts and applications of various wireless communication techniques.
- CO2: Analyze the design issues of ad hoc and sensor networks.
- CO3: Learn architecture of various wireless sensor networks and MAC protocols
- CO4: To analyze the design issues and concepts 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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<b>Programme</b> B.E	<b>Course Code</b> 19CS7304	<b>Name of the Course</b> C# and .NET AND PROGRAMMING	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- 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#.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
I	<b>INTRODUCTION TO C#</b> 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	<b>OBJECT ORIENTED ASPECTS OF C#</b> 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	<b>APPLICATION DEVELOPMENT ON .NET</b> 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	<b>WEB BASED APPLICATION DEVELOPMENT ON .NET</b> 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	<b>CLR AND .NET FRAMEWORK</b> Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET.	9
<b>Total Instructional Hours</b>		<b>45</b>

**Course Outcome**

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

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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



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<b>Programme</b> B.E	<b>Course Code</b> 19CS7305	<b>Name of the Course</b> SOFTWARE TESTING	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- 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.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>INTRODUCTION</b> 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
I		
	<b>TEST CASE DESIGN</b> 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
II		
	<b>LEVELS OF TESTING</b> 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
III		
	<b>TEST AMANAGEMENT</b> 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
IV		
	<b>TEST AUTOMATION</b> 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. <b>Tools: Selenium, TestingWhiz, Sahi, Tosca Testsuite and Katalon Studio.</b>	9
V		
<b>Total Instructional Hours</b>		<b>45</b>



**Course  
Outcome**

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

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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



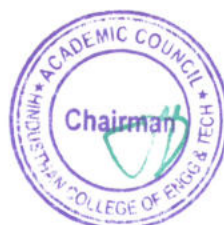
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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19CS7401	FOUNDATION SKILLS IN INFORMATION TECHNOLOGY(NASSCOM)	3	0	0	3

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

Unit	Description	Instructional Hours
I	<b>BASIC PROGRAMMING CONCEPTS IN C LANGUAGE</b> 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	<b>FUNCTIONS, POINTERS, STRUCTURES AND UNIONS</b> 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	<b>SORTING, SEARCHING, HASHING TECHNIQUES</b> 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	<b>SOFTWARE TESTING AND ITS TYPES</b> 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	<b>STAFFING IN SOFTWARE PROJECTS</b> 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
<b>Total Instructional Hours</b>		<b>45</b>

- 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)**

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

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>INTRODUCTION</b> 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
I	<b>MODELING AND RETRIEVAL EVALUATION</b> 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
II	<b>INDEXING</b> 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
III	<b>WEB RETRIEVAL AND WEB CRAWLING</b> 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
IV	<b>RECOMMENDER SYSTEM</b> 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
V		
<b>Total Instructional Hours</b>		<b>45</b>

- 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, 2<sup>nd</sup> Edition Wiley, 2010.



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<b>Programme</b> B.E	<b>Course Code</b> 19CS8307	<b>Name of the Course</b> USER INTERFACE DESIGN	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- Course Objective**
- To learn the basics of User Interface Design.
  - To understand the process of design interface and business functions.
  - To understand the concepts of screen design, web systems, windows and menus.
  - To learn about multimedia and to design effective web pages.
  - To understand the design process and to evaluate user interface design.

UNIT	Description	Instructional Hours
I	<b>INTERACTIVE SOFTWARE AND INTERACTION DEVICE</b> Human-Computer Interface – Characteristics of Graphics Interface – Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.	9
II	<b>HUMAN COMPUTER INTERACTION</b> 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	<b>WINDOWS</b> 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	<b>MULTIMEDIA</b> Text for Web Pages – Effective Feedback– Guidance & Assistance– Internationalization– Accessibility– Icons– Image– Multimedia – Coloring- Case Study: Addressing usability in E- Commerce sites.	9
V	<b>DESIGN PROCESS AND EVALUATION</b> User Interface Design Process - Usability Testing - Usability Requirements and Specification procedures and techniques- User Interface Design Evaluation	9
<b>Total Instructional Hours</b>		<b>45</b>

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

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Introduction – Issues – Data Representation – Data Presentation – Common Mistakes in design	9
	<b>FOUNDATIONS FOR DATA VISUALIZATION</b>	
II	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
	<b>COMPUTER VISUALIZATION</b>	
III	Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Interacting with visualization	9
	<b>MULTIDIMENSIONAL VISUALIZATION</b>	
IV	One Dimension – Two Dimensions – Three Dimensions – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.	9
	<b>CASE STUDIES</b>	
V	Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis	9
<b>Total Instructional Hours</b>		<b>45</b>

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

**TEXT BOOKS:**

- T1: Colin Ware “Information Visualization Perception for Design” Morgan Kaufmann Publishers, 2004, 2<sup>nd</sup> 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 Interactivity, Springer, 2011  
R4: ChaomeiChan, “Information Visualization”, Beyondthehorizon, 2nd edition, Springer Verlag, 2004.

  
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<b>Programme</b> B.E	<b>Course Code</b> 19CS8309	<b>Name of the Course</b> DEEP LEARNING	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- 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
	<b>BASICS</b>	
I	Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.	9
	<b>FEEDFORWARD NETWORKS</b>	
II	Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders. <b>DEEP NEURAL NETWORKS:</b> Difficulty of training deep neural networks, Greedy layerwise training.	9
	<b>BETTER TRAINING OF NEURAL NETWORKS</b>	
III	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). <b>RECURRENT NEURAL NETWORKS:</b> Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs. <b>CONVOLUTIONAL NEURAL NETWORKS:</b> LeNet, AlexNet.	10
	<b>GENERATIVE MODELS</b>	
IV	Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines. <b>RECENT TRENDS:</b> Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning.	9
	<b>APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION</b>	
V	Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks. <b>APPLICATIONS OF DEEP LEARNING TO NLP:</b> Introduction to NLP and Vector Space Model of Semantics.	8
<b>Total Instructional Hours</b>		<b>45</b>

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

#### TEXT BOOKS:

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

#### REFERENCE BOOKS:

- R1: Giancarlo Zaccane, Md. RezaulKarim, "Deep Learning with TensorFlow: Explore neural networks and build intelligent systems with python", Packt Publishing, 2<sup>nd</sup> edition, 2018 (Unit IV)
- R2: Li Deng, Dong Yu "Deep Learning Methods and Applications", Now Publishers, 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.



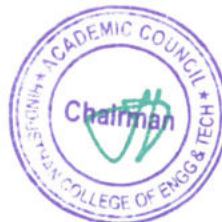
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<b>Programme</b> B.E	<b>Course Code</b> 19CS8310	<b>Name of the Course</b> BLOCK CHAIN TECHNOLOGY	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- Course Objective**
1. To learn the basic concepts of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

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

- 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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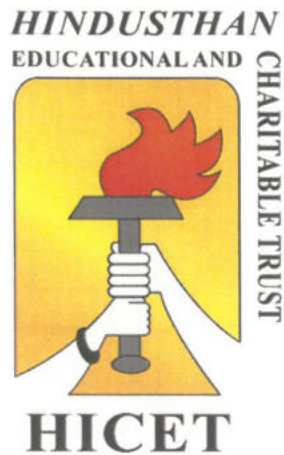
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**HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY**  
(An Autonomous Institution Affiliated to Anna University, Chennai)  
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)  
Coimbatore - 641 032.

**B.E. COMPUTER SCIENCE AND ENGINEERING**



III - CSS

**CHOICE BASED CREDIT SYSTEM**

**Revised Curriculum and Syllabus for the Odd 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
<b>THEORY</b>										
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1101	Calculus	BS	3	1	0	4	40	60	100
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
7	21HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
<b>MANDATORY</b>										
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
<b>Total Credits</b>				<b>16</b>	<b>2</b>	<b>10</b>	<b>20</b>	<b>580</b>	<b>320</b>	<b>900</b>

**SEMESTER II – 22 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21HE2101	Business English 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
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
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
<b>Total Credits</b>				<b>14</b>	<b>2</b>	<b>16</b>	<b>22</b>	<b>540</b>	<b>360</b>	<b>900</b>

**SEMESTER III – 20 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
5	21CS3251	Digital Principles and System Design / ICC-3	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
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
<b>MANDATORY</b>										
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
<b>Total Credits</b>				<b>20</b>	<b>1</b>	<b>8</b>	<b>20</b>	<b>530</b>	<b>370</b>	<b>900</b>

**SEMESTER IV – 21 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
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
<b>MANDATORY</b>										
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
<b>Total Credits</b>				<b>20</b>	<b>1</b>	<b>10</b>	<b>21</b>	<b>540</b>	<b>360</b>	<b>800</b>

**SEMESTER V – 24 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
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
<b>PRACTICAL</b>										
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
<b>Total Credits</b>				<b>17</b>	<b>1</b>	<b>12</b>	<b>24</b>	<b>590</b>	<b>410</b>	<b>1000</b>

**SEMESTER VI – 24 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>THEORY &amp; LAB COMPONENT</b>										
6	21CS6251	Compiler Design	PC	2	0	3	3.5	50	50	100
<b>PRACTICAL</b>										
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
<b>Total Credits</b>				<b>19</b>	<b>1</b>	<b>6</b>	<b>24</b>	<b>510</b>	<b>490</b>	<b>1000</b>

**SEMESTER VII – 20 Credits**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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
<b>Total Credits</b>				<b>14</b>	<b>0</b>	<b>12</b>	<b>20</b>	<b>380</b>	<b>420</b>	<b>800</b>

#### 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
<b>Total Credits</b>				<b>6</b>	<b>0</b>	<b>16</b>	<b>14</b>	<b>180</b>	<b>220</b>	<b>400</b>

#### 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
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**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
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### 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	CATE GORY	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			TCP	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 N o	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

  
Chairman BoS

  
Dean Academics

  
Principal

Chairman - BoS  
CSE - HiCET

Dean (Academics)  
HiCET





HICET – Department of Computer Science and Engineering

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

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
I	<b>Automata Theory</b> Introduction-Need of automata theory-Formal proof- Additional Forms of Proof- Inductive Proofs-Central Concepts of Automata Theory-DFA and NDFA-Finite Automaton with $\epsilon$ - Transitions-Equivalence of DFA and NFA-Applications of Finite Automata.	12
II	<b>Regular Expressions</b> 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	<b>Context Free Grammars</b> 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	<b>PushDown Automata and Turing Machines</b> 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	<b>Undecidability</b> 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
<b>Total Instructional Hours</b>		<b>60</b>

- 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

*HICET – Department of Computer Science and Engineering*

**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



**Chairman, Board Of Studies**

**Chairman - BoS  
CSE - HICET**



**Dean-Academics**

**Dean (Academics)  
HiCET**

HICET – Department of Computer Science and Engineering

<b>Programme</b> B.E	<b>Course Code</b> 21CS5202	<b>Name of the Course</b> COMPUTER NETWORKS	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- 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.

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

- Course Outcome**
- Upon completion of this course, the Students will be able to
- CO1: Learn about the Protocol Layering and Physical Level Communication
  - CO2: Understand the Data Communication System and the purpose of Layered Architecture.
  - CO3: Analyze the concepts of Routing Methods and Subnetting.
  - CO4: Design protocols for various functions in the Network.
  - CO5: Understand the functions and Protocols of the Transport Layer.



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**TEXT BOOK:**

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

**REFERENCES:**

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



A handwritten signature in green ink, appearing to be "J.S.H.", written over the printed name.

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<b>Programme</b> B.E	<b>Course Code</b> 21EC5231	<b>Name of the Course</b> PRINCIPLES OF MICROPROCESSORS AND MICRO CONTROLLERS	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- Course Objective**
1. Study the Architecture of 8085 and 8086 microprocessor.
  2. Learn the design aspects of I/O and Memory Interfacing circuits.
  3. Study about communication and bus interfacing.
  4. Study the Architecture of 8051 microcontroller
  5. Study the concepts of microcontroller interfacing

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

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

**TEXT BOOKS:**

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

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

**REFERENCE BOOKS:**

R1: Douglas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012

R2: A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", 3<sup>rd</sup> 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	<p><b>UNIFIED PROCESS AND USE CASE DIAGRAMS</b>                      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.</p>	6+3
II	<p><b>STATIC UML DIAGRAMS</b>                      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.</p>	6+3
III	<p><b>DYNAMIC AND IMPLEMENTATION UML DIAGRAMS</b>                      Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modeling –When to use State Diagrams - Activity diagram – When to use activity diagrams - Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams. <i>Experiments: Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams for Airline/Railway reservation system. Draw relevant State Chart and Activity Diagrams for the same system for Exam registration.</i></p>	6+3
IV	<p><b>DESIGN PATTERNS</b>                      GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code. <i>Experiments: Improve the reusability and maintainability of the software system by applying appropriate design pattern</i></p>	5+4
V	<p><b>TESTING</b>                      Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans  <i>Experiments: Implement the modified system and test it for various scenarios</i></p>	6+3
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

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<b>Course</b>	CO1: Express software design with UML diagrams
<b>Outcome</b>	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 Development, Third Edition, Pearson Education, 2005.  
T2: Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

**REFERENCE BOOKS :**

- R1: Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.  
R2: Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, 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	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	<p><b>DATA WAREHOUSE, OLAP TECHNOLOGY</b> Need for Data Warehouse- Data Warehouses - multidimensional data model- Data Warehouse architecture – Data Warehouse Implementation - Data Warehousing to Data mining.</p> <p><b>Program:</b> 1. Demonstrate OLAP Cube and its different operations (using OLAPWriter/Tableau/Oracle, etc.)</p>	(6T+3P)
II	<p><b>DATA MINING</b> 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</p> <p><b>Program:</b> 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</p>	(6T+3P)
III	<p><b>DATA PREPROCESSING AND MINING FREQUENT PATTERNS</b> <b>DATA PREPROCESSING:</b> Descriptive data summarization –Data Cleaning – Data integration and transformation – Data Reduction. <b>MINING FREQUENT PATTERNS:</b> Basic Concepts, Frequent item set Mining Methods.</p> <p>1. Generate Association Rules using the Apriori algorithm using RapidMiner.</p>	(6T+3P)
IV	<p><b>CLASSIFICATION:</b> Introduction – Decision trees – Naïve Bayes’ classification - Artificial Neural Networks - Support Vector Machines - Issues regarding classification and prediction.</p> <p><b>Program:</b> 1. Demonstrate classification process on a given dataset using Naïve Bayesian Classifier using R Programming.</p>	(6T+3P)

**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.

V

(6T+3P)

**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

**Total Instructional Hours 45**

After completion of course, students would be able to:

- |                       |     |                                                                   |
|-----------------------|-----|-------------------------------------------------------------------|
|                       | CO1 | Explain data warehouse, OLAP technology concepts.                 |
|                       | CO2 | Discuss the basic concepts of Data Mining.                        |
| <b>Course Outcome</b> | 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**



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<b>Programme</b> B.E	<b>Course Code</b> 21CS5601	<b>Name of the Course</b> DATA STRUCTURES AND DESIGN	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- Course Objective**
1. Understand the fundamental concepts of linear data structures
  2. Learn the concept of various linear data structures like Linked list
  3. Study the 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
	<b>FUNDAMENTALS OF DATA STRUCTURES</b>	
I	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
	<b>LINKED LIST</b>	
II	Representation – Basic Operations – Types: Singly linked list – Doubly linked list – Circular linked list – Applications: Polynomial Addition, Sparse Matrices.	9
	<b>STACK AND QUEUE</b>	
III	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
	<b>TREE</b>	
IV	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
	<b>GRAPH AND HASHING</b>	
V	Graph: Terminologies – Representation of Graph - Graph traversal – Topological sort – Hashing: Hash table – Hash functions – Resolving Collision Techniques: Separate chaining – Open addressing – Double hashing.	10
<b>Total Instructional Hours</b>		<b>45</b>

- 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.

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



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**HONOURS WITH SPECIALIZATION**  
**(IOT)**

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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
	<b>BASICS OF IOT</b>	
I	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
	<b>IOT NETWORK ARCHITECTURE AND DESIGN</b>	
II	Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino	9
	<b>DEVELOPING INTERNET OF THINGS</b>	
III	Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.	9
	<b>IMPLEMENTATION</b>	
IV	Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN),SDN for IoT, Data Handling and Analytics	9
	<b>CASE STUDIES</b>	
V	Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring	9
<b>Total Instructional Hours</b>		<b>45</b>

- 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

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**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. Walteneug 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)**

10

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Programme **B.E** Course Code **21CS5205** Name of the Course **PUBLIC KEY INFRASTRUCTURE AND TRUST MANAGEMENT** L **3** T **0** P **0** C **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	<b>INTRODUCTION</b> 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	<b>PUBLIC KEY INFRASTRUCTURE</b> Crypto Hardware and software, Smart cards, Universal Crypto interface, Real world attacks, Evaluation and certification, Public Key Infrastructure, PKI Works.	9
III	<b>DEVELOPING PKI</b> 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	<b>IMPLEMENTATION</b> 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	<b>SECURE CRYPTO PROTOCOLS</b> 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
<b>Total Instructional Hours</b>		<b>45</b>
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..



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	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)**

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<b>Programme</b> B.E	<b>Course Code</b> 21CS5206	<b>Name of the Course</b> WEB TECHNOLOGY	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- 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	<b>WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0</b> 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	<b>CLIENT SIDE PROGRAMMING</b> 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	<b>SERVER SIDE PROGRAMMING</b> Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.	9
IV	<b>INTRODUCTION TO PHP and</b> An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation.	9
V	<b>INTRODUCTION TO XML</b> XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL	9
<b>Total Instructional Hours</b>		<b>45</b>

- 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.

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**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**

10

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<b>Programme</b>	<b>Course Code</b>	<b>Name of the Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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	<b>INTRODUCTION TO FINANCIAL MANGEMENT</b> 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	<b>SOURCES OF FINANCE</b> 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	<b>INVESTMENT DECISIONS:</b> 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	<b>FINANCING AND DIVIDEND DECISION</b> 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	<b>WORKING CAPITAL DECISION</b> 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
<b>Total Instructional Hours</b>		<b>45</b>
<b>Course Outcome</b>	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

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

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Programme	Course Code	Course Name	L	T	P	C
B.E	21CS5351	INTERNET AND WEB TECHNOLOGY	2	0	2	3
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To understand the concepts of object oriented programming paradigm.</li> <li>To learn the basics involved in publishing content on the World Wide Web.</li> <li>To expose students to the basic tools and applications used in Web publishing.</li> <li>To understand how web pages are connected to database through JDBC.</li> <li>To know about server side programming</li> </ol>					
Unit	Description	Instructional Hours				
	<b>INTRODUCTION TO OBJECT ORIENTED PROGRAMMING</b> Object oriented concepts – object oriented programming (review only) — advanced concept in OOP – relationship – inheritance – abstract classes – polymorphism – Object Oriented design methodology – approach – best practices. UML class diagrams – interface – common base class. <i>Illustrative Programs: Polymorphism and inheritance</i>	5+2				
I	<b>NETWORKING AND SECURITY</b> Internetworking – Working with TCP/IP – IP address – sub netting – DNS – VPN – proxy servers – firewalls – Client/Server concepts - World Wide Web – components of web application – MIME types, browsers and web servers – types of web content – URL – HTML – HTTP protocol – Web applications – performance – Application servers – Web security. User Experience Design – Basic UX terminology – UXD in SDLC – Rapid prototyping in Requirements. <i>Illustrative programs: write an HTML page that has one input, which can take multiline text and a submit button. Once the user clicks the submit button it should show the number of characters, words and lines in the text entered using an alert message.</i>	6+3				
II	<b>HTML AND CSS</b> Client Tier using HTML – Basic HTML tags – Look and feel using CSS – Client side scripting using Java Script and Validations - Document Object Model (DOM). <i>Illustrative programs: Create an XML template to describe the result of students in an examination. The description should include the students roll number, name, three subject names and marks, total marks, percentage and result.</i>	6+3				
III	<b>JDBC</b> Business tier using POJO (Plain Old Java Objects) – Introduction to Frameworks – Introduction to POJO – Multithreaded Programming – Java I/O – Java Database Connectivity (JDBC). <i>Illustrative programs :Write a program for maintaining database by sending queries. Design and implement a servlet book query with a help of JDBC and SQL. Create MS-Access database, create an ODBC link, compile and execute java JDBC socket.</i>	6+4				
IV	<b>SERVLETS</b> Presentation tier using JSP – Role of Java EE in Enterprise applications – Basics of Servlets - To introduce server side programming with JSP - Standard Tag Library. <i>Illustrative programs: Write a servlet program to connect database and extract data from the tables and display them, Authenticate the user when he/she submits the login form using the user name and password from the database using JSP.</i>	6+4				
V						
		<b>Total Instructional Hours</b>	<b>29+16=45</b>			

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<b>Course Outcome</b>	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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<b>Programme</b> B.E	<b>Course Code</b> 21CS5352	<b>Name of the Course</b> ADVANCED JAVA PROGRAMMING	<b>L</b> 2	<b>T</b> 0	<b>P</b> 2	<b>C</b> 3
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- Course Objective**
1. To learn GUI concepts using Swing and JavaFX.
  2. To learn network programs using java
  3. To understand concepts needed for distributed and multi-tier applications
  4. To understand Servlets and JDBC to develop web pages.
  5. To understand bean concepts for enterprise application development

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

- 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.

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**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

- R1: Hortsman & Cornell, "core Java 2 Advanced Feature, 9th Edition", Pearson Education, 2013.  
R2: Ed Roman, "Mastering Enterprise Java Beans", John Wiley & sons Inc., 1999.  
R3: Elliotte Rusty Harold, "Java Network programming", O'Reilly publishers, 2000.  
R4: Patrick Naughton, "Complete Reference: Java2, 9<sup>th</sup> 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
	<b>INTRODUCTION</b> Introduction to Open sources – Need of Open Sources – Advantages of Open Sources– Application of Open Sources. List of open source software and open source hardware -Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux. <i>Illustrate Programs: Windows and Linux installation with dual boot, Micro kernel installation like MYSQL, PHP and PYTHON.</i>	6+3
I	<b>OPEN SOURCE DATABASE</b> MySQL: Introduction – Setting up account – Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata – Using sequences –MySQL and Web. <i>Illustrate Programs:.DML and DDL command using MYSQL</i>	6+3
II	<b>OPEN SOURCE PROGRAMMING LANGUAGES</b> PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Debugging and error handling, case study-Symfony. <i>Illustrate Programs: Running PHP: Simple applications like login form, File handling ,Exception handling and Database connectivity using PHP</i>	6+3
III	<b>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.</b>	5+4
IV	<b>PYTHON DATABASES AND PERSISTENCE</b> Persistence options in python-DBM Files-Pickled Objects-Shelve Files-The ZODB Object- Oriented Database-SQL Database Interfaces- ORMs: Object Relational Mappers- PyForm: A Persistent Object Viewer. <i>Illustrate Programs: Database connectivity.</i>	6+3
V		
<b>TOTAL INSTRUCTIONAL HOURS</b>		<b>45</b>

- Course Outcome**
- CO1. Understand open source operating systems and application.
  - CO2. Develop MYSQL query.
  - CO3. Develop PHP program with database connection.
  - CO4. Create a python program using exception.
  - CO5. Develop a python application using database.

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**TEXT BOOKS:**

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

**REFERENCE BOOKS :**

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



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<b>Programme</b> B.E	<b>Course Code</b> 21CS5354	<b>Name of the Course</b> R Programming	<b>L</b> 2	<b>T</b> 0	<b>P</b> 2	<b>C</b> 3
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- 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	<b>R Overview:</b> Evolution of R – Features of R - What is R? - Why R?-Installing R - R environment – R basic syntax – R data types – R variables – R constants- R operators. <i>Illustrative programs: Take input from the user, Addition of two numbers.</i>	9
II	<b>R Functions and Strings:</b> R Decision Making – R Loops – R Functions – R Strings – R Vectors – R List – Matrices – R Arrays – R Factors – R data frame. <i>Illustrative programs: factorial of given number, Prime Number, Sum of natural numbers, Create an array two 3x3 matrices.</i>	9
III	<b>R Package and R Files:</b> R Packages – R Data reshaping – R CSV Files - R Excel File – R Binary files – R XML Files – R JSON Files. <i>Illustrative programs: Joining column and rows in data frame, Create and read the XML file for employee details.</i>	9
IV	<b>R Data base and R charts:</b> R Web data – R data base – R Pie chart – R Bar chart – R Box Plots – R histogram – R Line Graphs – R Scatter plots – R Mean , Median, Mode. <i>Illustrative programs: pie chart in the current R working directory, boxplot graph for the relation between mpg (miles per gallon) and cyl (number of cylinders).</i>	9
V	<b>R Linear Regression, Non Linear Regression, R Distribution:</b> R Linear Regression - R Multiple Regression - R Logistic Regression - R Normal, Binominal distribution – R Poisson regression – R Time series analysis – R Nonlinear least square – R decision tree. <i>Illustrative programs: height of the probability distribution at each point for a given mean and standard deviation.</i>	9
<b>Total Instructional Hours</b>		<b>45</b>

- 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 Golemund, First Edition.
- T2: Lawrence Leemis. *Learning Base R*. Lightning Source, 2016.

**REFERENCE BOOKS:**

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- 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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<b>Programme</b> B.E	<b>Course Code</b> 21CS5355	<b>Name of the Course</b> COMPUTER GRAPHICS AND MULTIMEDIA	<b>L</b> 2	<b>T</b> 0	<b>P</b> 2	<b>C</b> 3
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- 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
	<b>INTRODUCTION AND OVERVIEW OF GRAPHICAL SYSTEMS</b> 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. <i>Illustrative Programs: Implementation of Line, Circle and Ellipse Drawing Algorithms.</i>	
I		7+2(P)
	<b>TWO DIMENSIONAL GRAPHICS</b> 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. <i>Illustrative Programs: Implementation of 2D Transformation, viewing and Line Clipping Algorithm.</i>	
II		5+4(P)
	<b>THREE DIMENSIONAL GRAPHICS</b> 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. <i>Illustrative Programs: Graphics programming using OPENGL - Creating 3D Objects and scenes. Implementation of 3D Transformation.</i>	
III		5+4(P)
	<b>VISIBLE SURFACE DETERMINATION, ILLUMINATION AND COLOR MODELS</b> 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. <i>Illustrative Programs: Implementation of color models</i>	
IV		7+2(P)
	<b>INTRODUCTION TO MULTIMEDIA:</b> 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. <i>Illustrative Programs: Using Flash/Maya perform different operations (rotation, scaling move etc.) on objects. Create an object using Key frame animation and Path animation.</i>	
V		5+4(P)
<b>Total Instructional Hours</b>		<b>45</b>

- 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,

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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", 4<sup>th</sup> Edition, Pearson Education, 2014

R2: Francis S Hill, Jr. Stephen M Kelley., "Computer Graphics using OpenGL", 3<sup>rd</sup> 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**



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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
<b>DESIGN THINKING HISTORY AND OVERVIEW</b>		
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. <i>Illustrative program: Listening and HMW</i>	9
<b>KEY HABITS</b>		
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. <i>Illustrative program: USER RESEARCH and PRACTICE MAPPING INSIGHTS FROM USER RESEARCH</i>	7+2(P)
<b>USER RESEARCH AND MAKE</b>		
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. <i>Illustrative program: PRACTICE IDEATION AND PRIORITIZATION, COLLABORATIVELY CONSOLIDATE STORYBOARDS</i>	5+4(P)
<b>USER FEEDBACK AND TEACHING</b>		
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. <i>Illustrative program: DEVELOP A SUMMARY HILL STATEMENT AND BUILD YOUR STORY BOARD AND HILL INTO A PROTOTYPE</i>	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	<b>Design Ability:</b> 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	<b>Designing to Win:</b> Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
III	<b>Design to Please and Designing Together:</b> 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
<b>Course Outcome</b>	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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<b>Programme</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
I	<b>Introduction to Soft Skills:</b> 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	<b>Art of Communication:</b> 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	<b>World of Teams:</b> 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	<b>Quantitative Aptitude:</b> Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	<b>Logical Reasoning:</b> Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	2
<b>Course Outcome:</b>	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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*HICET – Department of Computer Science and Engineering*

## **Minor Degree in Entrepreneurship**



*HICET – Department of Computer Science and Engineering*

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

<b>Course Objective</b>	<p>CO1: To enable students gain insights on entrepreneurship.</p> <p>CO2: To make students understand the sources of product &amp; business ideas.</p> <p>CO3: To provide knowledge on business opportunity identification.</p> <p>CO4: To enable students to develop business plan</p> <p>CO5: To enable students to prepare feasibility reports and understand trends in entrepreneurship.</p>
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Unit	Description	Instructional Hours
I	<b>Introduction to Entrepreneurship:</b> 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	<b>Product Development:</b> 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	<b>Business Opportunity Identification:</b> Need and Importance - Steps in identification of Business Opportunity. Techniques of market Survey – Market Research Procedure.	9
IV	<b>Business Plan Development:</b> 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	<b>Feasibility Report &amp; trends:</b> 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
<b>Total Instructional Hours</b>		<b>45</b>

<b>Course Outcome</b>	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

*HICET – Department of Computer Science and Engineering*

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.



**Chairman - BOS**

**Chairman - BoS  
CSE - HiCET**



**Dean – Academics**

**Dean (Academics)  
HiCET**



*HICET – Department of Computer Science and Engineering*

**Minor Degree In Environment And Sustainability**

**HICET – Department of Computer Science and Engineering**

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

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

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO SUSTAINABLE DEVELOPMENT</b>	
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
	<b>ENVIRONMENTAL SUSTAINABILITY</b>	
II	Land, Water and Food production - Moving towards sustainability: Energy powering Sustainable Development - Financing the environment and Sustainable Development.	9
	<b>SUSTAINABILITY INDICATORS</b>	
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
	<b>URBAN PLANNING AND ENVIRONMENT</b>	
IV	Environment and Resources, Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development.	9
	<b>THE BUILT-IN ENVIRONMENT</b>	
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
	<b>Total Instructional Hours</b>	<b>45</b>

**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

  
**Chairman – BOS**



  
**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**



III Yr - CSS

**CHOICE BASED CREDIT SYSTEM**

**Revised Curriculum and Syllabus for the odd semester**  
**Academic year 2023-2024**  
**(Academic Council Meeting Held on 19.06.2023 )**





**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  
Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.



**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
<b>THEORY</b>											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
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
<b>EEC COURSES (SE/AE)</b>											
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
<b>MANDATORY COURSES</b>											
8	22MC1091/ 22MC1092	அறிவியல் தமிழ் / Indian Constitution	MC	2	0	0	0	2	100	0	100
<b>TOTAL</b>				<b>16</b>	<b>1</b>	<b>8</b>	<b>19</b>	<b>26</b>	<b>480</b>	<b>320</b>	<b>800</b>



SEMESTER II (Credits – 22)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>THEORY WITH LAB COMPONENT</b>											
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
<b>PRACTICAL</b>											
7	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
<b>EEC COURSES (SE/AE)</b>											
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
<b>MANDATORY COURSES</b>											
10	22MC2091/ 22MC2092	தமிழர்மரபு/ <i>Heritage of Tamils</i>	MC	2	0	0	0	2	100	0	100
11	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in any one of the personality and character development programmes and undergo training for about 80 hours							
<b>TOTAL</b>				<b>18</b>	<b>1</b>	<b>12</b>	<b>22</b>	<b>29</b>	<b>630</b>	<b>370</b>	<b>1000</b>

SEMESTER III (Credits – 25)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>THEORY WITH LAB COMPONENT</b>											
5	22CS3251/ 22CS3253	Object Oriented Programming Using Java / Clean Coding and Devops	PCC/ICC- 3	3	0	2	4	4	50	50	100
<b>PRACTICAL</b>											
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
<b>EEC COURSES (SE/AE)</b>											
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
<b>TOTAL</b>				<b>18</b>	<b>2</b>	<b>14</b>	<b>25</b>	<b>34</b>	<b>590</b>	<b>410</b>	<b>1000</b>

SEMESTER IV (Credits – 23)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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

<b>THEORY WITH LAB COMPONENT</b>											
6	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
<b>PRACTICAL</b>											
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
<b>EEC COURSES (SE/AE)</b>											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
<b>TOTAL</b>				<b>17</b>	<b>1</b>	<b>10</b>	<b>23</b>	<b>28</b>	<b>470</b>	<b>430</b>	<b>900</b>

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

SEMESTER VI (Credits – 24)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>PRACTICAL</b>											
8	22CS6001	Machine Learning Techniques Lab	PCC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
9	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
<b>TOTAL</b>				<b>22</b>	<b>0</b>	<b>4</b>	<b>24</b>	<b>27</b>	<b>440</b>	<b>460</b>	<b>900</b>

SEMESTER VII (Credits – 20)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>PRACTICAL</b>											
6	22CS7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
7	22CS7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
<b>TOTAL</b>				<b>15</b>	<b>1</b>	<b>4</b>	<b>20</b>	<b>22</b>	<b>360</b>	<b>340</b>	<b>700</b>

\* - 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
<b>EEC COURSES (SE/AE)</b>											
1	22CS8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>	<b>20</b>	<b>100</b>	<b>100</b>	<b>200</b>

**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	✓	✓							
<b>Total</b>		<b>19</b>	<b>22</b>	<b>25</b>	<b>23</b>	<b>22</b>	<b>24</b>	<b>20</b>	<b>10</b>	<b>165</b>

**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	CATEGOR Y	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
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**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 and Animation	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 Management	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 Network Security	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
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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 N o	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	VI I	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



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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
<b>MATHEMATICAL LOGIC</b>		
I	Propositional logic - Tautology and Contradiction - Propositional equivalences - Normal forms - Principal normal forms - Theory of Inference.	12
<b>COMBINATORICS</b>		
II	Mathematical induction – Recurrence relations – Solving linear recurrence relations - generating functions – principle of inclusion and exclusion – applications.	12
<b>LATTICES AND BOOLEAN ALGEBRA</b>		
III	Lattices – Properties of lattices – Lattices as algebraic system – Sub lattices - some special lattices – Boolean algebra – Definition and simple properties.	12
<b>GRAPHS</b>		
IV	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
<b>TREES</b>		
V	Trees – properties of trees –spanning tree – minimum spanning tree – Rooted and binary trees – properties of binary trees - spanning trees in a weighted graph.	12
<b>Total Instructional Hours</b>		<b>60</b>

- 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-2<sup>nd</sup> Edition 2018.
- T2- Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, Delhi, 2016.

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**REFERENCE BOOKS :**

- R1 - T.Veerarajan, “Discrete Mathematics with Graph Theory and Combinatorics”, Tata. McGraw-Hill Education, 15<sup>th</sup> 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



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<b>Programme</b> B.E	<b>Course Code</b> 22CS3201	<b>Name of the Course</b> DATA STRUCTURES	<b>L</b> 3	<b>T</b> 0	<b>P</b> 0	<b>C</b> 3
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- 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
	<b>FUNDAMENTALS OF DATA STRUCTURES AND LINKED LIST</b>	
I	Introduction – Need for data structures – Types of data structures – List ADT- Single Linked List-Doubly Linked List-Circular Linked List- its operations.	9
	<b>STACK AND QUEUE</b>	
II	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
	<b>TREES</b>	
III	Tree ADT-Binary Tree-Tree Traversal Algorithms-Search Tree: Binary Search Tree-AVL Tree- B+ trees- Priority Queues- Binary Heap	9
	<b>SEARCHING, SORTING AND HASHING</b>	
IV	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
	<b>GRAPHS</b>	
V	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
<b>Total Instructional Hours</b>		<b>45</b>

- 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

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**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, Yeedidiah 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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<b>Programme</b>	<b>Course Code</b>	<b>Name of the Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>OPERATING SYSTEMS OVERVIEW</b>	
I	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
	<b>PROCESS MANAGEMENT</b>	
II	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
	<b>STORAGE MANAGEMENT</b>	
III	Memory Hierarchy, Cache Memory, Main Memory-Swapping-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory	12
	<b>FILE SYSTEM IMPLEMENTATION &amp; MASS STORAGE STRUCTURE</b>	
IV	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
	<b>TYPES OF OPERATING SYSTEMS</b>	
V	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
<b>Total Instructional Hours</b>		<b>60</b>

- 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.

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**TEXT BOOKS:**

- T1: Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10<sup>th</sup> 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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<b>Programme</b> B.E	<b>Course Code</b> 22CS3251	<b>Name of the Course</b> OBJECT ORIENTED PROGRAMMING USING JAVA	<b>L</b> 3	<b>T</b> 0	<b>P</b> 2	<b>C</b> 4
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- 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
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**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
    
```

I

12

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.

**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.

II

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

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.

- IV 12

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**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 **B.E** Course Code **22CS3203** Name of the Course **DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION** L **3** T **0** P **0** C **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	<b>COMBINATIONAL CIRCUITS</b> Circuits for arithmetic operations: adder: Half adder, Full adder, subtractor: Half subtractor, Full subtractor-BCD adder-Magnitude comparator-Encoders, Decoders-Multiplexers, Demultiplexers, Code converters: Binary to Gray, Gray to Binary	9
II	<b>SYNCHRONOUS SEQUENTIAL CIRCUITS</b> 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	<b>COMPUTER FUNDAMENTALS</b> 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	<b>PROCESSOR</b> Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.	9
V	<b>MEMORY AND I/O SYSTEMS</b> 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

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**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”, Fourth Edition, 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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<b>Programme</b> BE	<b>Course Code</b> 22CS3253	<b>Name of the Course</b> CLEAN CODING AND DEVOPS	<b>L</b> 3	<b>T</b> 0	<b>P</b> 2	<b>C</b> 4
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- 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	<p><b>INTRODUCTION TO CLEANCODING</b> 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.</p>	9+3(P)
II	<p><b>COMMENTS, FORMATTING AND OBJECTS</b> 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.</p>	8+2(P)
III	<p><b>INTRODUCTION TO DEV-OPS</b> An overview about DevOps,-Why it is needed? how it is different from traditional IT &amp; 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</p>	9+4(P)
IV	<p><b>ADVANCED DEV-OPS</b> An overview of advanced DevOps concepts - Automatic Rollback &amp; Provisioning, Scalability, Clustering &amp; Infrastructure as Code Lab Exercises- Import code and create Devops build pipeline, Create the Devops release pipeline</p>	9+4(P)
V	<p><b>INTRODUCTION TO DEV-OPS ON CLOUD</b> 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</p>	9+3(P)
<b>Total Instructional Hours</b>		<b>44(T)+16(P)</b>

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<b>Course Outcome</b>	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**
- To learn the methodical way of solving problem.
  - To comprehend the different methods of organizing large amount of data.
  - To efficiently implement the different data structures.
  - To Understand the concepts of Sorting, Searching and Hashing techniques
  - To Understand graph algorithms for solving real world problems

**S. No. Description Of the Experiments**

**Singly Linked List and Doubly Linked List**

- 1
- Create and display Singly Linked List.
  - Given a singly linked list with head node root, write a function to split the linked list into k consecutive linked list "parts".
  - Find k<sup>th</sup> node from the end of linked list
  - Reverse a doubly linked list.
  - Merge two sorted singly Linked Lists without creating new nodes.

**a) Implementation of Stack**

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

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

**b) Implementation of Queue**

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

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

**Binary search tree and traversal**

- 4
- Insertion, Deletion, Searching in a BST
  - Find k<sup>th</sup> smallest and k<sup>th</sup> largest element in a BST
- Check if a given sequence represents the in-order, pre-order and post-order traversal of a BST.

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

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

**Heaps using priority queue**

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

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

- 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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<b>Programme</b> B.E	<b>Course Code</b> 22CS3001	<b>Name of the Course</b> DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION LABORATORY	<b>L</b> 0	<b>T</b> 0	<b>P</b> 4	<b>C</b> 2
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- 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	22MC3191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

**The student should be able**

- |                         |   |                                                                                                                                                                       |
|-------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Objective</b> | 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	<b>Introduction to traditional knowledge:</b> 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
	<b>Protection of traditional knowledge:</b> The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	
II	<b>Itihas and Dharma-Shastra</b>	9
III	<b>Itihas:</b> The Mahabharata - The Puranas - The Ramayana Dharma-Shastra: Manu Needhi - The Tirukkural – Thiru Arutpa	9
IV	<b>Traditional knowledge and intellectual property:</b> 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	<b>Indian philosophy</b> Jain – Buddhist – Charvaka – Samkhya - Yoga - Nyaya - Vaisheshika - Saiva Siddhanta	9
<b>Total Instructional Hours</b>		<b>45</b>

<b>Course Outcome</b>	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
<b>Logical Reasoning</b>		
I	Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	9
<b>Quantitative Aptitude</b>		
II	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
<b>Verbal Ability</b>		
III	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
<b>Writing skills for placements</b>		
IV	Essay writing: Idea generation for topics, Best practices, Practice and feedback	2
<b>Total Instructional Hours</b>		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

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- 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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**(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)**  
**Coimbatore - 641 032.**

**B.E. COMPUTER SCIENCE AND ENGINEERING**



*I - Year - CSS*

**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**

<b>SEMESTER I (Credit : 18)</b>											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
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
<b>EEC COURSES (SE/AE)</b>											
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
<b>MANDATORY COURSES</b>											
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
<b>TOTAL</b>				<b>17</b>	<b>1</b>	<b>8</b>	<b>18</b>	<b>26</b>	<b>580</b>	<b>320</b>	<b>900</b>



**SEMESTER II (Credits – 23)**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>THEORY WITH LAB COMPONENT</b>											
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
<b>PRACTICAL</b>											
7	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
<b>EEC COURSES (SE/AE)</b>											
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
<b>MANDATORY COURSES</b>											
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, in anyone of the personality and character development programmes and undergo training for about 80 hours							
<b>TOTAL</b>				<b>18</b>	<b>1</b>	<b>13</b>	<b>23</b>	<b>29</b>	<b>640</b>	<b>360</b>	<b>1000</b>

SEMESTER III (Credits – 25)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>THEORY WITH LAB COMPONENT</b>											
5	22CS3251/ 22CS3253	Object Oriented Programming Using Java / Clean Coding and Devops	PCC/ICC- 3	3	0	2	4	4	50	50	100
<b>PRACTICAL</b>											
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
<b>EEC COURSES (SE/AE)</b>											
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
<b>TOTAL</b>				<b>17</b>	<b>2</b>	<b>14</b>	<b>25</b>	<b>34</b>	<b>590</b>	<b>410</b>	<b>1000</b>

SEMESTER IV (Credits – 23)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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

<b>THEORY WITH LAB COMPONENT</b>											
6	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
<b>PRACTICAL</b>											
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
<b>EEC COURSES (SE/AE)</b>											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
<b>TOTAL</b>				<b>17</b>	<b>1</b>	<b>10</b>	<b>23</b>	<b>28</b>	<b>470</b>	<b>430</b>	<b>900</b>

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

SEMESTER VI (Credits – 24)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>PRACTICAL</b>											
8	22CS6001	Machine Learning Techniques Lab	PCC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
9	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
<b>TOTAL</b>				<b>22</b>	<b>0</b>	<b>4</b>	<b>24</b>	<b>27</b>	<b>440</b>	<b>460</b>	<b>900</b>

SEMESTER VII (Credits – 20)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
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
<b>PRACTICAL</b>											
6	22CS7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
7	22CS7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
<b>TOTAL</b>				<b>15</b>	<b>1</b>	<b>4</b>	<b>20</b>	<b>22</b>	<b>360</b>	<b>340</b>	<b>700</b>

\* - 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
<b>EEC COURSES (SE/AE)</b>											
1	22CS8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>	<b>20</b>	<b>100</b>	<b>100</b>	<b>200</b>

**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	✓	✓							
<b>Total</b>		<b>19</b>	<b>22</b>	<b>25</b>	<b>23</b>	<b>22</b>	<b>24</b>	<b>20</b>	<b>10</b>	<b>165</b>

### 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	CATEGOR Y	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



<b>22CS7301</b> Recommender Systems	<b>22CS7302</b> Visual Effects	<b>22CS7303</b> Cloud Security	<b>22CS7304</b> Data privacy preservation	<b>22CS7305</b> Virtual Reality	<b>22CS7306</b> Ethics and AI
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**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	<b>22CS5301</b>	Data Engineering	PEC	3	0	0	3	3
2	<b>22CS5302</b>	Information Retrieval	PEC	3	0	0	3	3
3	<b>22CS5303</b>	Data Security	PEC	3	0	0	3	3
4	<b>22CS6301</b>	Information Science and Ethics	PEC	3	0	0	3	3
5	<b>22CS6302</b>	Fuzzy logic and Neural Networks	PEC	3	0	0	3	3
6	<b>22CS7301</b>	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	<b>22CS5304</b>	Multimedia Data Compression and Storage	PEC	3	0	0	3	3
2	<b>22CS5305</b>	Multimedia and Animation	PEC	3	0	0	3	3
3	<b>22CS5306</b>	Video Creation and Editing	PEC	3	0	0	3	3
4	<b>22CS6303</b>	UI and UX Design	PEC	3	0	0	3	3
5	<b>22CS6304</b>	Digital marketing	PEC	3	0	0	3	3
6	<b>22CS7302</b>	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	<b>22CS5307</b>	Principles of Cloud Computing	PEC	3	0	0	3	3
2	<b>22CS5308</b>	Virtualization	PEC	3	0	0	3	3

3	22CS5309	Cloud Architecture	PEC	3	0	0	3	3
4	22CS6305	Cloud Services Management	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 Network Security	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
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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 N o	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	VI I	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



**Chairman BoS**

**Chairman - BoS  
CSE - HiCET**



**Dean Academics**

**Dean (Academics)  
HiCET**



**Principal**







# SYLLABUS I SEMESTER



Chairman, Board of Studies



Dean - Academics

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22MA1101	<b>MATRICES AND CALCULUS</b> (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. Analyse and discuss the maxima and minima of the functions of several variables.
  4. Evaluate the multiple integrals and apply in solving problems.
  5. Apply vector differential operator for vector function and theorems to solve engineering problems.

Unit	Description	Instructional Hours
I	<b>Matrices</b> 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	<b>Single Variate Calculus</b> Rolle's Theorem–Lagrange's Mean Value Theorem–Maxima and Minima–Taylor's and Maclaurin's Series.	12
III	<b>Functions of Several Variables</b> Partial derivatives–Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers	12
IV	<b>Integral Calculus</b> 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	<b>Vector Calculus</b> Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.	12
<b>Total Instructional Hours</b>		<b>60</b>

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

- Course Outcome
- 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. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 9<sup>th</sup> Edition Addison Wesley Publishing Company, 2016.

T2: Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2019.

T3: K.P. Uma and S. Padma, "Engineering Mathematics I (Matrices and Calculus)", Pearson Ltd, 2022.

**REFERENCE BOOKS:**

R1- Jerrold E. Marsden, Anthony Tromba, "Vector Calculus", W.H. Freeman, 2003

R2- Strauss M.J, G.L. Bradley and K.J. Smith, "Multivariable calculus", Prentice Hall, 2002.

R3- Veeraranjan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.



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

The learner should be able to

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	<b>CHEMISTRY IN EVERYDAY LIFE</b> 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	<b>WATER TECHNOLOGY</b> 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. <b>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.</b>	6+9
III	<b>ELECTROCHEMISTRY AND CORROSION</b> 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. <b>Conductometric titration of strong acid vs strong base (HClvsNaOH). Estimation of Ferrous iron by Potentiometry.</b>	6+6
IV	<b>ENERGY SOURCES AND STORAGE DEVICES</b> 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 <sub>2</sub> -O <sub>2</sub> fuel cell applications.	6
V	<b>SPECTROSCOPY</b> 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
<b>Total Instructional Hours</b>		<b>45</b>

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	<b>ENGLISH FOR ENGINEERS</b> (Common to all Branches)	L	T	P	C
			2	0	2	3

The student should be able

- Course Objective
- To improve the communicative proficiency of learners.
  - To help learners use language effectively in professional writing.
  - To advance the skills of maintaining the suitable one of communication.
  - To introduce the professional life skills.
  - To impart official communication etiquette.

Unit	Description	Instructional Hours
I	<b>Language Proficiency:</b> Types of Sentences, Functional Units, Framing question. <b>Writing:</b> process description, Writing Checklist. <b>Vocabulary – words on environment.</b> <b>Practical Component: Listening-</b> Watching short videos and answer the questions, <b>Speaking-</b> Self introduction ,formal & semi-formal, <b>Reading-</b> Purpose of Reading - <b>Churning &amp; Assimilation, Interpreting Ideas - Interpreting Graphs in Technical Writing</b>	7+2
II	<b>Language Proficiency:</b> Tenses, Adjectives and adverbs. <b>Writing:</b> Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension. <b>Vocabulary– words on entertainment.</b> <b>Practical Component: Listening-</b> Comprehensions based on TED talks <b>Speaking-</b> Narrating a short story or an event happened in their life <b>Reading - Skimming – Scanning – Reading Scientific Texts – Literary Texts .</b>	7+2
III	<b>Language Proficiency:</b> Prepositions, phrasal verbs. <b>Writing:</b> Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. <b>Vocabulary – words on tools.</b> <b>Practical Component: Listening-</b> Listen to songs and answer the questions <b>Speaking-</b> Just a minute <b>Reading-</b> Reading feature articles (from newspapers and magazines) - <b>Reading to identify point of view and perspective (opinion pieces, editorials etc.)</b>	5+4
IV	<b>Language Proficiency:</b> Subject verb concord, Prefixes & suffixes. <b>Writing:</b> Preparing agenda & minutes, writing an event report. <b>Vocabulary– words on engineering process.</b> <b>Practical Component: Listening-</b> Comprehensions based on Talk of orators or interview shows <b>Speaking-</b> Presentation on a general topic with ppt. <b>Reading-</b> Reading Comprehension - <b>Techniques for Good Comprehension - Sequencing of Sentences</b>	5+4
V	<b>Language Proficiency:</b> Modal Auxiliaries, Active & passive voice, <b>Writing:</b> Project report (proposal & progress) ,sequencing of sentences <b>Vocabulary – words on engineering material</b> <b>Practical Component: Listening-</b> Listening- Comprehensions based on Nat Geo/Discovery channel videos <b>Speaking-</b> Preparing posters and presenting as a team <b>Reading-</b> Biographies, travelogues, technical blogs.	6+3
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome
- After completion of the course the learner will be able
- CO1: To communicate in a professional forum  
CO2: To speak or write a content in the proficient language  
CO3: To maintain and use appropriate one of the communication.  
CO4: To read, write and present in a professional way.  
CO5: To follow the etiquettes in formal communication.

**TEXTBOOKS:**

- T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016. T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

**REFERENCEBOOKS:**

- R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.  
R2- Raymond Murphy, "English Grammar in Use" - 4<sup>th</sup> edition Cambridge University Press, 2004.  
R3- Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-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
- To discuss the essence of software development methods
  - To gain knowledge about basic HTML Tags.
  - To create static websites using HTML.
  - To impart knowledge about Cascading Style sheet.
  - To design a front end web application using HTML and CSS

Unit	Description	Instructional Hours
I	Unit-1 Software Development Life Cycle Software Development Model -Waterfall Model- Incremental Process Models- Evolutionary Process Models- Spiral Model-Agile Software Development –Agile process-Agility principles-Introduction Github.	5
II	Unit-2 Hyper Text Markup Language-1 Web Essentials: Clients, Servers, Basic Terminologies-HTML Basic Tags – Elements - Attributes - Basic Formatting, Fonts and Colors-Hyperlink-Images- Tables - cell spanning, cell spacing- Table contents, Border. List –ordered List-Unordered List-Definition List. Illustrative problems: Designing a web page using HTML basic tags, Developing web site with suitable contents and links, Designing web pages using lists and tables, Designing a web page using images and embed an image map in a web page	(6+4)
III	Unit-3 Hyper Text Markup Language-II Frames-HTML Forms - Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box–HTML 5 features. Illustrative problems: Designing the Login form with username, password and submit field, Designing a course registration form.	(6+4)
IV	Unit-4 Cascading Style Sheet-I Introduction - CSS Syntax -Type of CSS Selector-Simple Selectors, Universal Selector, ID Selector, Class selector and Pseudo Classes – Style Specification Formats-Inline Style-Embedded Style sheet- External Style sheet. Illustrative problems: Developing a web application using internal, external and embedded style sheet, Applying style specification in HTML page using CSS.	(6+4)
V	Unit-5 Cascading Style Sheet-II Font properties-List properties- Background properties-Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border- Padding, Margin-CSS Layout- Normal Flow Layout-Relative positioning-Float positioning-Absolute positioning. Illustrative problems:Developing a web application using CSS Positioning.	(6+4)
<b>Total Instructional Hours</b>		<b>45</b>

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

- Course Outcome
- CO1 : 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
------	-------------	---------------------

**INTRODUCTION TO COMPUTERS**

- |   |                                                                                                                                                                                         |   |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| I | Computer Systems – Computing Environments – Computer Language – Creating and Running programs – Computer Numbering System – Storing Integers and Real Numbers – Algorithms - Flowchart. | 7 |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|

**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:**

- |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| II | <ul style="list-style-type: none"> <li>• The first line of the input consists of an integer – N, representing the total number of apples that Josh wants to buy.</li> <li>• 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.</li> <li>• 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.</li> </ul> | 10 |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|

**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.

**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**

- |     |                                                                                                                                                                                                |    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| III | Print N space-separated integers such that all the odd numbers of the list come after the even numbers<br>2) Given an integer matrix of size N x N. Traverse it in a spiral form. (Wipro 2022) | 10 |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|

**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)

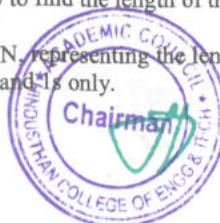
**Input**

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**

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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

#### 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 key =2, then 5 will be replaced by 7, "-"(minus sign) will remain as it is. Key value less than 0 should result into "INVALID INPUT". Write a function CustomCaesarCipher(int key, String message) which will accept plaintext and key as input parameters and returns its cipher text as output. (TCS NQT 2022)

Enter your PlainText: All the best

Enter the Key: 1

The encrypted Text is: BmmuifCftu

#### 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.

**Total Instructional Hours 45**

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.

Course  
Outcome

#### TEXT BOOKS:

T1: Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3<sup>rd</sup> edition, 2017.

#### REFERENCE BOOKS:

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

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

R3: YashvantKanetkar, "Exploring C", BPB Publishers, 2<sup>nd</sup> edition, 2003.

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

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

**The learner should be able**

- Course Objective
- To read and write simple Python programs.
  - To develop Python programs with conditionals and loops.
  - To define Python functions and call them.
  - To understand OOP concepts and write programs using classes and objects.
  - To do input/output with files in Python.

Unit	Description	Instructional Hours
I	<b>INTRODUCTION TO PYTHON</b> What is Python - Advantages and Disadvantages, Benefits and Limitation- Downloading and Python-installation-Python Versions-Running Python Scripts, Executing scripts with python launcher-Using interpreter interactively- Using variables-String types: normal, raw and Unicode-String operations and functions- Math operator and functions.Illustrative program: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	7+2
II	<b>DATA TYPES, STATEMENTS, CONTROL FLOW</b> Data Types(List, Tuple, string, dictionary, set)-Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if - else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass. Illustrative programs: Find the square root of a number, To find the given number is Prime or not, Write a Python program which accepts a sequence of comma-separated numbers from user, generate a list and find the sum and average of the numbers.	5+4
III	<b>PYTHON FUNCTIONS</b> Introduction to functions-Global and local variable in python-Decorators in python-Python lambda functions-Exception handling in python. Illustrative programs: Square root, GCD, exponentiation, linear search, binary search, Write a menu driven program to perform the following task: a) A function Sum_DigN( ) to find the sum of the digits of a given number, b) A recursive function Sum_DigR( ) to find the same.	5+4
IV	<b>PYTHON OOPS</b> Introduction to oops concept-Python class and objects-Constructor in python-Inheritance-Types of inheritance-Encapsulation in python-Polymorphism in python. Illustrative programs: Write a Python program using class for the calculation of telephone bill. The charges for the calls are fixed as follows: Unit Call Cost/unit Below 100 calls No Charge, only rental amount Rs. 250 100-150 calls Rs. 1.00 151-300 calls Rs. 2.50 301-600 calls Rs. 4.50 Above 600 Rs. 6.00	5+4
V	<b>FILES, PACKAGES</b> File handling in python-Open a file in python-How to read from a file in python-writing to file in python-Python numpy-Python pandas. Illustrative programs: How to display the contents of text file in reverse order? Write the code for the same, not exceeding 10 lines of code, Creating Modules and Packages for arithmetic Operations.	5+4
<b>Total Instructional Hours</b>		<b>45</b>

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

- Course Outcome
- CO1: Understanding the basic concepts to read, write and execute simple python programs.
  - CO2: Apply the conditional and looping concepts for solving problems.
  - CO3: Apply functions to decompose larger complex programs.
  - CO4: Understanding the OOPS concepts and writing programs using classes and objects
  - CO5: Understand to read and write data from/to files in Python Programs.

**TEXT BOOKS:**

T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

**REFERENCE BOOKS:**

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

  
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# 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

The students should be made

Course Objectives

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implication of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit

Description

Instructional Hours

I	<b>Introduction to Value Education</b> 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	<b>Harmony in the Human Being and Harmony in the Family</b> 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	<b>Harmony in the Family and Society</b> Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society	6
IV	<b>Harmony in the Nature / Existence</b> 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	<b>Implications of the Holistic Understanding – a Look at Professional Ethics</b> Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
<b>Total Instructional Hours</b>		<b>30</b>

Course Outcome

- At the end of the course, the learner will be able
- CO1: To become more aware of holistic vision of life - themselves and their surroundings.
- CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.
- CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.
- CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions.
- CO5: To develop competence and capabilities for maintaining Health and Hygiene.

**Reference Books:**

- R1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- R2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
- R3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- R4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

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rogramme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22HE1072	<b>ENTREPRENEURSHIP &amp; INNOVATION</b> (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  | <b>Entrepreneurial Thinking</b>                      |
| 2  | <b>Innovation Management</b>                         |
| 3  | <b>Design Thinking</b>                               |
| 4  | <b>Opportunity Spotting / Opportunity Evaluation</b> |
| 5  | <b>Industry and Market Research</b>                  |
| 6  | <b>Innovation Strategy and Business Models</b>       |
| 7  | <b>Financial Forecasting</b>                         |
| 8  | <b>Business Plans/ Business Model Canvas</b>         |
| 9  | <b>Entrepreneurial Finance</b>                       |
| 10 | <b>Pitching to Resources Providers / Pitch Deck</b>  |
| 11 | <b>Negotiating Deals</b>                             |
| 12 | <b>New Venture Creation</b>                          |
| 13 | <b>Lean Start-ups</b>                                |
| 14 | <b>Entrepreneurial Ecosystem</b>                     |
| 15 | <b>Velocity Venture</b>                              |

**TOTAL INSTRUCTIONAL HOURS 15**

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

**Course Outcome**

- CO1: Understand the nature of business opportunities, resources, and industries in critical and creative 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: Develop a business model for a new venture, including revenue. Margins, operations, Working capital, and investment

**TEXTBOOKS**

- T1: Arya Kumar "Entrepreneurship - Creating and Leading an Entrepreneurial Organization", Pearson, Second Edition (2012).
- T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition (2016).

**REFERENCEBOOKS**

- R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).
- R2: Thomas Lockwood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017).
- R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).

**WEBRESOURCES**

- W1: <https://blof.forgeforward.in/tagged/startup-lessons>
- W2: <https://blof.forgeforward.in/tagged/entrepreneurship>
- W3: <https://blof.forgeforward.in/tagged/minimum-viable-product>
- W4: <https://blof.forgeforward.in/tagged/minimum-viable-product>
- W5: <https://blof.forgeforward.in/tagged/innovation>

  
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Programme	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	<b>Language and Literature</b> 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	<b>Heritage _ Rock Art Paintings to Modern Art – Sculpture</b> 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	<b>Folk and Martial Arts</b> Therukoothu, Karagattam, Villupattu, Kaniyan koothu, Oyilattam, Leather puppetry, Silambattam., Valari Tiger dance – Sports and Games of Tamils. <b>Thinai Concept of Tamils</b>	6
IV	Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Export and Import during Sangam age – Overseas conquest of Cholas. <b>Contribution of Tamils to Indian National Movement and Indian Culture</b>	6
V	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
<b>Total Instructional Hours</b>		<b>30</b>

**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.  
CO3: Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.  
CO4: Appreciate the intricacies of Tamil literature that had existed in the past.  
CO5: Understand the contribution of Tamil Literature to Indian Culture

**TEXTBOOKS:**

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

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

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Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE1073	INTRODUCTION TO SOFT SKILLS	1	0	0	1
<b>Course Objectives:</b>	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	<b>Lessons on excellence</b> Skill introspection, Skill acquisition, consistent practice					2
II	<b>Logical Reasoning</b> Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail					11
III	<b>Quantitative Aptitude</b> 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	<b>Recruitment Essentials</b> Resume Building - Impression Management					2
V	<b>Verbal Ability</b> Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement - Punctuations					4
<b>Total Instructional Hours</b>					30	
<b>Course Outcome:</b>	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.				



*(Signature)*

**SUBJECT CODE – 22MC1093**

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**அலகு I மொழி மற்றும் இலக்கியம்:**

3

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

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

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

3

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

**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:**

3

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

விளையாட்டுகள்.

**அலகு IV தமிழர்களின் திணைக்கோட்பாடுகள்:**

3

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

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:**

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச 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. பொருதை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.



  
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**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	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

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

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	1	1	1	-	1	-	1	2	-	-
CO2	2	3	2	1	1	1	1	-	1	-	1	2	-	-
CO3	2	2	2	2	1	1	1	-	1	-	1	2	-	-
CO4	2	2	3	1	2	1	1	-	1	-	2	2	-	1
CO5	2	3	3	2	2	1	1	-	1	-	1	2	-	-
Avg	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	0	1

Course Code & Name: 22HE1151 / ENGLISH FOR ENGINEERS

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

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

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	2			3	2		3	3	3	2	
C02	3	2	2	2	2				2					2
C03	2	2	2	2			2			3	3	3	2	2
C04	3	3	2		2			2				4	2	
C05	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	PO10	PO11	PO12	PSO1	PSO2
C01	2	3	3	-	2	-	-	-	-	-	-	2	2	2
C02	2	3	3	-	2	-	-	-	2	-	-	2	2	2
C03	2	3	3	-	2	-	-	-	2	-	-	2	2	2
C04	2	3	3	-	2	-	-	-	2	-	-	2	2	2
C05	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	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3			1	2					1	2	1
C02	3	3	3	1	2	1	2				1	1	2	2
C03	3	2	3	2	1		2		1		2	2	2	2
C04	3	3	3	1		1	2		1			2	2	3
C05	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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2			3	2		3	3	3	2	
CO2	3	2	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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	0	1	0	1	1	3	1	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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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: 21CSS201/ Theory of Computing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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: 21CSS202/ Computer Networks

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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: 21ECS231 / Principles of Microprocessors and Microcontrollers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3			3	1		2	2	1	2
CO2	3	3	3	2	3			3	1		2	2	2	2
CO3	3	2	3	2	3			3	1		2	2	2	2
CO4	3	3	3	2	3			3	1		2	2	2	2
CO5	3	3	3	2	3			3	1		2	2	2	2
Avg	3	2.8	3	2	3	0	0	3	1	0	2	2	2	2

Course Code & Name: 21CS5252/ Object Oriented Analysis And Design

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



Course Code & Name: 21CSS5351 Internet and Web Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	2	2	1		2	3		3	2	
C02	3	3	3	3	2	2	1			3		3		2
C03	3	3	3	3	2	1	1		1	3		3	2	2
C04	3	3	3	3	2	1			1	3		3		3
C05	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: 21CSS5352 Advanced Java Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	1	0	0	3	0	0	0	0	0	2	2	1	2
C02	3	1	3	0	3	0	0	0	1	0	0	1	1	2
C03	3	1	2	0	3	0	0	0	0	1	0	3	0	1
C04	1	1	3	0	0	0	0	0	1	0	1	1	0	1
C05	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: 21CSS5353 Fundamentals of Open Source Software

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	0	0	3	0	0	0	0	0	2	2	1	2
C02	3	1	3	0	3	0	0	0	1	0	0	1	1	2
C03	3	3	2	0	3	0	0	0	0	1	0	3	0	1
C04	1	1	3	0	0	0	0	0	1	0	1	1	0	1
C05	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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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 <sup>10</sup>	PO <sup>11</sup>	PO <sup>12</sup>	PSO <sup>1</sup>	PSO <sup>2</sup>
PO1	3	2	2										3	2
PO2	3		2			2							3	2
PO3		1	2	2										3
PO4	3		2									2		3
PO5	1	3	3	3								2		3
PO6	2	1.2	2.2	1	0	0.4	0	0	0	0	0	0.8	1.2	2.6
Avg														

Course Code & Name: 19CS7202 Cloud Computing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO <sup>10</sup>	PO <sup>11</sup>	PO <sup>12</sup>	PSO <sup>1</sup>	PSO <sup>2</sup>
PO1	3	2	3	1			2	2	1		1	2	2	3
PO2	3	2	3	1			2	2	1		1	2	2	3
PO3	3	2	3	2			2	2	1		2	2	2	3
PO4	3	2	3	1			2	2	1		1	2	2	3
PO5	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 <sup>10</sup>	PO <sup>11</sup>	PO <sup>12</sup>	PSO <sup>1</sup>	PSO <sup>2</sup>
PO1	3			3		1	1	1	1	1	3	3	3	3
PO2	3	3	2	3	3	1		1	1	1	3	3	3	3
PO3	3	3	2	3	3	1		1	1	1	3	3	3	3
PO4	3	3	2	3	2	1		1	1	1	3	3	3	3
PO5	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	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	0	0	0	0	0	0	1	1	2
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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	1	0	2	0	0	0	2	0	0	1	1	0
C02	3	2	1	0	2	0	0	1	2	0	0	2	1	1
C03	3	3	1	0	2	0	0	1	2	0	0	1	1	1
C04	3	2	1	0	0	0	0	1	0	0	0	2	1	1
C05	3	1	1	0	2	0	0	0	2	0	0	1	1	0
Avg <sup>e</sup>	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	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	1	0	0	0	0	0	0	2	3	3	2	1
C02	3	2	1	2	1	0	0	0	0	1	3	1	3	0
C03	3	2	1	1	1	0	0	0	0	2	0	2	1	0
C04	3	2	1	0	0	0	0	0	0	1	1	1	2	1
C05	3	2	1	0	0	0	0	0	0	2	1	1	1	0
Avg <sup>e</sup>	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	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	1	0	1	0	0	0	0	1	3	0	1	1
C02	2	2	1	0	1	1	0	1	0	0	3	1	3	0
C03	3	3	1	0	1	1	0	1	0	0	0	2	1	1
C04	1	2	1	0	0	1	0	1	0	0	1	1	2	1
C05	3	2	1	0	0	0	0	0	0	0	1	1	1	0
Avg <sup>e</sup>	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	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	0	0	0	3	0	3	0	1	2
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	PO10	PO11	PO12	PSO1	PSO2
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	PO10	PO11	PO12	PSO1	PSO2
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







		21EC5231 –Principles of Microprocessors and Micro Controllers	3	2	2	2	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	3	3	0	1			2	2		
		19CS53XX -Professional Elective I																	
		21CS5001 – Engineering Clinic	3	2	2	2	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	2	2	0	1	1	0	2	2	2	1	0
		21HE5071-Soft Skills - I																	
		21HE5072-Design Thinking																	
		19CS7201 - Cryptography and Network Security	2	1.2	2.2	1	0	0.4	0	0	0	0	0	0	0	0	0.8	1.2	2.6
		19CS7202 – Cloud Computing	3	2	3	1.2	0	0	2	2	2	1	1	0	1.2	2	2	2	3
		19XX7401 -Open Elective – II																	
		19CSXXXX - Professional Elective-III																	
IV	VII	19CS7251 – Machine Learning Techniques	3	3	2	3	2.25	1	1	1	1	1	1	1	1	3	3	3	3
		19CS7001 – Cloud Computing Laboratory	3	2	1	1	2	0	0	0	0	1	1	0	0	0	1	1	1
		19CS7002 – Security Laboratory	2.8	2.8	1.6	2	2.8	2.8	2.8	1	1.2	2.2	0	2	2	2.6	2	2	1.8
		19CS7901 – Project Phase I	3	2	2	2	2	2	2	0	1	1	0	2	2	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	
<b>I</b>	<b>V</b>	21CS5351 – Internet and Web Technology	3	3	3	2	1.4	0	1	3	0	0	0	3	1.2	1.4	
		21CS5352 – Advanced Java Programming	3	1	2	0	2	0	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	0	1	2	1	1
		21CS5354 – R Programming	3	1	1	1	1	0	0	1	0	1	0	1	1	1	0
		21CS5355 – Computer Graphics and Multimedia	1.7	2.3	3	3	2	0	0	0	0	0	2	2	2	2.3	2.8
<b>III</b>	<b>VII</b>	19CS7301 - Multi-core Architecture and Programming	3	2	1	0	2	0	0	0	1	2	0	0	1	1	
		19CS7302 – Cyber Forensics	3	2	1	1	0	0	0	0	0	0	2	2	2	2	0
		19CS7303 – Wireless Sensor Networks	2	2	1	0	1	1	0	0	0	0	0	2	1	2	1
		19CS7304 - C# and .Net Programming	3	2	2	2	2	0	1	1	0	1	0	2	2	1	0
		19CS7305 – Software Testing	3	2	1	1	0	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**