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.TECH. INFORMATION TECHNOLOGY

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

Curriculum & Syllabus

2020-2021

CHOICE BASED CREDIT SYSTEM

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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IT - HiCET

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Dean (Academics)
HiCET

VISION AND MISSION OF THE DEPARTMENT

VISION

To develop IT Professionals of the best caliber with entrepreneurship zeal

MISSION

To achieve the vision of the department with sustained efforts to,

DM1: To establish a best learning environment that helps the students to face the challenges of information technology field.

DM2: To enable students develop skills to solve technical problems and also endorse collaborative and multidisciplinary activities through curricular, co-curricular and extra-curricular activities.

DM3: To increase the visibility of academic programs at all level and fascinate talent to meet entrepreneurship skills.

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/Development Of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct Investigations Of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The Engineer And Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment And Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics**: Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.

PO9: **Individual And Team Work**: Function effectively as an individual, and as amember or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give andreceive clear instructions.

PO11: **Project Management And Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO 1: Able to Design and develop software solutions by employing appropriate problem solving strategies, including Logically thinking, Create a user interface, Write code to connect a front end user interface with a backend database using a contemporary object-oriented language.

PSO 2: Ability to design and develop mobile applications and Web based Applications with testing skills, which consequently leads to employability and entrepreneurship skills.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 Graduates of the program will be proficient in identifying, formulating and solving complex problems by applying their knowledge of mathematics, science and Information Technology principles.

PEO 2 Graduates of the program will be capable of analyzing, designing, implementing and managing software projects through continuous learning and use modern tools to meet real-world constraints.

PEO 3 Graduates of the program exhibits professionalism with ethical attitude, communication, team work and will contribute to society needs.

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CURRICULUM

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. INFORMATION TECHNOLOGY (UG)

REGULATION-2019

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

SEMESTER – I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1101R	Calculus	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	19EC1154	Basics of Electron Devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
8	19HE1072	**Career Guidance Level – I** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
9	19HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
Total :				**16**	**2**	**10**	**20**	**550**	**350**	**900**
As Per AICTE Norms 3 Weeks Induction Programme is Added in the First Semester as an Audit Course										

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SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2104	Differential Equations and Linear Algebra	BS	3	1	0	4	25	75	100
3	19IT2151	Programming in C	ES	2	0	2	3	50	50	100
4	19ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
THEORY WITH LAB COMPONENT										
5	19PH2151	Material Science	BS	2	0	2	3	50	50	100
6	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9	19HE2072	**Career Guidance Level – II** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
Total:				**14**	**2**	**16**	**22**	**500**	**400**	**900**

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

ICC. No.	Sem. No	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
ICC1	**I**	**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	50	50	100
ICC8	VI	19CS6306	Development of Machine Learning Models	3	0	0	3	25	75	100
ICC9	VII	19CS7306	AI Analyst	3	0	0	3	25	75	100

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER III

S. No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19IT3201	Data Structures and Algorithm Design	PC	3	0	0	3	25	75	100
2	19IT3202	Object Oriented Programming Using C++	PC	3	0	0	3	25	75	100
3	19IT3203	Computer Organization and Architecture	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										

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4	19MA3151	Statistics and Queuing Theory	BS	3	0	2	4	50	50	100
5	19IT3251	Digital Principles and System Design	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19IT3001	Data Structures and Algorithm Laboratory	PC	0	0	3	1.5	50	50	100
7	19IT3002	Object Oriented Programming using C++ Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
Total:				**17**	**0**	**10**	**20**	**375**	**425**	**800**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA4102	Discrete Mathematics	BS	3	1	0	4	25	75	100
2	19IT4201	Java Programming	PC	3	0	0	3	25	75	100
3	19IT4202	Database Management Systems	PC	3	0	0	3	25	75	100
4	19IT4203	Principles of Operating Systems	PC	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
5	19IT4251	Object Oriented Software Engineering	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19IT4001	Java Programming Laboratory	PC	0	0	3	1.5	50	50	100
7	19IT4002	Database Management System Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19MC4191	Essence of Indian Tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
Total:				**17**	**2**	**8**	**21**	**350**	**450**	**800**

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19IT5201	Mobile Computing	PC	3	0	0	3	25	75	100
2	19IT5202	Computer Networks	PC	3	0	0	3	25	75	100
3	19IT5203	Microcontrollers and Embedded Systems	PC	3	0	0	3	25	75	100
4	19IT5204	Artificial Intelligence and Machine Learning	PC	3	0	0	3	25	75	100
5	19IT5205	Data Warehousing and Data Mining	PC	3	0	0	3	25	75	100
6	19IT53XX	Professional Elective-I	PE	2	0	2	3	50	50	100

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PRACTICALS										
7	19IT5001	Machine Learning Laboratory	PC	0	0	3	1.5	50	50	100
8	19IT5002	Mobile Application Development Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19HE5071	Soft Skills – I	EEC	1	0	0	1	100	0	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
Total:				**19**	**0**	**8**	**23**	**475**	**525**	**1000**

SEMESTER VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19IT6181	Software Project Management	HS	3	0	0	3	25	75	100
2	19IT6201	Internet of Things	PC	3	0	0	3	25	75	100
3	19IT6202R	Principles of Compiler Design	PC	3	0	0	3	25	75	100
4	19IT63XX	Professional Elective II	PE	3	0	0	3	25	75	100
5	19XX64XX	Open Elective I	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENTS										
6	19IT6251	Cryptography and Network Security	PC	3	0	2	4	50	50	100
PRACTICALS										
7	19IT6001	Internet of Things Laboratory	PC	0	0	3	1.5	50	50	100
8	19IT6002	Hardware and Software Clinic	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19IT6701	Internship/Industrial Training	EEC	0	0	0	1	100	0	100
10	19HE6071	Soft Skills – II	EEC	1	0	0	1	100	0	100
11	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
Total:				**20**	**0**	**8**	**25**	**575**	**525**	**1100**

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	19IT5351R	Internet and Web Technology	PE	2	0	2	3	50	50	100
2	19IT5352	Advanced Java Programming	PE	2	0	2	3	50	50	100
3	19IT5353	C# and .Net Programming	PE	2	0	2	3	50	50	100
4	19IT5354	Advanced Data Structure	PE	2	0	2	3	50	50	100
5	19IT5355	Advanced Database Technology	PE	2	0	2	3	50	50	100
6	19IT5356	Ethical Hacking	PE	2	0	2	3	50	50	100
PROFESSIONAL ELECTIVE II										
1	19IT6301	Business Intelligence and Analysis	PE	3	0	0	3	25	75	100
2	19IT6302	Information Security	PE	3	0	0	3	25	75	100
3	19IT6303	Software Design	PE	3	0	0	3	25	75	100
4	19IT6304	Natural Language Processing	PE	3	0	0	3	25	75	100
5	19IT6305	Soft Computing	PE	3	0	0	3	25	75	100
6	19IT6307	Virtual Reality and Augmented Reality	PE	3	0	0	3	25	75	100

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OPEN ELECTIVE

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	19IT6401	Cyber Security and Forensics	3	0	0	3	25	75	100

REGULATION-2016

For the students admitted during the academic year 2018-2019 and onwards
SEMESTER V

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16IT5201	Computer Networks	3	0	0	3	25	75	100
2	16IT5202	Web Technology	3	0	0	3	25	75	100
3	16IT5203	Information Security	3	0	0	3	25	75	100
4	16IT5204	Theory Of Computation	3	0	0	3	25	75	100
5	16IT53XX	**Professional Elective-I**	3	0	0	3	25	75	100
6	16IT5001	Network Laboratory	0	0	4	2	50	50	100
7	16IT5002	Web Technology Laboratory	0	0	4	2	50	50	100
8	16IT5701	Technical Seminar	0	0	4	2	50	50	100
Total:			**15**	**0**	**12**	**21**	**275**	**525**	**800**

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16IT6201	Mobile Computing	3	0	2	4	50	50	100
2	16IT6202	Microcontrollers and Embedded Systems	3	0	0	3	25	75	100
3	16IT6203	Software Testing and Quality Assurance	3	0	0	3	25	75	100
4	16IT6204	Professional ethics	3	0	0	3	25	75	100
5	16IT63XX	**Professional Elective II**	3	0	0	3	25	75	100
6	16XX64XX	**Open Elective I**	3	0	0	3	25	75	100
7	16IT6001	Embedded Systems Laboratory	0	0	4	2	50	50	100
8	16IT6002	Open Source Software Laboratory	0	0	4	2	50	50	100

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9	16IT6801	Mini Project	0	0	6	3	50	50	100
Total:			**18**	**0**	**16**	**26**	**325**	**575**	**900**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – I									
1	16IT5301	Graphics and Multimedia	3	0	0	3	25	75	100
2	16IT5302	Soft Computing	3	0	0	3	25	75	100
3	16IT5303	System Software	3	0	0	3	25	75	100
4	16IT5304	High Speed Networks	3	0	0	3	25	75	100
5	16IT5305	Data Warehousing and Data Mining	3	0	0	3	25	75	100
6	16IT5306	Software Design Patterns	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE – II									
1	16IT6301	Multimedia Communications	3	0	0	3	25	75	100
2	16IT6302	Artificial Intelligence	3	0	0	3	25	75	100
3	16IT6303	Compiler Design	3	0	0	3	25	75	100
4	16IT6304	Cryptography and Network Security	3	0	0	3	25	75	100
5	16IT6305	Business Intelligence	3	0	0	3	25	75	100
6	16IT6306	Human Computer Interface	3	0	0	3	25	75	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16IT6401	Cyber Security and Forensics	3	0	0	3	25	75	100

For the students admitted during the academic year 2017-2018 and onwards

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16IT7201	Data Analytics	3	0	0	3	25	75	100
2	16IT7202	Distributed And Cloud Computing	3	0	0	3	25	75	100
3	16IT7203	Internet of Things	3	0	0	3	25	75	100
4	16IT73XX	**Professional Elective III**	3	0	0	3	25	75	100
5	16IT73XX	**Professional Elective IV**	3	0	0	3	25	75	100
6	16XX74XX	**Open Elective II**	3	0	0	3	25	75	100

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7	16IT7001	Application Development Laboratory	0	0	4	2	50	50	100
8	16IT7002	Distributed and Cloud Computing Laboratory	0	0	4	2	50	50	100
9	16IT7901	Project Work - Phase I	0	0	4	2	50	50	100
Total:			**18**	**0**	**12**	**24**	**300**	**600**	**900**

SEMESTER VIII

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16IT83XX	Professional Elective V	3	0	0	3	25	75	100
2	16IT83XX	Professional Elective VI	3	0	0	3	25	75	100
3	16IT8902	Project Work – Phase II	0	0	20	10	100	100	200
Total:			**6**	**0**	**20**	**16**	**150**	**250**	**400**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – III									
1	16IT7301	Multimedia Design and Storage	3	0	0	3	25	75	100
2	16IT7302	Knowledge Based Decision Support System	3	0	0	3	25	75	100
3	16IT7303	Computer Hardware and Peripherals	3	0	0	3	25	75	100
4	16IT7304	Wireless Security	3	0	0	3	25	75	100
5	16IT7305	Social Network Analysis	3	0	0	3	25	75	100
6	16IT7306	Service Oriented Architecture	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE – IV									
1	16IT7307	Digital Image Processing	3	0	0	3	25	75	100
2	16IT7308	Genetic Algorithms	3	0	0	3	25	75	100
3	16IT7309	Advanced Data Structures	3	0	0	3	25	75	100
4	16IT7310	Wireless Communication	3	0	0	3	25	75	100
5	16IT7311	Semantic Web	3	0	0	3	25	75	100
6	16IT7312	Software Project Management	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE – V									
1	16IT8301	Virtual and Augmented Reality	3	0	0	3	25	75	100
2	16IT8302	Natural Language Processing	3	0	0	3	25	75	100
3	16IT8303	Advanced Database Technology	3	0	0	3	25	75	100

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4	16IT8304	Mobile and Adhoc Networks	3	0	0	3	25	75	100
5	16IT8305	Media Analytics	3	0	0	3	25	75	100
6	16IT8306	Enterprise Resource Planning	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE – VI									
1	16IT8307	Multimedia Mining	3	0	0	3	25	75	100
2	16IT8308	Speech Processing	3	0	0	3	25	75	100
3	16IT8309	Information Storage and Retrieval	3	0	0	3	25	75	100
4	16IT8310	Pervasive Computing	3	0	0	3	25	75	100
5	16IT8311	Grid Computing	3	0	0	3	25	75	100
6	16IT8312	E-Commerce	3	0	0	3	25	75	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16IT7402	Web Development Essentials	3	0	0	3	25	75	100

CREDIT DISTRIBUTION – R2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	23	25	21	26	24	16	**187**

CREDIT DISTRIBUTION – R2020

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	23	25	20	14	**165**

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Chairman, Board of Studies

Chairman - BoS
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Dean – Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College of Engineering & Technology
COIMBATORE - 641 032

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

1. To facilitate students to communicate effectively with coherence.
2. To train the learners in descriptive communication.
3. To introduce professional communication.
4. To enhance knowledge and to provide the information on corporate environment.
5. To equip the trainers with the necessary skills on critical thinking

Unit	Description	Instructional Hours
I	**Listening and Speaking** – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) Reading – Reading articles from newspaper, reading comprehension Writing Chart analysis, process description, Writing instructions **Grammar and Vocabulary-** Tenses, Regular and irregular verb, technical vocabulary	9
II	**Listening and Speaking-** listening to product description, equipment & work place (purpose, appearance, function) Reading- Reading technical articles Writing- Letter phrases, writing personal letters, **Grammar and Vocabulary**-articles, Cause & effect, Prepositions.	9
III	**Listening and Speaking-** listening to announcements Reading- Reading about technical inventions, research and development Writing- Letter inviting a candidate for interview, Job application and resume preparation **Grammar and Vocabulary-** Homophones and Homonyms.	9
IV	**Listening and Speaking-**Practice telephone skills and telephone etiquette (listening and responding, asking questions). Reading-Reading short texts and memos Writing-invitation letters, accepting an invitation and declining an invitation **Grammar and Vocabulary-** Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.	9
V	**Listening and Speaking-** listening to technical group discussions and participating in GDs Reading- reading biographical writing - Writing- Proposal writing, Writing, definitions, **Grammar and Vocabulary-** Abbreviation and Acronym, Prefixes &suffixes, phrasal verbs.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, —Business Benchmark-Pre-intermediate to Intermediatel, Cambridge University Press, 2016.
T2- Raymond Murphy, —Essential English Grammarl, Cambridge University Press, 2019.

REFERENCE BOOKS:

R1- Meenakshi Raman and Sangeetha Sharma. —Technical Communication- Principles and Practicel, Oxford University Press, 2009.
R2- Raymond Murphy, —Enlgish Grammar in Usel- 4th edition Cambridge University Press, 2004.
R3- Kamalesh Sadanan —AFoundation Course for the Speakers of Tamil-Part-I &III, Orient Blackswan, 2010.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19MA1101R	CALCULUS (COMMON TO CSE, IT& AI)	3	1	0	4

Course Objective

1. Understand the concept of differentiation
2. Evaluate the functions of several variables which are needed in many branches of engineering.
3. Understand the concept of double integrals.
4. Understand the concept of triple integrals.
5. Interpret in the area of infinite series and their convergence

Unit	Description	Instructional Hours
	DIFFERENTIAL CALCULUS	
I	Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12
	MULTIVARIATE CALCULUS (DIFFERENTIATION)	
II	Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives	12
	DOUBLE INTEGRATION	
III	Double integrals in Cartesian coordinates– Area enclosed by the plane curves (excluding surface area)– Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parellopiped	12
	TRIPLE INTEGRATION	
IV	Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped	12
V	**SEQUENCES & SERIES Sequences:** Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test and D'Alembert's ratio test – Alternating series – Leibnitz's test — Absolute and conditional convergence.	12
	TOTAL INSTRUCTIONAL HOURS	60

Course Outcome

CO1: Apply the concept of differentiation in any curve.
CO2: Identify the maximum and minimum values of surfaces
CO3: Apply double integrals to compute area of plane curves
CO4: Evaluation of triple integrals to compute volume of solids
CO5: Evaluation of infinite series approximations for problems arising in mathematical modeling

TEXT BOOKS:

T1 - Erwin Kreyszig, —Advanced Engineering Mathematics, 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
T2 - Veerarajan T, —Engineering Mathematics, McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS:

R1- Thomas & Finney — Calculus and Analytic Geometry, Sixth Edition, Narosa Publishing House, New Delhi.
R2 - Weir,M.D and Joel Hass, ' Thomas Calculus" 12th Edition, Pearson India 2016.
R3 - Grewal B.S, —Higher Engineering Mathematicsl, 42nd Edition, Khanna Publications, Delhi, 2012.

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SYLLABUS

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19PH1151	APPLIED PHYSICS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

The student should be able to

1. Enhance the fundamental knowledge in properties of matter
2. Analysis the oscillatory motions of particles
3. Extend the knowledge about wave optics
4. Gain knowledge about laser and their applications
5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER** Elasticity – Hooke's law – Stress-strain diagram – Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment.	6
	Determination of Young's modulus by uniform bending method	3
II	**OSCILLATONS** Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment.	6
	Determination of Rigidity modulus – Torsion pendulum.	3
III	**WAVE OPTICS** Conditions for sustained Interference – air wedge and its applications - Diffraction of light – Fresnel and Fraunhofer diffraction at single slit –Diffraction grating –Rayleigh's criterion of resolution power - resolving power of grating.	6
	Determination of wavelength of mercury spectrum – spectrometer grating	3
	Determination of thickness of a thin wire – Air wedge method	3
IV	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd: YAG laser and CO2 laser- Laser Applications – Holography – Construction and reconstruction of images.	6
	Determination of Wavelength and particle size using Laser	3
V	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors– Temperature and displacement sensors.	6
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome

After completion of the course the learner will be able to

CO1: Illustrate the fundamental properties of matter
CO2: Discuss the Oscillatory motions of particles
CO3: Analyze the wavelength of different colors
CO4: Understand the advanced technology of LASER in the field of Engineering
CO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

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REFERENCE BOOKS:

R1 - Arthur Beiser —Concepts of Modern Physicsl Tata McGraw Hill, New Delhi – 2015
R2 - M.N Avadhanulu and PG Kshirsagar —A Text Book of Engineering physicsl S. Chand and Company ltd., New Delhi 2016
R3 - Dr. G. Senthil Kumar —Engineering Physics – II VRB publishers Pvt Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech	19CY1151	CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques.
2. The principles of polymer chemistry and engineering applications of polymers and composites.
3. The principles of electrochemistry and with the mechanism of corrosion and its control.
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
5. The important concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	**WATER TECHNOLOGY** Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. **Estimation of total, permanent and temporary hardness of water by EDTA.**	6 +3=9
II	**POLYMER & COMPOSITES** Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
III	**ELECTROCHEMISTRY AND CORROSION** Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4. Estimation of Ferrous iron by Potentiometry.**	6+9 =15
IV	**ENERGY SOURCES AND STORAGE DEVICES** Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	6
V	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principle – instrumentation (block diagram only) – 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. **Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).**	6+3
	Total Instructional Hours	**45**

Course Outcome

CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life

CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.

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: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCE BOOKS

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19CS1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objective

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

Unit	Description	Instructional Hours
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	5
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments;modules and functions, function definition and use, flow of execution, parameters and arguments. *Illustrative programs: exchange the values of two variables, circulate the values of n variables,distance between two points.*	4 5
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. *Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.*	4 5 4
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; *Illustrative programs: selection sort, insertion sort, mergesort, histogram.*	5 4
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages. *Illustrative programs: word count, copying file contents.*	9
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome

CO1: Develop algorithmic solutions to simple computational problems
CO2: Read, write, execute by hand simple Python programs
CO3: Structure simple Python programs for solving problems and Decompose a Python program into functions
CO4: Represent compound data using Python lists, tuples, dictionaries
CO5: Read and write data from/to files in Python Programs.

TEXT BOOKS:

T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.6.2, Shroff Publishers, First edition (2017).
T2:S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019

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REFERENCE BOOKS:

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

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19EC1154	BASICS OF ELECTRON DEVICES AND ELECTRIC CIRCUITS	2	0	2	3

Course Objective

1. To introduce the fundamental concepts of electrical circuits and theorems.
2. To introduce the concept of circuit transients and resonance.
3. To understand the basics theory, operational characteristics of diodes and transistors.
4. To study the operating principles of special semiconductor devices.
5. To create awareness on the methods for electrical safety and protection.

Unit	Description	Instructional Hours
I	**ELECTRICAL CIRCUITS AND ANALYSIS** Ohm's law, DC and AC circuits fundamentals, Kirchhoff's laws, Mesh and Nodal Analysis-Theorems and simple problems: Superposition, Maximum power transfer theorem - **Experimental study -Verification of superposition theorem.**	6+3
II	**CIRCUIT TRANSIENTS AND RESONANCES** Basic RL, RC and RLC circuits and their responses to DC and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor. Experimental verification of series resonance. **Experimental study-Determination of Resonance Frequency of Series RLC Circuits**	6+3
III	**DIODE AND TRANSISTOR** Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect– Zener Voltage Regulator. Bipolar Junction Transistor (BJT) Construction – CB, CE, CC Configurations and Characteristics- **Experimental study-PN Junction Diode Characteristics, Zener Diode Characteristics**	6+3
IV	**SPECIAL SEMICONDUCTOR DEVICES** Construction, Characteristics and Applications of FET - UJT – SCR, Photo diode, Photo Transistor - LED and LCD- Implementation of Photo diode application. **Experimental study- FET Characteristics**	6+3
V	**BASICS OF POWER SUPPLY AND ELECTRICAL WIRING** Introduction to Power supply circuits: Half wave, Full wave Rectifier –SMPS - UPS (online & offline). Cable and wire types and applications – Two way and three-way control- **Experimental study- Implementation of simple wiring circuit for a Computer network.**	6+3
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome

CO1:Apply network theorems for AC and DC Circuits.
CO2:Understand the concept of transient response of circuits.
CO3:Ability to explain the theory, construction, and operation of diodes and BJT.
CO4:Ability to explain the theory, construction, and operation of FET and special

TEXT BOOKS:

T1 -W David A. Bell, Electronic Devices and Circuitsl, Oxford University Press, 5Th Edition, (2008).

T2 -Sudhakar A and Shyam Mohan SP, —Circuits and Network Analysis and Synthesis, Tata McGraw Hill, (2007).

REFERENCE BOOKS:

R1- M.Robert T. Paynter, Introducing Electronics Devices and Circuitsl, Pearson Education, 7th Education, (2006).
R2-J. Millman &Halkins, Satyebranta Jit, Electronic Devices &Circuits, Tata McGraw Hill, 2nd Edition, 2008
R3 -William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, —Engineering Circuit Analysis, Tata McGraw Hill, 6th Edition, 2002.
R4 -Robert Boylestad and Louis Nashelsky,Electron Devices and Circuit Theory Prentice Hall, 10th edition, July 2008

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

- ✓ To enhance student language competency
- ✓ To identify individual students level of communication skills
- ✓ To develop English Vocabulary and spoken communication skills.
- ✓ To revive the fundamentals of English Grammar.

Unit	Description	Instructional Hours
I	**Listening** Language of Communication- English listening- Hearing Vs Listening- Verbal and Non-verbal communication – Listening strategies-Sounds of English.	3
III	**Reading** English Language Enhancement – Indianism in English – Role of Reading in effective communication – Techniques for good reading (skimming and scanning) Reading articles from newspaper, magazine. Reading and interpreting a passage.	3
III	**Speaking** Common errors in Pronunciation – Signposts in English (Role play) – Public Speaking skills – Social Phobia – Eliminating fear – Common etiquette of speaking - Debate and Discuss.	3
IV	**Writing** Writing genre – Enhancement of basic English Vocabulary; Parts of Speech, Noun, Verbs, and Tenses – combining sentences, sentence formation and completion.	3
V	**Art of Communication** Communication process – Word building and roleplay – Exercise on English Language for various situations through online and offline activities.	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma,9th edition,Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.
3. High School English Grammar by Wren and Martin,S.CHAND Publications, 1 January 2017.
4 Practical course in Spoken English by J.K. Gangal,PHI Learning , Second edition, 1 January 2018.

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Programme	Course code	Name of the Course	L	T	P	C
B.TECH.	19HE1072	CAREER GUIDANCE – LEVEL I PERSONALITY, APTITUDE AND CAREER DEVELOPMENT	2	0	0	0

Course Objectives:

1. Introduce students to building blocks of Logical reasoning and Quantitative Aptitude [SLO1]
2. Train students on essential grammar for placements [SLO2]
3. Introduce students on scientific techniques to pick up skills [SLO3]
4. Provideanorientationforrecruiterexpectationintermsofnon-verbalskills,andforhowtobuildone'scareer with placements in mind [SLO4]

Expected Course Outcome:

Enable students to approach learning Aptitude with ease, and understand recruiter expectation.

Student Learning Outcomes (SLO): 1, 2, 3 and 4

Module:1 **Lessons on excellence** **1 hour** **SLO:** 3

Skill introspection, Skill acquisition, consistent practice

Module:2 **Logical Reasoning** **7 hours** **SLO:** 1

Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles

Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail

Picture and word driven Qs to develop attention to detail as a skill

Module:3 **Quantitative Aptitude** **8 hours** **SLO:** 1

Speed Maths

- 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

Module:4 **Recruitment Essentials** **1 hour** **SLO:** 4

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Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's careerachievements
- How a resume lookslike?
- An effective resume vs. a poor resume: what skills you must build starting today andhow?

Impression Management

Getting it right for the interview:

- Grooming,dressing
- Body Language and other non-verbalsigns
- Displaying the rightbehaviour

Module:5 Verbal Ability **3 hours** **SLO:** 2

Essential grammar for placements:

- Nouns andPronouns
- Verbs
- Subject-VerbAgreement
- Pronoun-AntecedentAgreement
- Punctuations

Verbal Reasoning

Total Lecture hours: **20 hours**

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

Recommended by Board of Studies

Approved by Academic Council Date

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19HE1073	ENTREPRENEURSHIP & INNOVATION	1	0	0	0

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 itsimportance.

Module	Description	Instructional Hours
1	Entrepreneurial Thinking	
2	Innovation Management	
3	Design Thinking	
4	Opportunity Spotting / Opportunity Evaluation	
5	Industry and Market Research	
6	Innovation Strategy and Business Models	
7	Financial Forecasting	
8	Business Plans/ Business Model Canvas	
9	Entrepreneurial Finance	
10	Pitching to Resources Providers / Pitch Deck	
11	Negotiating Deals	
12	New Venture Creation	
13	Lean Start-ups	
14	Entrepreneurial Ecosystem	
15	Velocity Venture	
	Total Instructional Hours	**15**

Course Outcome

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.

Text Books:

T1 Arya Kumar "Entrepreneurship – Creating and leading an Entrepreneurial Organization",Pearson, Second Edition (2012).

T2 Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition, 2016.

Reference Books:

R1 Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition, 2007.

R2 R2: Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second Edition, 2017.

R3 Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition, 2010.

Web Resources:

W1: https://blof.forgeforward.in/tagged/startup-lessons

W2: https://blof.forgeforward.in/tagged/entrepreurship

W3: https://blof.forgeforward.in/tagged/minimum-viable-product

W4: https://blof.forgeforward.in/tagged/minimum-viable-product

W5: https://blof.forgeforward.in/tagged/innovation

W6:https://www.youtube.com/watch?v=8vEyL7uKXs&list=PLmP9QrmTNPqBEvKbMSXvwlwn7f dnXe6Lw

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19CS1152	OBJECT ORIENTED PROGRAMMING USING PYTHON	2	0	2	3

(Common to CSE, IT, ECE and AI&ML)

Course Objective

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and call them.
4. To understand OOP concepts and write programs using classes and objects.
5. To do input/output with files in Python.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO PYTHON** What is Python - Advantages and Disadvantages, Benefits and Limitation- Downloading and Python-installation-Python Versions-Running Python Scripts, Executing scripts with python launcher-Using interpreter interactively- Using variables-String types: normal, raw and Unicode-String operations and functions- Math operator and functions. *Illustrative program: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.*	7+2(P)
II	**DATA TYPES, STATEMENTS,CONTROL FLOW** Data Types(List,Tuple,string,dicionary,set)-Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if –elif-else); Iteration: state, while, for, break, continue, pass. *Illustrative programs: Find the square root of a number, To find the given number is Prime or not, Write 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(P)
III	**PYTHON FUNCTIONS** Introduction to functions-Global and local variable in python-Decorators in python-Python lamda functions-Exception handling in python. *Illustrative programs:* Square root, GCD, exponentiation, linear search, binary search, Write a *menu driven program to perform the following task:a) A function Sum_DigN( ) to find the s um of the digits of a given n umber, b) A recursive function Sum_DigR( ) to find the same.*	5+4(P)
IV	**PYTHON OOPS** Introduction to oops concept-Python class and objects-Constructor in python-Inheritance-Types of inheritance-Encapsulation in python-Polymorphism in python. *Illustrative programs: Write a Python program using class for the calculation of telephone bill. The charges for the calls are fixed as follows:* *Unit Call — Cost/unit* *Below 100 calls — No Charge, only rental amount Rs. 250* *100-150 calls — Rs. 1.00* *151-300 calls — Rs. 2.50* *301-600 calls — Rs. 4.50* *Above 600 — Rs. 6.00*	5+4(P)

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	FILES, PACKAGES	
V	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(P)
	Total Instructional Hours	**45**

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 andupdated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS:

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

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

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

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE2101	BUSINESS ENGLISH FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

1. To introduce to business communication.
2. To train the students to react to different professional situations.
3. To make the learner familiar with the managerial skills
4. To empower the trainee in business writing skills.
5. To learn to interpret and expertise different content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement Reading –reading auto biographies of successful personalities Writing Formal & informal email writing, Recommendations **Grammar and Vocabulary-Business vocabulary, Adjectives & adverbs**	9
II	**Listening and Speaking-** listening to TED talks Reading- Making and interpretation of posters Writing- Business letters: letters giving good and bad news, thank you letter, Congratulating someone on a success **Grammar and Vocabulary- Active & passive voice, Spotting errors (Tenses, Preposition, Articles)**	9
III	**Listening and Speaking-**travel arrangements and experience Reading- travel reviews Writing- Business letters (Placing an order, making clarification & complaint letters).**Grammar and Vocabulary- Direct and Indirect speech,**	9
IV	**Listening and Speaking-** Role play - Reading- Sequencing of sentence Writing- Business report writing (marketing, investigating) **Grammar and Vocabulary- Connectors, Gerund & infinitive**	9
V	**Listening and Speaking-** Listen to Interviews & mock interview Reading- Reading short stories, reading profile of a company - Writing- Descriptive writing (describing one's own experience) **Grammar and Vocabulary- Editing a passage (punctuation, spelling &number rules)**	9
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome

CO1- Introduced to different modes and types of business communication.
CO2- Practiced to face and react to various professional situations efficiently.
CO3- learnt to practice managerial skills.
CO4- Familiarized with proper guidance to business writing.
CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19MA2104	DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA (CSE & IT)	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications
2. Extend the knowledge of vector spaces
3. Describe some methods to solve different types of first order differential equations.
4. Solve ordinary differential equations of certain types using Wronskian technique.
5. Use the effective mathematical tools for the solutions of partial differential equations

Unit	Description	Instructional Hours
I	**MATRICES** Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof)Cayley – HamiltonTheorem (excluding proof)-Orthogonalmatrices – Definition – Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**VECTOR SPACES** Complex matrices – Conjugate of the matrix – Hermitian and Skew Hermitian matrices – Properties (without proof) – Unitary matrix – Properties (without proof) - Inner product spaces – Gram – Schmidt orthogonalization	12
III	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS** Equations of the first order and of the first degree – Homogeneous equations – Exact differential equations – Linear equations – Equations reducible to the linear form - Bernoulli's equation.	12
IV	**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER** Second order linear differential equations with constant and variable co-efficient – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of parameters.	12
V	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equationsof the form f(p,q)=0, Clairaut's type : z = px+qy +f(p,q) – Lagrange's linear equation.	12
	TOTAL INSTRUCTIONAL HOURS	60

Course Outcome

CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies
CO2: Infer the knowledge of vector spaces
CO3: Apply few methods to solve different types of first order differential equations. CO4: Develop sound knowledge of techniques in solving ordinary differential equations. CO5: Solve Partial Differential Equations using various methods.

TEXT BOOKS:

T1- Grewal B.S, —Higher Engineering Mathematicsl, 43rd Edition, Khanna Publications, Delhi, 2015.
T2- Howard Anton, Chris Rorres, Elements of Linear Algebra with Applications, Wiley, New Delhi, 2nd Edition, 2015.

REFERENCE BOOKS:

R1-E. A. Coddington, An Introduction to ordinary Differential Equations, Prentice Hall India, 1995.
R2 - G.F.Simmons and S. G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
R3 - Veerarajan T, —Engineering Mathematicsl, 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.TECH.	19IT2151	PROGRAMMING IN C (Common to Auto, Agri, Food and IT)	2	0	2	3

Course Objective

1. To develop C Programs using Basic programming constructs
2. To develop C programs using Arrays and Strings
3. To develop applications in C using Functions, Pointers and Structures
4. To do Input / Output and File handling in C

Unit	Description	Instructional Hours
I	**Basics of C Programming** Structure of C program - C programming: Data Types –Keywords – Variables - Operators: Precedence and Associativity - Expressions – Input / Output statements Decision making statements - Looping statements – Pre-processor directives - Compilation process **Programs using decision - making and Looping Constructs.**	5+4(P)
II	**Arrays and Strings** Introduction to Arrays:Declaration, Initialization–Onedimensional array –Two dimensional arrays – String operations and String functions **Programs Using Arrays and string functions.**	5+4(P)
III	**Functions and Pointers** Introduction to functions: Function prototype, function definition, function call - Parameter passing: Pass by value, Pass by reference – Recursion – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers –Pointer to pointers – pointer to strings **Programs Using Functions and Pointers**	5+4(P)
IV	**Structures and Unions** Structure - Nested structures – Pointer to Structures – Array of structures – Self-referential structures – Dynamic memory allocation – Typedef-Unions – Union of Structures **Programs Using Structures and Unions.**	7+2(P)
V	**File Processing** Files – Types of file processing: Sequential access, Random access – Sequential access file- Random access file – Command line arguments **Programs Using File concepts**	7+2(P)
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Select appropriate data types and control structures for solving a given problem.
CO2: Develop applications using arrays and strings
CO3: Understand the importance of functions, pointers and dynamic memory allocation.
CO4: Understand the Concepts of structures to develop applications in C using
CO5: Understand the sequential and random-access file processing and develop applications in C.

TEXT BOOKS:

T1- E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 7th Edition,201. ISBN 13:9789339219666

T2-ReemaThareja, "Programmingin C",Oxford UniversityPress, Second Edition, 2016.ISBN9780199456147

REFERENCE BOOKS:

R1- Ashok.N. Kamthane,RajKamal ,— Computer Programming and IT, Pearson Education (India),2012, ISBN - 9788131799604

R2- Paul Deitel and Harvey Deitel, "C How to Program, Eighth edition",2012, Pearson Publication, ISBN-9780132990448

R3-Kernighan, B.W and Ritchie,D.M,"The C Programming language", Second Edition, Pearson Education, 2012 ISBN 13: 9789332549449

R4- Yashavant P. Kanetkar. —Let Us C, BPB Publications, 15th Edition, ISBN-13:978-8183331630

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19ME2154	ENGINEERING GRAPHICS	1	0	4	3

Course Objective

1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
2. To learn about the orthogonal projections of straight lines and planes.
3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
4. To learn about the projection of sections of solids and development of surfaces.
5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
I	**PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales.Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method.Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section.Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions.Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

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

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.

CO2: Draw the orthogonal projections of straight lines and planes.

CO3: Interpret the projections of simple solid objects in plan and elevation.

CO4: Draw the projections of section of solids and development of surfaces of solids. CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOKS:

T1- K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New Delhi 2016.

T2.-K.V.Natarajan, "A textbook of Engineering Graphics", Dhanalaksmi Publishers, Chennai 2016.

REFERENCE BOOKS:

R1-Basant Agrawal and C.M.Agrawal, —Engineering Drawing, Tata McGraw Hill Publishing company Limited, New Delhi 2013.

R2- N.S. Parthasarathy, Vela Murali, —Engineering Drawing, Oxford University PRESS, India 2015.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19PH2151	MATERIAL SCIENCE (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

The student should be able to

1. Acquire fundamental knowledge of semiconducting materials which is related to the engineering program
2. Extend the knowledge about the magnetic materials
3. Explore the behavior of super conducting materials
4. Gain knowledge about Crystal systems
5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
I	**SEMICONDUCTING MATERIALS** Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirectbandgapofsemiconductors. Carrier concentration derivation – Fermilevel–Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber (Qualitative).	6
	Determination of band gap of a semiconductor	3
	Determination of acceptance angle and numerical aperture in an optical fiber	3
II	**MAGNETIC MATERIALS** Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.	6
	B – H curve by Magnetic hysteresis experiment	3
III	**SUPERCONDUCTING MATERIALS** Superconductivity: properties (Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
IV	**CRYSTAL PHYSICS** Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystalstructures.	6
V	**ULTRASONICS** Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Nondestructive testing – Ultrasonic pulse echo system.	6
	Determination of velocity of sound and compressibility of liquid – Ultrasonic wave,	3
	Determination of Coefficient of viscosity of a liquid –Poiseuille's method	3
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome

After completion of the course the learner will be able to

CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor
CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday
CO3: Discuss the behavior of super conducting materials
CO4: Illustrate the types and importance of crystal systems
CO5: Evaluate the production of ultra-sonics and its applications in NDT

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications(P)Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser —Concepts of Modern Physics Tata McGraw Hill, New Delhi – 2015
R2 - M.N Avadhanulu and PG Kshirsagar —AText Book of Engineering physics S. Chand and Company ltd., New Delhi 2016
R3 - Dr. G. Senthilkumar —Engineering Physics – II VRB publishers Pvt Ltd., 2016

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19CY2151	ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

The student should be conversant with

1. The natural resources, exploitation and its conservation
2. The importance of environmental education, ecosystem and biodiversity.
3. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	**NATURAL RESOURCES** Renewable and Nonrenewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests andtribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non-renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	6
II	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Importance of environment – need for public awareness - concept of an ecosystem–structure and function of an ecosystem - energy flow in the ecosystem–ecological succession processes – Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem– Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity–endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	6
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution. **Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.**	6+9=15
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy-environmental ethics: Issues and possible solutions –Principles of green chemistry-Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. **Determination of pH in beverages.**	6+3=9
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. **Estimation of heavy metal ion (copper) in effluents by EDTA.**	6+3=9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

After completion of the course the learner will be able to

CO1: Develop an understanding of different natural resources including renewable resources.

CO2: Realize the importance of ecosystem and biodiversity for maintaining ecological balance.

CO3: Understand the causes of environmental pollution and hazards due to manmade activities.

CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.

CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

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TEXT BOOKS:

T1- Anubha Kaushik and C. P. Kaushik, —Perspectives in Environmental studies, Sixth edition, New Age International Publishers, New Delhi, 2019.

T2 – S.Annadurai and P.N. Magudeswaran, —Environmental studies, Cengage Learning India Pvt.Ltd, Delhi, 2018

REFERENCE BOOKS:

R1 – Erach Bharucha, Textbook of environmental studies University Press (I) Pvt.ltd, Hyderabad, 2015

R2 - G.Tyler Miller, Jr and Scott E. Spoolman, Environmental Science Thirteenth Edition, Cengage Learning, 2010.

R3 - Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19ME2001	ENGINEERING PRACTICES	0	0	4	2

Objective:

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

GROUP A (CIVIL & MECHANICAL)

CIVIL AND MECHANICAL ENGINEERING PRACTICES

S.NO	Description of the Experiments
1	Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2	Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction
3	Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction
4	Preparation of arc welding of Butt joints, Lap joints and Tee joints.
5	Practice on sheet metal Models– Trays and funnels
6	Hands-on-exercise in wood work, joints by sawing, planning and cutting.
7	Practice on simple step turning, taper turning and drilling.
8	Demonstration on Smithy operation.
9	Demonstration on Foundry operation.
10	Demonstration on Power tools.

GROUP B (ELECTRICAL)

ELECTRICAL ENGINEERING PRACTICES

S.NO	Description of the Experiments
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring.
3	Stair case wiring.
4	Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5	Measurement of energy using single phase energy meter.
6	Soldering practice using general purpose PCB.
7	Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8	Study of Energy Efficient Equipment's and Measuring Instruments.

TOTAL INSTRUCTIONAL HOURS 45

At the end of the course the students shall be able to

Course Outcome

CO1: Fabricate wooden components and pipe connections including plumbing works.

CO2: Fabricate simple weld joints.

CO3: Fabricate different electrical wiring circuits and understand the AC Circuits.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II	0	0	2	1

(COMMON TO ALL BRANCHES)

Course Objective

- ✓ **To improve communication skills and Professional Grooming.**
- ✓ **To impart deeper knowledge of English Language and its practical application in different facets of life.**
- ✓ **To equip the techniques of GD, Public Speaking, debate etc.**

Unit	Description	Instructional Hours
I	**Listening** Listening for gist and respond – Listen for detail using key words to extract specific meaning – listen for phonological detail – Listen and identify the main points for short explanations and presentation.	3
II	**Reading** Strategies for effective reading – read and recognize different text types – Genre and Organization of Ideas – Quantifying reading – reading to comprehend – Interpreting sentences – contrasting, summarizing or approximating	3
III	**Speaking** Speak to communicate – Make requests and ask questions to obtain personal information – use stress and intonation – articulate the sounds of English to make the meaning understood – speaking to present & Interact – opening and closing of speech.	3
IV	**Writing** Plan before writing – develop a paragraph: topic sentences, supporting sentences – write a descriptive paragraph – elements of good essay – descriptive, narrative, argumentative – writing emails – drafting resumes – project writing – convincing proposals.	3
V	**Language Development** Demonstration at level understanding of application of grammar rules – revision of common errors : preposition, tenses, conditional sentences –reference words – pronouns and conjunctions.	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Introduced to different modes and types of communication.
CO2- Practiced to face and react to various professional situations efficiently.
CO3- learnt to practice managerial skills.
CO4- Familiarized with proper guidance to writing.
CO5- Trained to analyze and respond to different types of communication.

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma, 9th edition, Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.
3. High School English Grammar by Wren and Martin, S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.

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Programme	Course code	Name of the Course	L	T	P	C
B.TECH.	19HE2072	**CAREER GUIDANCE – LEVEL II** Personality, Aptitude and Career Development	2	0	0	0

Course Objectives:

1. Solve Logical Reasoning questions of easy to intermediate level [SLO6]
2. Solve Quantitative Aptitude questions of easy to intermediate level [SLO7]
3. Solve Verbal Ability questions of easy to intermediate level [SLO8]

Expected Course Outcome:

Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

Student Learning Outcomes (SLO): 6, 7, 8

Module:1 Logical Reasoning **5 hours** **SLO:** 6

Word group categorization questions

Puzzle type class involving students grouping words into right group orders of logical sense

Crypt Arithmetic:

Data arrangements and Blood relations

- LinearArrangement
- CircularArrangement
- Multi-dimensionalArrangement
- BloodRelations

Module:2 Quantitative Aptitude **8 hours** **SLO:** 7

Ratio andProportion

- Ratio
- Proportion
- Variation
- Simpleequations
- Problems onAges
- Mixtures andalligations

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase /Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle

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- Factors, Multiples
- HCF andLCM

Module:3 Verbal Ability **7 hours** **SLO:** 8

Essential grammar for placements

- Prepositions
- Adjectives andAdverbs
- Tenses
- Forms and Speech andVoice
- Idioms and PhrasalVerbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types ofquestions
- Comprehensionstrategies
- Practiceexercises

Articles, Prepositions and Interrogatives

- Definite and IndefiniteArticles
- Omission ofArticles
- Prepositions
- Compound Prepositions and PrepositionalPhrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total Lecture hours: **20 hours**

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

Recommended by Board of Studies

Approved by Academic Council Date

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19CS2153	JAVA FUNDAMENTALS	2	0	2	3
		(COMMON TO CSE, ECE AND AI&ML)				

Course Objective

1. To Understand the Basics of java Programming.
2. To discuss the packages and interfaces in java programming
3. To learn IO streams and multithreading in java
4. To learn generics and collections framework in java
5. To understand event handling and swing in java

Unit	Description	Instructional Hours
	INTRODUCTION TO JAVA	
I	JAVA-History of JAVA-Features of JAVA-Hello worlds java program-Setting path-JDK, JRV and JVM-JAVA variables-JAVA data types-Keywords-Operators. *Illustrative Programs: Java program to swap two numbers using bitwise operator, Java program to find the smallest three numbers using ternary operator.*	5+2(P)
	CONTROL STATEMENTS	
II	Introduction to control statements in programming-If-else-switch-for loop-while loop-do while loop-Break-continue-JAVA comments. *Illustrative programs: Find the square root of a number , To determine leap year or not, Java program to find the factorial of number using recursion, Create Generic number calculator using Java.*	5+6(P)
	JAVA POLYMORPHISM	
III	Introduction to polymorphism concepts-Method overloading-Method overriding-Covariant return type-Super keyword-Instance Initializer block-final keyword-Runtime polymorphism-Dynamic binding-Instance of operator-Abstract class-interface-abstract Vs interface. *Illustrative programs: Method overriding, Abstract classes.*	7+2(P)
	ENCAPSUALATION, ARRAY	
IV	Java encapsulation-package-access modifier-Encapsulation-Object cloning- call by value-Java array concepts-Single dimension array-Multi dimension array. *Illustrative programs: Java program to check the whether the input character is vowels or not*	7+2(P)
	FILES, PACKAGES	
V	File handling in python-Open a file in JAVA-How to read from a file in JAVA-writing to file in JAVA-Exception handling-Java swing-java applet-Java AWT and events-Java collection. *Illustrative programs: Find the most frequent words in a text read from a file, Linked List implementation using collections, Program that handles all mouse events, Program using swing.*	5+4(P)
	Total Instructional Hours	**45**

Course Outcome

CO1: Understanding the OOPS and basic concepts of Java.

CO2: Understand how to program using user defined packages and interfaces.

CO3: Apply multithreading concepts based on appropriate problems.

CO4: Understand generics and collections framework in java

CO5: Apply event handling classes and swing concepts to create different applications in java

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TEXT BOOKS:

T1: Herbert Schildt, "The complete reference java 2", 11th edition, McGraw – Hill 2019.

T2: "Core Java 2",Vol 2,Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education

REFERENCE BOOKS:

R1: E.Balagurusamy,"Programming with java A Primer", fifth edition, McGraw – Hill 2014.

R2: H.M.Deitel, P.J.Deitel, "Java: how to program", Eleventh edition, Prentice Hall of India private limited, 2017.

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SYLLABUS

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT3201	DATA STRUCTURES AND ALGORITHM DESIGN	3	0	0	3

Course Objective

1. To provide a good understanding of the fundamental Data structures
2. To provide a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
3. To educate on the space and time efficiency of most algorithms
4. To educate on design of new algorithms or modify existing ones for new applications
5. To introduce graph algorithms

Unit	Description	Instructional Hours
I	**LINEAR STRUCTURES** Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists - doubly-linked lists – Stack ADT – Operations -QueueADT – Operations - Circular Queue	9
II	**TREES AND GRAPH STRUCTURES** Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT– AVL Trees - Graphs - Definition – Representation of Graph – Breadth-first traversal -Depth-first traversal	9
III	**FRAMEWORK OF ANALYSIS** Definition and properties of an algorithm- Analysis of algorithms - Brute Force-SelectionSort – Bubble Sort. Divide and Conquer –Finding maximum and minimum- Analysis ofMerge sort- Analysis of Quick sort-	9
IV	**GREEDY AND DYNAMIC PROGRAMMING** Greedy Approach - Minimum Spanning Trees- Single-source shortest paths.Dynamic Programming: Computing a Binomial Coefficient; Floyds Algorithm – KnapsackProblem and Memory functions.	9
V	**COPING WITH THE LIMITATIONS OF ALGORITHM POWER** P, NP NP - Complete and NP Hard Problems. Backtracking – n-Queen problem -Hamiltonian Circuit Problem. Branch and Bound – Knapsack Problem – TravellingSalesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

CO 1: Implement abstract data types for Linear Data Structures.
CO 2: Apply the different linear and Non-Linear Data Structures to problem solutions
CO 3: Explain the fundamentals of Analysis of Algorithm.
CO 4: Analyze algorithms and estimate their Best-Case, Worst-Case and Average-case Behavior.
CO 5: Explain the concepts of NP Complete problems

TEXT BOOKS:

T1: M A Weiss,Data Structures and Algorithm Analysis in C++, Pearson Education, 4th Edition, 2014.ISBN-13: 978-0-13-284737-7

T2- AnanyLevitin, Introduction to the Design and Analysis of Algorithms, Pearson Publications, 3rd Edition, 2012. ISBN-13: 978-0132316811

REFERENCE BOOKS:

R1: Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012. ISBN-13: 9780070131446

R2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithmsl, Pearson Education, Reprint 2006.ISBN-13: 978-0201000238

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT3202	OBJECT ORIENTED PROGRAMMING USING C++	3	0	0	3

Course Objective

1. Be familiar with the C++ concepts of Abstraction, Encapsulation, Constructor
2. To understand the concepts of Polymorphism, Overloading and Inheritance
3. Learn to apply Exception Handling
4. To study the concept of Generic Programming
5. To learn the concept of File Handling And built classes from STL

Unit	Description	Instructional Hours
I	**INTRODUCTION TO OBJECT ORIENTED PROGRAMMING** Object Oriented Programming Concepts – Objects – Classes – Methods and Messages – Abstraction and Encapsulation – Inheritance – Abstract Classes – Polymorphism -Introduction to C++ – Arrays – Structures and Unions- Functions- Storage Class	9
II	**CONSTRUCTORS AND OPERATOR OVERLOADING** Defining A Class – Creating Objects - Access Specifiers – Function and Data Members Default Arguments – Function Overloading – Friend Functions – Const With Class –Static Member of a Class – Nested Classes – Local Classes - Constructors – Destructors– Operator Overloading – Overloading Through Friend Functions – Overloading the Assignment Operator – Type Conversion – Explicit Constructor	9
III	**TEMPLATES AND EXCEPTION HANDLING** Function and Class Templates - Exception Handling – Try-Catch-Throw Paradigm -Exception Specification – Terminate and Unexpected Functions – Uncaught Exception.	9
IV	**INHERITANCE AND POLYMORPHISM** Inheritance – Public, Private, and Protected Derivations – Multiple Inheritance – Virtual Base Class – Abstract Class – Composite Objects - Runtime Polymorphism – Virtual Functions – Pure Virtual Functions	9
V	**FILE HANDLING** File Streams and Formatted I/O – I/O Manipulators - File Handling – File Pointers- Random Access – Standard Template Library – STL Component	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Differentiate between structures of Procedure Oriented Programming and Object-Oriented Programming.

CO2: Apply the concepts of Data Abstraction, Encapsulation and Inheritance for problem solutions.

CO3: Understand the concept of Function Overloading, Operator Overloading, Virtual Functions and Polymorphism.

CO4: Classify Inheritance with the understanding of early and late binding, usage of Exception Handling

CO5: Use File handling techniques and apply Generic Programming Techniques

TEXT BOOKS:

T1- Balagurusamy.E, Object Oriented Programming with C++, Tata McGraw Hill Publications, Seventh edition, 2017, ISBN 13: 9789352607990.

T2- Robert Lafore, Object-Oriented Programming in C++l, Sams Publishing; 4th edition;2002 ISBN - 9788131722824

REFERENCE BOOKS:

R1-Ira Pohl, —Object Oriented Programming using C++, Pearson Education, Second Edition Reprint 2006.ISBN- 13: 978-8131703915

R2- Rohit Khrana, Object Oriented Programming with C++, Vikas Publishing, 2nd edition,2014; ISBN-13: 9789325975644;

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT3203	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3

Course Objective

1. To understand the Computer instructions, Addressing Modes and Performance measurements.
2. To familiarize the implementation of Fixed point and Floating-point arithmetic operations.
3. To expose the students about Parallelism using the concept of Pipelining.
4. To study about Instruction Level Parallelism and Multithreading
5. To familiarize the students about Hierarchical Memory System and Accessing I/O devices

Unit	Description	Instructional Hours
I	**OVERVIEW & INSTRUCTIONS** Components of a computer system – Performance –Instructions– operations and operands– Representing instructions – Logical operations – Control operations for DecisionMaking –MIPS addressing modes	9
II	**ARITHMETIC OPERATIONS** Introduction - Addition and Subtraction – Multiplication – Division: Restoring and Non-Restoring division algorithm – Floating point representation- Floating point representationoperations	9
III	**PROCESSOR AND CONTROL UNIT** A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme –Overview of Pipelining – Pipelined Datapath- Pipelined control –Hazards – Types ofHazards - Handling Data Hazards –Handling Control Hazards, Exception Handling.	10
IV	**PARALLELISM** Parallel processing challenges – Flynn's classification –Vector Architectures, Hardwaremultithreading – Introduction to Multicore processors.	8
V	**MEMORY AND I/O SYSTEMS** Memory hierarchy – Memory technologies –CacheMemory- mapping functions - measuring and improving cache performance – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Interface circuits – USB	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Understand the Basic Instructions and Addressing Modes.
CO2: Demonstrate and perform Computer arithmetic Operations on Integer and Real numbers.
CO3: Learn the Pipelined concepts and Hazards. To know how to overcome the Hazards
CO4: Compare the parallel processing architectures.
CO5: Exemplify in a better way the I/O and Memory Organization.

TEXT BOOKS:

T1 - David A. Patterson and John L. Hennessey, —Computer organization and design", Morgan Kauffman, Elsevier, Fifth edition, 2014. ISBN: 9780124078864

T2- V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, —Computer Organization and Embedded systems—, VIth edition, Mc Graw-Hill Inc, 2012. ISBN 9781283394772

REFERENCE BOOKS:

R1 - William Stallings —Computer Organization and Architecture- Designing for performance, Tenth Edition, Pearson Education, 2016, ISBN 9780134165981

R2- Vincent P. Heuring, Harry F. Jordan, —Computer System Architecture, Second Edition, Pearson Education, 2008. SBN 13: 9780805343304

R3-Govindarajalu, Computer Architecture and Organization, Design Principles and Applications", Second edition, Tata McGraw Hill, New Delhi, 2010. ISBN: 978-0-07-015277-9

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19MA3151	STATISTICS AND QUEUING THEORY	3	0	2	4

Course Objective

1. Construct a well-defined knowledge of random variables.
2. Understand the concept of standard distributions which can describe the real-life phenomenon.
3. Illustrate the relation between two random variables by using correlation concepts along with R studio
4. Describe some basic concepts of statistical methods for testing the hypothesis together with R studio.
5. Apply the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

Unit	Description	Instructional Hours
I	**PROBABILITY AND RANDOM VARIABLE** Random variable –Discrete and continuous random variables – Probability mass function - Probability density function – Cumulative distribution functions - Moment generatingfunction.	9
	Introduction to R programming **Application of descriptive statistics – Mean, Median, Mode, variance and Box plot.**	3
II	**STANDARD DISTRIBUTIONS** Discrete Distributions - Binomial, Poisson, Continuous Distributions -Uniform, Exponential and Normal distributions.	9
	Application of Normal distribution	3
III	**CORRELATION AND REGRESSION** Correlation – Karl Pearson's correlation coefficient – Spearman's Rank Correlation – Regression lines.	9
	Applications of Correlation and Regression	3
IV	**HYPOTHESIS TESTING** Test for means– t test for single mean and difference of mean - F test for proportion of variance, Chi – Square test – independence of attributes – goodness of fit.	9
	Application of Student t- test for Single mean & difference of means, Application of Chi – square test	6
V	**QUEUEING THEORY** Markovian models: Single and Multiple server queueing models (Excluding proof) – (M/M/1) :(∞/FCFS), (M/M/1) :(N/FCFS), (M/M/C) :(∞/FCFS) and (M/M/C) :(N/FCFS).	9
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

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

CO1: Understand the concepts of random variables.

CO2: Describe various discrete and continuous distribution functions.

CO3: Compute correlation between variables, and predict unknown values using regression along with R studio.

CO4: Understand the concepts of statistical methods for testing the hypothesis together with R studio.

CO5: Identify the queuing models in the given system, find the performance measures and analyze the result.

TEXT BOOKS:

T1 - Gupta S. P, Statistical Methodsl, Sultan Chand & Sons Publishers, 2016.

T2 – Medhi J, "Stochastic Processes "New Age International Publishers, New Delhi,2014.

REFERENCE BOOKS:

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

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

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

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT3251	DIGITAL PRINCIPLES AND SYSTEM DESIGN	3	0	2	4

Course Objective

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

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

Course Outcome

CO1: Simplify Boolean functions using different methods.
CO2: Analyse, design and implement combinational logic circuits.
CO3: Analyse, design and implement Synchronous sequential logic circuits.
CO4: Analyse, design and implement Asynchronous sequential logic circuits
CO5: Simulate and implement combinational and sequential circuits using HDL.

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

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 Fundamentalsl, Pearson Education, Inc, New Delhi, 2013 ISBN: 978-1-292-07598-3.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT3001	DATA STRUCTURES AND ALGORITHM LABORATORY	0	0	3	1.5

Course Objective

1. To understand various advanced abstract data type (ADT) and Data structures and their implementations
2. To learn linear data structures – stack and queue.
3. Be exposed to sorting, searching, hashing algorithms
4. Learn to apply Tree and Graph structures
5. Learn how to analyze and design solution to the problem.

Exp. No	Description of the Experiments
1	After getting her PhD, XXX has become a celebrity at her university, and her facebook profile is full of friend requests. Being the nice girl, she is, XXX has accepted all the requests. Now YYY is jealous of all the attention she is getting from other guys, so he asks her to delete some of the guys from her friend list. To avoid a 'scene', XXX decides to remove some friends from her friend list, since she knows the popularity of each of the friend she has. Implement the above scenario using appropriate data structure.
2	Given an array of n integers nums, a 132 pattern is a subsequence of three integers nums[i], nums[j] and nums[k] such that i< j < k and nums[i] <nums[k] <nums[j]. Return true if there is a 132 pattern in nums, otherwise, return false. Implement using Stack data structure.
3	In a deck of cards, every card has a unique integer. You can order the deck in any order you want. Initially, all the cards start face down (unrevealed) in one deck. Now, you do the following steps repeatedly, until all cards are revealed: • Take the top card of the deck, reveal it, and take it out of the deck. • If there are still cards in the deck, put the next top card of the deck at the bottom of the deck. • If there are still unrevealed cards, go back to step 1. Otherwise, stop. Return an ordering of the deck that would reveal the cards in increasing order. Write a program to implement the above concept.
4	Given the root of a Binary Search Tree and a target number k, return true if there exist two elements in the BST such that their sum is equal to the given target. Implement using BST.
5	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 appearsfirst.
6	Given an array, sort its element by their frequency and index. i., e if two elements have different frequencies, then the one which has more frequency should come first; otherwise the one which has less index should come first.
7	WatsongivesSherlockanarrayofintegers.Hischallengeistofindanelementofthe array such that the sum of all elements to the left is equal to the sum of all elements to the right. You will be given arrays of integers and must determine whether there is an element that meets the criterion. If there is, return YES. Otherwise, returnNO.
8	Write a C program to Implement Hash Tables with QuadraticProbing.
9	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 thesubgraph.
10	Given the root of a binary tree and an integer targetSum, return true if the tree has a root- to-leaf path such that adding up all the values along the path equals targetSum. A leaf is a node with nochildren.
11	A thief enters a house for robbing it. He can carry a maximal weight of 16 kg into his bag. There are 4 items in the house with the following weights and values. Whatitemsshould thief take if he either takes the item completely or leaves it completely? (Use knapsack algorithm)

Item	Weight (kg)	Value ($)

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Mirror	10	100
Silver nugget	7	63
Painting	8	56
Vase	4	12

A Cable Company Manager is assigned to connect all houses of an Apartment with his network. Find the solution to connect all houses by using minimum length of cable. The network with the length of cable required to do the connection is given.(Use Prim's Algorithm)

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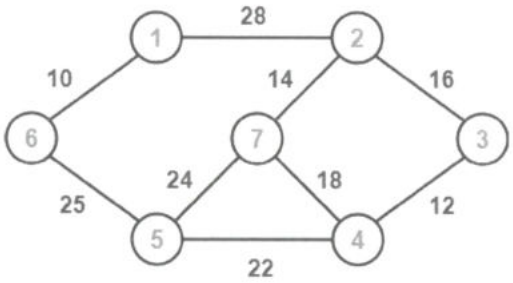

Total Practical Hours **45**

Course Outcome

CO1: Demonstrate the various Linear data structures using simple applications.
CO2: Demonstrate the various Non-Linear data structures using simple applications.
CO3: Develop skills to use appropriate Data Structures for solving problems
CO4: To Implement various Sorting and Searching Techniques.
CO5: Implement various Algorithms Design Techniques suitable for different types of problem

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT3002	OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY	0	0	3	1.5

Course Objective

1. To understand the basic concepts of Object-Oriented Programming
2. To solve problems based on the concepts of Overloading and Friend Function in C++
3. To understand the concepts of Templates and Virtual Functions
4. To apply the concepts like polymorphism, inheritance and exception handling in C++
5. To apply File Concepts in Programming based on File Manipulation Applications

Exp. No	Description of the Experiments
1	Write a C++ Program to perform a Calculator Operation using Switch Case
2	Write a C++ program to print right angled (Right oriented) pyramid of numbers.
3	Write a C++ program to add two integer numbers using class and Objects
4	A customer in a departmental store is purchasing five products. The marketing prices of the five products are: Price of item 1 = Get input from the user Price of item 2 = Get input from the user Price of item 3 = Get input from the user Price of item 4 = Get input from the user Price of item 5 = Get input from the user Write a C++ program to hold / save the price of the five products through five different variables. Display each product's price, the subtotal of the sale, the amount of sales tax,and the total. Assume the sales tax is 8%.
5	Ramu went to a restaurant to had his meals. He is charged with Rs. 70.50. The tax should be 8% of the meal cost. The tip should be 10% of the total after adding the tax. Display the meal cost, tax amount, tip amount, and total bill on thescreen. Write a C++ Program to demonstrate this scenario.
6	Write a C++ Program to Calculate Difference Between Two Time Period using Structures
7	Draft a C++ Program to Calculate Average of 'n' Numbers Using Arrays
8	Write a C++ program to create student class with the following attributes: Name, RollNo, Dept, TotalMarks Do the following Operations with the above read values: 1. ReadValues() 2. Print_student_details() 3. Find_percentage() Demonstrate the above concept using Classes and Objects Concept along with the use of Arrays to Store the values
9	With the help of Operator Overloading Concept in C++ , Use Prefix Increment ++ to illustrateoperatoroverloading with return type
10	Write C++ Program to Subtract Complex Number Using Operator Overloading
11	Using Function Overloading in C++, write a program to add numbers. Method 1: takes 2 input as integer data type Method 2: takes 2 input as float data type Method 3: takes 3 input of type integer and float mixed with each other
12	Suppose you have a Piggie Bank with an initial amount of $50 and you have to add some more amount to it. Create a class 'AddAmount' with a data member named 'amount' with an initial value of $50. Now make two constructors of this class as follows: 1 - without any parameter - no amount will be added to the PiggieBank 2 - having a parameter which is the amount that will be added to the PiggieBank Create an object of the 'AddAmount' class and display the final amount in the Piggie Bank.
13	Write a Simple Program for C++ Program for Friend Function to mean/average of 2 values
14	Class Square is a friend of Class Rectangle. Write a C++ Program to find the area of the square and rectangle using Friend Class Concept.
15	Write a Simple Program to swap two numbers using Function Template
16	Using Class Template write a program to find maximum of two numbers
17	Implement the concept of Class Template Array Program to Search a Number from an array.
18	Write a small program for Exception Handling with Multiple Catch Example Program
19	Write a Simple C++ Program for Catch All or Default Exception Handling
20	Write an example program for Exception Handling Divide by Zero Exception

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21 Simple C++ Program for Nested Exception Handling

22 Write an Example Program to illustrate Private Base Class for Employee Salary Calculation.

23 Write a C++ program to read and print student's information using two classes by implementing simple inheritance concept

24 Simple Program for Virtual Base Class Using C++ Programming To calculate the total mark of a student using the concept of virtual base class.

25 Write a C++ program to demonstrate example of hierarchical inheritance to get square and cube of a number

Ankit is a very competitive person and always tries to compare him to other. He has got 5 subjects in his course and he wants to make a list of total marks and average marks of the students in his class with their roll numbers. He wants to use the concept of multi-level inheritance doing this. Help him achieve the requiredgoal.

Student class is already been created.

Create 2 classes:

Test: containing the marks of a student in 5 subjects inheriting class student (having roll number of the student).

Result: containing the function Display() to compute the total and average and then displaying the output as Roll number, total and average which are space separated.

26 Input:

Most of the input is handled for you by the locked code in the editor. The first line will contain the number of test cases(number of students) Each test case has roll number of student in the first line followed by 5 space separated floating numbers in the second line.

Output:

For each test case or student, the output should consist of 3 space-separated values- Roll number, total marks, averagemarks

Constraints:

$1 < T <= 100$

$1 < n < 100$

$0 <= marks <= 100$

Create two classes:

Cuboid

The Cuboid class should have three data fields- length, width and height of int types. The class should have display() method, to print the length, width and height of the cuboid separated by space.

CuboidVol

The CuboidVol class is derived from Cuboid class, i.e., it is the sub-class of Cuboid class. The class should have read_input() method, to read the values of length, width and height of the Cuboid. The CuboidVol class should also overload the display() method to print the volume of the Cuboid (length * width * height).

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Input:

The first line contains the number of test cases and one and only line of each test case contains 3 space separated integer denoting length, width, and height of the Cuboid

Output:

The output should consist of exactly two lines:

In the first line, print the length, width, and height of the cuboid separated by space. In the second line, print the volume of the cuboid.

Constraints:

$0 <= (length, width, height) <= 100$

Create 2 Classes

Class 1: Shape – Base Class

28 Class 2: Rectangle – Derived Class 1 from Shape Class 3: Triangle – Derived Class 2 from Shape

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19MC3191	INDIAN CONSTITUTION	2	0	0	0

Course Objective

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

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

Course Outcome

CO1: Understand the functions of the Indian government
CO2.Understand and abide the rules of the Indian constitution.

TEXT BOOKS:

T1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India, NewDelhi.
T2. R.C.Agarwal, (1997) Indian Political System, S.Chand and Company, New Delhi.
T3. Maciver and Page, Society: An Introduction Analysis, Mac Milan India Ltd., New Delhi.
T4. K.L.Sharma, (1997) —Social Stratification in India: Issues and Themesl, Jawaharlal Nehru University, New Delhi.

REFERENCE BOOKS:

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

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29	Use Abstract Class Concept to find area of a Rectangle and Triangle. Consider this is the Content in the file name "**Input.txt**" Welcome to Hindusthan College of Engineering and Technology! AvulPakirJainulabdeen Abdul Kalam was an Indian aerospace scientist who served as the 11th President of India from 2002 to2007. He was born and raised in Rameswaram, Tamil Nadu and studied physics and aerospace engineering. Born: 15 October 1931,Rameswaram Died: 27 July 2015, Shillong Full name: AvulPakirJainulabdeen Abdul Kalam Awards: Bharat Ratna, Hoover Medal, Padma Vibhushan, MORE Education: Madras Institute of Technology, Anna University (1955–1960)
30	Write a Program to count the number of lines in this file Consider this is the Content in the file name "**Input.txt**" Welcome to Hindusthan College of Engineering and Technology! AvulPakirJainulabdeen Abdul Kalam was an Indian aerospace scientist who served as the11th President of India from 2002 to2007. He was born and raised in Rameswaram, Tamil Nadu and studied physics and aerospace engineering. Born: 15 October 1931,Rameswaram Died: 27 July 2015, Shillong Full name: AvulPakirJainulabdeen Abdul Kalam Awards: Bharat Ratna, Hoover Medal, Padma Vibhushan, MORE Education: Madras Institute of Technology, Anna University(1955–1960)
	Write a C++ Program to copy data from Input.txt and Paste it inOutput.txt

Total Practical Hours **45**

Course Outcome

CO1: Able to Understand advanced use of Arrays in C++ programming.
CO2: Able to create Classes and Objects and use them in their program
CO3: Able to Understand the concept of pointers in C++ programming.
CO4: Able to identify the exception in program and handle them.
CO5: Able to model and implement software solutions with Object Oriented design concepts

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19MA4102	DISCRETE MATHEMATICS	3	1	0	4

Course Objective

1. Illustrate logical theory and proportional calculus techniques that will create logical thinking.
2. Explain counting problems using mathematical induction, inclusion and exclusion principles.
3. Analyze the Boolean algebra which is used in the Boolean logics and circuits.
4. Apply formal mathematical methods to prove properties of languages, and Context free grammar.
5. Describe discrete knowledge in computer engineering through finite automata theory.

Unit	Description	Instructional Hours
I	**MATHEMATICAL LOGIC** Propositional logic - Tautology and Contradiction - Propositional equivalences – Normalforms - Principal normal forms - Theory of Inference.	12
II	**COMBINATORICS** Mathematical induction – Recurrence relations – Solving linear recurrence relations - generating functions – principle of inclusion and exclusion – applications	12
III	**LATTICES AND BOOLEAN ALGEBRA** Lattices – Properties of lattices – Lattices as algebraic system – Sub lattices – somespecial lattices – Boolean algebra – Definition and simple properties.	12
IV	**FORMAL LANGUAGES** Languages and Grammars - Classification of Grammars – ContextFree Grammars and Languages – Derivations.	12
V	**FINITE STATE AUTOMATA** ConceptsofAutomataTheory–FiniteAutomata–TypesoffiniteAutomata - DeterministicFiniteStateAutomata(DFA),Non-DeterministicFinite State Automata(NFA) – Transition Diagrams - Equivalence of DFA and NFA.	12
	TOTAL INSTRUCTIONAL HOURS	60

Course Outcome

CO1: Study the notion of mathematical thinking, proofs, and algorithmic thinking .
CO2: Solve problems using counting techniques and recurrence relations.
CO3: Infer the knowledge about Lattices and Boolean Algebra.
CO4: Understand the knowledge of formal languages of Compiler Design.
CO5: Apply the knowledge of finite automata theory and design discrete problems.

TEXT BOOKS:

T1 -Ralph. P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education Asia, Delhi, 2016.
T2-Kenneth H rosen , Discrete Mathematics and its Application, Tata McGraw Hill,New Delhi,2018.

REFERENCE BOOKS:

R1 - Jean Paul Trembley, R Manohar, Discrete Mathematical Structures with Application to Computer Sciencel, McGraw Hill,Inc. New York, 30th reprint, 2008.
R2- Kenneth H.Rosen, Discrete Mathematics and its Applications, seventh Edition, Tata Mc Graw Hill Pub.Co.Ltd.,New Delhi, 2013.
R3- John. C. Martin, Introduction to Languages and the Theory of Computation, Tata McGraw-Hill, 2003. R4 - Hopcroft J.E and Ullman,J.D, Introduction to Automata Theory, Languages and Computation, Narosa Publishing House, Delhi, 2002.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT4201	JAVA PROGRAMMING	3	0	0	3

Course Objective

1. Learn the basics of Java programming language
2. Discuss the packages and interfaces in Java programming
3. Learn IO streams and multithreading in Java
4. Learn generics and collections framework in Java
5. Understand Event handling and swing in Java

Unit	Description	Instructional Hours
I	**INTRODUCTION** Review of Object-oriented Programming-Introduction to java programming-Features of Java Language, JVM -The Java Environment-Primitive Data types-variables-arrays-control statements-classesandobjects-accessspecifier-methods-constructor-finalizemethod-strings-Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes.	9
II	**INTERFACES AND PACKAGES** Interfaces-Defining an interface-implementing an interface-applying interface-variables ininterface-extended interface-- Packages-defining package-access protection-importingpackages -Exception Handling-exception types-uncaught exception-multiple catch-nested try-throw and finally-built-in exceptions-user defined exceptions	9
III	**IO STREAMS AND MULTITHREAD** I/Obasics-readingconsoleinput-writingconsoleoutput-readingand writingfiles-Serialization-Multithreadedprogramming-javathreadmodel-threadpriorities-synchronization-thread class and runnable interface-creating multiple threads- inter thread communication.	9
IV	**GENERICS AND COLLECTIONS FRAMEWORK** Generics- simple Generic Example-Generic class with parameters-The General Form of aGeneric Class-Bounded Types-Creating Generic method- Generic interfaces- Generic class hierarchies-Generic restrictions. Collections overview-interfaces-classes-an iterator.	9
V	**V EVENT HANDLING AND SWING** Window fundamentals-layout managers-working with 2D shapes-Using color, fonts and images-The DelegationEventModel-Event Classes-TheActionEventClass-TheAdjustmentEventClass-TheComponentEventClass-The ContainerEvent Class-EventListener Interfaces-The ActionListener Interface-The AdjustmentListener Interface-The ComponentListener Interface-The Container Listener Interface-Introduction to Swing- Swing components-Text Fields, Text Areas-Buttons-Check Boxes-Radio Buttons-Lists- Choices-Scrollbars-windows-Menus-Dialog Boxes.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

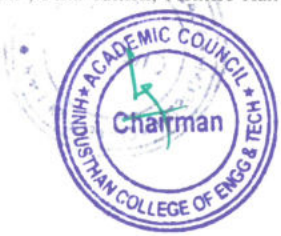
CO1: To Understand the basics of Java Programming
CO2: Design program using User Defined packages and interfaces
CO3: Develop applications using Multithreading concepts in java
CO4: Design real time applications using Generics and Collection frameworks.
CO5: Apply Event handling classes and Swing concepts to create different applications in java

TEXT BOOKS:

T1 - Herbert Schildt, Java: The Complete Reference,Tenth edition, McGraw – Hill 2018. ISBN: 9789387432291

REFERENCE BOOKS:

R1 - E.Balagurusamy,Programming with java A Primerl, fifth edition, McGraw – Hill 2014 ISBN: 9789351343202
R2 - H.M.Deitel, P.J.Deitel, "Java : how to program", Fifth edition, Prentice Hall of India private limited,2003. ISBN: 9780131016217



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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT4202	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Course Objective

1. Learn the fundamentals of data models.
2. Acquire knowledge about ER diagrams and Normalization.
3. Gain knowledge about various SQLs and optimization techniques
4. Familiarize with the concepts of transactions and concurrency control.
5. Acquire knowledge about various storage media and databases.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO DBMS** Purpose of Database System - Database characteristics - Data Models – DatabaseArchitecture – Key issues and challenges in Database Systems-Introduction to relationaldatabases – Relational Model – Relational Algebra.	9
II	**DATABASE DESIGN** Relational DBMS – ERmodel - Extended ER- Functional Dependencies,Non-loss Decomposition, Anomaly - 1NF to 5NF	8
III	**SQL & QUERY OPTIMIZATION** SQL fundamentals- SQL Standards- Data types- DDL – DML – DCL – TCL - Keys-Integrity – Views-Trigger-Cursors- Embedded SQL - Dynamic SQL - Query Processing and Optimization	9
IV	**TRANSACTION PROCESSING AND CONCURRENCY CONTROL** Transaction Concepts - - ACID Properties - Serializability - Concurrency – Need forConcurrency- Concurrency Control - Transaction Recovery –Locking Protocols – TwoPhase Locking –SQL Facilities for Concurrency and recovery– Two Phase Commit Protocol - Dead lock.	10
V	**INDEXING AND HASHING** Basic concepts, Ordered Indices: Dense and Sparse Indices - Multi Level Indices – IndexUpdate. B+-Tree Index Files: Structure of a B+-Tree - Queries in B+-Trees-B-Tree IndexFile- Static Hashing, Dynamic Hashing.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

CO1: Able to design a Data Model.
CO2: Apply ER Diagrams and Normalization concepts for real time applications.
CO3: Apply SQL queries and optimization techniques in real time.
CO4: Apply Transactions and Concurrency mechanisms for real time applications.
CO5: Evaluate the performance of various storage media

TEXT BOOKS:

T1 - RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2016. ISBN 9780133971279

T2- Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Seventh Edition, Tata McGraw Hill, 2019. ISBN: 9789339212124

REFERENCE BOOKS:

R1- C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2012. ISBN 13: 9788177585568

R2- Raghu Ramakrishnan, —Database Management Systemsl, Fourth Edition, Tata McGraw Hill, 2014. ISBN: 9789339213114

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT4203	PRINCIPLES OF 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 Linux operating systems

Unit	Description	Instructional Hours
I	**INTRODUCTIONANDPROCESSMANAGEMENT** Introduction: Operating System Structure–Operating System Operations–Process Management– Memory Management– Storage Management.System Structures: Operating System Services – System Calls –Types of System Calls –System Programs– Process Concept-Process Scheduling– Operations on Processes –Inter-process Communication – Multithreaded Programming: Overview– Multithreading Models– Threading Issues. Process Scheduling: Basic Concepts– Scheduling Criteria– Scheduling Algorithms	9
II	**PROCESSCOORDINATION** Synchronization: The Critical-Section Problem – Peterson's Solution – SynchronizationHardware – Mutex Locks - Semaphores – Classic problems of Synchronization–Monitors–Deadlocks:SystemModel–Deadlock Characterization– Methods for HandlingDeadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection– Recovery from Deadlock	11
III	**MEMORYMANAGEMENT** Memory Management Strategies: Swapping – Contiguous Memory Allocation– Paging–Structureofthe PageTable–Segmentation.Virtual-MemoryManagement:DemandPaging–Copy-on-Write–PageReplacement – Allocation of Frames– Thrashing	8
IV	**FILEMANAGEMENT** FileSystem:FileConcept–AccessMethods–DirectoryandDiskStructure–Protection – FileSystem Implementation: File System Structure–File System Implementation– DirectoryImplementation– Allocation Methods– Free-space Management.	9
V	**CASE STUDY: LINUX** Linux system – History- Design Principles – Kernel Modules – Process Management – Scheduling – Memory Management – File Systems – Input and output – Inter-processCommunication- Network Structure – Security	8
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

CO1: Analyse various Scheduling algorithms.
CO2: Apply Deadlock, prevention and avoidance algorithms.
CO3: Compare and Contrast various memory management schemes.
CO4: Analyse and implement a prototype File System.
CO5: Study the Linux operating system.

TEXT BOOKS:

T1:Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, —Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012. ISBN:9781118063330

REFERENCE BOOKS:

R1: Andrew S.Tanenbaum, Modern Operating Systems,4/E,Pearson Publications, 2014.ISBN13:9780133
R2: Harvey M.Deitel-Operating systems, Third Edition, Pearson/Prentice Hall,2004. ISBN 0-13-124696
R3:William Stallings, Operating Systems –Internals and Design Principles, 8/E, Pearson Publications

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT4251	OBJECT ORIENTED SOFTWARE ENGINEERING	3	0	2	4

Course Objective

1. To study pioneer of Software Development Life Cycle, Development models and Agile Software development.
2. To study fundamental concepts in Software Metrics, Measures and the techniques of estimation.
3. To discuss various issues and solutions in software Requirements.
4. To learn the process to model the Software Product.
5. To gain the techniques and skills on how to use modern software tools to support software projects and to expose Software Process Improvement and Reengineering

Unit	Description	Instructional Hours
I	**Introduction to Software and Software Engineering** The Evolving Role of Software, Software: A Crisis on the Horizon and Software Myths, Software Engineering: A Layered Technology, Software Process Models- Prescriptive Process Models, Specialized Process Models, Process, Product and Process. Agility and Agile Process model, Extreme Programming, Other process models of Agile Development and Tools.	9
II	**Managing Software Project** Software Metrics (Process, Product and Project Metrics), Software Project Estimations- COCOMO II, Software Project Planning process, Project Scheduling & Tracking, Risk Management- Software Risks, Risk identification, RMMI.	9
III	**Requirement Analysis and Specification** Understanding the Requirement, Requirement Modeling, Requirement Specification (SRS), Requirement Analysis and Requirement Elicitation, Requirement Engineering, System Architecture Applications-Satellite Based Navigation, Artificial Intelligence: Cryptanalysis. **Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart).**	8+4(P)
IV	**Object Modeling-** The Object Model, Classes and Objects, Classification, Static Modeling - Introduction to UML - Use Case Diagram, Domain Models, and UML Class Diagram. **Identify Use Cases and develop the Use Case model and identify the business activities and develop an UML Activity diagram,** **Identity the conceptual classes and develop a domain model with UML Class diagram and draw the State Chart diagram** **Dynamic Modeling** - Interaction and Package Diagram, Activity Diagrams and Modeling, State Machine Diagram and Modeling, UML Component Diagram, UML Deployment Diagram, Object Design, Applying GoF Design Patterns.	9+6(P)
V	**Using the identified scenarios find the interaction between objects and represent them using UML Interaction Diagrams and draw the Package diagram,** **Draw Component and Deployment diagrams, Practice forward engineering and reverse engineering**	7+8(P)
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

CO1: Prepare SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.

CO2: Apply the concept of Functional Oriented and Object-Oriented Approach for Software Design.

CO3: Recognize how to ensure the quality of software product, different quality standards and softwarereview techniques.

CO4: Apply various Modelling techniques to design the product.

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CO5: Able to understand modern Agile Development and Service Oriented Architecture Concept of Industry.

TEXT BOOKS:

T1 – RogerS.Pressman, Bruce R. Maxim, Software engineering- A practitioner's Approach, McGraw-Hill International Edition, 8th edition (2015). ISBN: 9789353165710

T2 – GradyBooch, Robert A. Maksimchuk, Michael W. Engle,Object-Oriented Analysis and Design with Applications, Pearson India; 3rd edition (2010) ISBN-13: 9780132797443

REFERENCE BOOKS:

R1 - Ian Sommerville, Software engineering, Pearson education Asia, 10th Edition,2015 ISBN 9780133943252

R2 – PankajJalote, Software Engineering – A Precise Approach Wiley, 2010, ISBN 8126523115

R3 - Craig Larmen, Applying UML and Patterns, Pearson Education; 3rd edition, 2015 ISBN-13: 9789332553941

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PROGRAMME	COURSE CODE	Name of the course	L	T	P	C
B.TECH.	19IT4001	JAVA PROGRAMMING LABORATORY	0	0	3	1.5

Course Objective

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

Exp. No	Description of the Experiments
1	Ritik wants a magic board, which displays a character for a corresponding number for his science project. Help him to develop such aJava application. For example, when the digits 65,66,67,68 are entered, the alphabet ABCD are to be displayed. [Assume the number of inputs should be always 4]
2	Write a Java program to calculate the fuel consumption of your truck. The program should ask the user to enter the quantity of diesel to fill up the tank and the distance covered till the tank goes dry. Calculate the fuel consumption and display it in the format (liters per 100 kilometers). Convert the same result to the U.S. style of miles per gallon and display the result. If the quantity or distance is zero or negative display" is an Invalid Input".[Note: The US approach of fuel consumption calculation (distance / fuel) is the inverse of the European approach (fuel / distance). Also note that 1 kilometer is 0.6214 miles, and 1 liter is 0.2642 gallons.]The result should be with two decimal places.
3	Vohra went to a movie with his friends in a Wave theatre and during break time he bought pizzas, puffs and cool drinks. Consider the following prices: Rs.100/pizza Rs.20/puffs Rs.10/cooldrink Generate a bill in Java for What Vohra has bought.
4	HICET wants to recognize the department which has succeeded in getting the maximum number of placements for an academic year. The departments that have participated in the recruitment drive are CSE, ECE, MECH. Help the college find the department getting maximum placements. Check for all the possible output given in the sample snapshot. Note : If any input is negative, the output should be "Input is Invalid". If all department has equal number of placements, the output should be "None of the department has got the highest placement".
5	Rhea Pandey's teacher has asked her to prepare well for the lesson on seasons. When her teacher tells a month, she needs to say the season corresponding to that month. Write a program to solve the above task. Spring – March to May, Summer – June to August, Autumn – September to November and, Winter – December to February. Month should be in the range 1 to 12. If not the output should be "Invalid month".
6	Write a Java program to read the value of an integer m and display the value of n is 1 when m is larger than 0, 0 when m is 0 and -1 when m is less than0.
7	Write a Java program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate pointlies.

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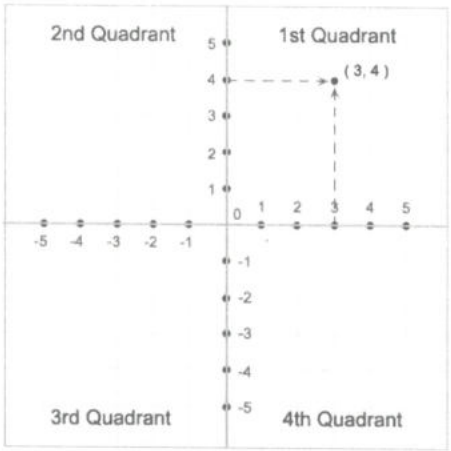

8. Write a Java program to find the eligibility of admission for a professional course based on the following criteria:
Eligibility Criteria:
Marks in Maths>=65 and Marks in Phy>=55 and Marks in Chem>=50 and Total in all three subject >=190 or
Total in Maths and Physics >=140 Input the marks obtained in Physics :65
Input the marks obtained in Chemistry :51 Input the marks obtained in Mathematics :72
Total marks of Maths, Physics and Chemistry: 188
Total marks of Maths and Physics: 137
The candidate is not eligible.

8

There is a jar full of candies for sale at a mall counter. The jar has the capacity N, that is JAR can contain maximum N Candies when a JAR is full. At any point in time, JAR can have an M number of candies where M<=N. Candies are served to the customers. JAR is never remaining empty as when the last K candidates are left, JAR is refilled with new candidates in such a way that JAR gets full. Write a Java to implement the above scenario. Display JAR at the counter with the available number of candies.Input should be the number of candies one customer orders at a point in time. Update the JAR after every purchase and display JAR at the counter. The output should give the number of candies sold and the updated number of candies in the JAR. If the input is more than the number of candies in JAR, return "INVALID INPUT".
Given, N=10, Where N is the number of candies available, K<=5, Where K is the numberof minimum candies that must be inside JAR ever.

9

XYZ Technologies is in the process of increment the salary of the employees. This increment is done based on their salary and their performance appraisal rating.
If the appraisal rating is between 1 and 3, the increment is 10% of the salary.
If the appraisal rating is between 3.1 and 4, the increment is 25% of the salary.
If the appraisal rating is between 4.1 and 5, the increment is 30% of the salary.
Help them to do this, by writing a Java program that displays the incremented salary.
Note: If either the salary is 0 or negative (or) if the appraisal rating is not in the range 1 to 5 (inclusive), then the output should be "Invalid Input".

10

Write a program to create a class Student2 along with two method getData(),printData() to get the value through argument and display the data in printData. Create the two objects s1, s2 to declare and access the values from classSTtest.

11

Write a Java program that prints all real solutions to the quadratic equation ax2 +bx +c= 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 -4ac isnegative, display a message stating that there are no realsolutions.

12

The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non-recursive functions to print the nth value in the Fibonaccisequence.

13

Write a java program to create an abstract class named Shape that contains an empty method named

14

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	number Of Sides( ).Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides( ) that shows the number of sides in the given geometricalfigures.
15	Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file inbytes.
16	Write a Java program to count a total number of duplicate elements in anarray.
17	Write a program in C to merge two arrays of same size sorted in descendingorder.
18	Write a Java program to find sum of rows and columns of aMatrix.
19	Write a Java program to set zeroes in lower triangular of amatrix.
20	Write a Java program to check whether a given substring is present in the givenstring.
21	Write a Java program to read n strings through keyboard and sortit.
22	Write a Java Program to read an excel.
23	Write a java program in which you will declare two interface sum and Add inherits these interfaces through class A1 and display theircontent.
24	Write a Java program that creates three threads. First thread displays "Good Morning" everyone second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every threeseconds.
25	Write a Java program that correctly implements producer consumer problem using the concept of inter threadcommunication.
26	Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and onlyone light can be on at a time No light is on when the programstarts.
27	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide byzero.
28	Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialogbox.
29	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 thenumber.
30	Write programs of database connectivity using JDBC-ODBC drivers.
	Total Practical Hours 45

Course Outcome

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

CO1: Understand the basics of Java Programming

CO2: Design program using Inheritance, interface and exception handling techniques.

CO3: Develop applications using multithread programming.

CO4: Implement data structure concepts using Generic programs and collection classes. CO5: Design real time applications using Event handling and Swing.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT4002	DATABASE MANAGEMENT SYSTEM LABORATORY	0	0	3	1.5

Course Objective

1. To understand data definitions and data manipulation commands.
2. To learn the use of nested and join queries
3. To understand views and constraints
4. To understand functions, procedures and procedural extensions of data bases
5. To understand design and implementation of typical database applications

Exp. No	Description of the Experiments
1	Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving tables
2	Database Querying – Simple queries, Nested queries, Sub queries and Joins
3	Views, Sequences, Synonyms
4	Database Programming: Implicit and Explicit Cursors
5	Procedures and Functions
6	Triggers
7	Exception Handling
8	Database Design using ER Modeling, Normalization

Total Practical Hours:45

Scenario 1

Example 1:

Table 1: Busdiv

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

Table 2: Busroute

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

Table 3: Busdepot

Place_id	Place	Address	Station
01	Chennai	12, Beach Rd	Broadway
02	Madurai	17, Bye Pass Rd	Ellis Nagar
03	Trichy	11, First Cross Road	Tollgate
04	Bangalore	15, Second St	Malleswaram
05	Hyderabad	115, Lakeview Rd	Charminar
06	Nellai	12, Temple Rd	Town

Table 4: Journey

J-Id	Date	Time	Route_id	Buscode
01	13-Jan-97	10:00:00	201	01

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02	13-Jan-97	12:00:00	201	01
03	13-Jan-97	13:00:00	201	01
04	13-Apr-97	15:00:00	202	02
05	13-Apr-97	17:00:00	202	03
06	13-Apr-97	19:00:00	203	04

Table 5: Ticket

J-Id	Tick_no	Dob	Doj	Time	Station	Origin	Dest	Adults	Child	Totfare	Route_id
01	001	10-Dec-96	13-Jan-97	10:00:00	Broadway	Chennai	Madurai	1	1	225	201
02	002	12-Dec-96	13-Jan-97	12:00:00	Broadway	Chennai	Madurai	2	0	90	202
03	003	01-Jan-97	13-Jan-97	13:00:00	Broadway	Chennai	Madurai	1	1	255	201
04	004	02-Feb-97	13-Apr-97	15:00:00	Tollgate	Trichy	Madurai	3	0	90	203
05	005	05-Mar-97	13-Apr-97	17:00:00	Tollgate	Trichy	Madurai	1	0	150	204
06	006	18-Mar-97	13-Apr-97	19:00:00	Town	Nellai	Madurai	1	1	90	202

Table 6: Ticketdetail

Tick_no	Name	Sex	Age	Fare
001	Latha	F	24	170
001	Anand	M	10	85
002	Pradeep	M	30	45
002	Kuldeep	M	32	45
003	Rakesh	M	48	170
003	Brindha	F	08	85
004	Radhika	F	22	30
004	Juliat	F	21	30

Constraints

1

Busdiv **Busroute**

Buscode(primary key) Busdesc(Unique)

Buscode(Foreign key)Route_no(Unique)

2

Journey **Ticket**

J_Id(primary key) J_Id(Foreign key)

Day(Notnull) Time(Notnull)

Time(Notnull) Origin(Notnull)

Dest(Notnull)

3

Busroute **Journey**

Route_id (primary key) Route_id (Foreign key)

4

Ticket **Ticketdetail**

Tick_no (primary key) Tick_no (Foreign key)

Sex (Check constraint for accepting either M of F)

5

Busdiv **Journey**

Buscode (primary key) Buscode (Foreign key)

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

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

Scenario 2:

Table 1: Emp

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

Table 2: Dept

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

Table 3: Salgrade

Grade	LoSal	HiSal
1	700	1200
2	1201	1400
3	1401	2000
4	2001	3000
5	3001	9999

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

Scenario 3

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

Scenario 4

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

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Course Outcome	Upon completion of this course, the students will be able to	
	CO1:	Able to populate and query a Database
	CO2:	Able to create different applications using SQL commands
	CO3:	Able to Create and maintain tables using PL/SQL
	CO4:	Able to use front end tool
	CO5:	Able to design and implementation of typical Database applications

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19MC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

Course Objective

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

Unit	Description	Instructional Hours
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic traditionnd Case Studies.	4
	TOTAL INSTRUCTIONAL HOURS	**20**

Course Outcome

CO1: Ability to understand the structure of Indian system of life.
CO2: Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective

REFERENCE BOOKS:

R1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

R2. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan

R3. Fritzof Capra, Tao of Physics

R4. Fritzof Capra, The wave of Life.

R5.V N Jha(Eng. Trans,), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, makuam

R6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.

R7. GN Jha(Eng. Trans.) Ed. R N Jha, Yoga-darshanam with VyasaBhashya, VidyanidhiPrakasham, Delhi, 2016.

R8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi,2016.

R9. P R Sharma (English translation), ShodashangHridayam

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SYLLABUS

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5201	MOBILE COMPUTING	3	0	0	3

Course Objective

The student should be made to:

1. Learn the basic concepts of Mobile Computing.
2. Understand the Architecture and Components of Mobile Operating Systems.
3. Identify the various schemes in MAC protocols.
4. Study the functionalities of Mobile IP protocols.
5. Gain knowledge on Routing and Security issues in Ad hoc and Sensor networks.

Unit	Description	Instructional Hours
I	**CELLULAR TECHNOLOGY** Mobile Computing – Mobile Computing Vs Wireless Networking-Mobile Computing Applications – Characteristics of Mobile Computing – Structure of Cellular Mobile Communication –GSM – Services – Architecture – GPRS – Services – Architecture Services – UMTS, Satellite Systems-GEO, LEO, MEO.	12
II	**MOBILE APPLICATION DEVELOPMENT AND OPERATING SYSTEMS** Responsibilities of OS in Mobile device – Mobile O/S-Windows Mobile-Palm OS-Symbian OS Android and Blackberry OS, Protocols and Platforms for Mobile Computing -Mobile Devices as Web clients-WAP- Bluetooth, XML, J2ME, JavaCard, Linux for Mobile Devices, Android Software Development Kit-M-Commerce-B2C and B2B applications-Security Issues	12
III	**MAC PROTOCOLS** Properties – Wireless MAC – Taxonomy – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes – Wireless LAN Standards – IEEE 802 Protocol Architecture, IEEE 802.11 System Architecture, Protocol Architecture & Services, MAC protocols for Ad Hoc networks, Cognitive Radio ad-Hoc networks	12
IV	**MOBILE INTERNET PROTOCOL AND MOBILE DATABASE** Mobile IP – Terminologies of Mobile IP – Packet Delivery – Features of Mobile IP – Key Mechanism– Route optimization -DHCP – Significance of DHCP , Transaction Processing in mobile Environment, Mobile Transaction models.	12
V	**MOBILE ADHOC NETWORKS &WIRELESS SENSOR NETWORKS** MANET : Characteristics – Routing Protocols- VANET –Security issues in MANET – Attacks on Adhoc Networks – Sensor Networks: Characteristics - Routing Protocols.	12
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

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

CO1: learn the basic concepts of mobile computing and its applications.
CO2: Execute and Analyse the components of Mobile Operating Systems
CO3 Understand the various schemes in MAC protocols.
CO4: Understand and demonstrate the functionalities of Mobile IP protocols
CO5: Understand the routing and security issues in Ad hoc and Sensor networks

TEXT BOOKS:

T1- Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning Pvt. Ltd, Second Edition, New Delhi ,2015.

T2 - Jochen H. Schller, —Mobile Communications, Pearson Education, Second Edition, New Delhi, 2008

REFERENCE BOOKS:

R1-AsokeKTalukder,HasanAhmedandRoopaRYavagal,-MobileComputing–Technology,Applications andService Creation, Tata McGraw Hill, New Delhi, 2010.

R2 -Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, Wiley Publishers, 2015

R3-RajKamal,-MobileComputing,OxfordUniversityPress,NewDelhi,2012

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5202	COMPUTER NETWORKS	3	0	0	3

Course Objective

The student should be made to:

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

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

Course Outcome

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

CO1:Learn about the Protocol Layering and Physical Level Communication

CO2:Understand the Data Communication System and the purpose of Layered Architecture.

CO3: Analyze the concepts of Routing Methods and Subnetting.

CO4: Design protocols for various functions in the Network.

CO5: Understand the functions and Protocols of the Transport Layer

TEXT BOOKS:

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.

REFERENCE BOOKS:

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 Networksl, Pearson Prentice Hall Publishers, Second Edition, 2015.

R3: Behrouz A. Forouzan, —Data communication and Networkingl, Tata McGraw – Hill, Fifth Edition, 2013.

R4: Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, Computer Networks: An Open Source Approach, McGraw Hil Publishers, 2011.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5203	MICROCONTROLLERS AND EMBEDDED SYSTEMS	3	0	0	3

Course Objective

The student should be made to:

1. To conceptualize the basics of Organizational and Architectural issues of a Microcontroller.
2. To Learn Programming Techniques used in Microcontroller.
3. To Understand the basic concepts of ARM Processor.
4. To Gain Knowledge about the Fundamentals of Embedded Computing and Memory Mechanisms.
5. To Study the Software Development Tools.

Unit	Description	Instructional Hours
I	**THE MICROCONTROLLER ARCHITECTURE** Introductionto8051Microcontroller- Pin Configuration-Architecture- Input /Output Ports-Addressing Modes.	9
II	**INTERFACING MICROCONTROLLER** Timers- Serial Port -Interrupts External- Memory Interface - LCD & Keyboard Interfacing-ADC,DAC - Stepper Motor	9
III	**ADVANCED RISC MACHINES** ARM Embedded Systems- ARM Processor: Architecture, Registers, CPSR, Processor Operating Modes- Brief introduction to Exceptions, Interrupts and Vector Table-Instruction set: Data processing, Load-Store -Addressing Modes.	9
IV	**EMBEDDED COMPUTING AND MEMORY MANAGEMENT** Characteristics of Embedded Computing- Challenges of Embedded Systems-Embedded system design process-Memory System Mechanisms: Caches, Memory System Performance, MMU and Address Translation.	9
V	**EMBEDDED SYSTEM DEVELOPMENT** Embedded Software Development Tools-Emulators and Debuggers-Design Methodologies-Case Studies- Digital Camera, Smart Card, Mobile Phone Software.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Learn the basic Structure of Microcontroller.

CO2: Analysis and Design to Interface Program Microcontroller.

CO3: Describe the Function of ARM Processor Architecture.

CO4: Understand Memory System Mechanisms

CO5: Design Conceptual Embedded System.

TEXT BOOKS:

T1-Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, The 8051Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education, 2nd Edition 2011.

T2-Marilyn Wolf, Computers as Components - Principles of Embedded Computing System Design, Morgan Kaufmann Publisher , 4th Edition, 2016.

REFERENCE BOOKS:

R1- Andrew N, Dominic symes, Chriswright, ARM System Developer's Guide: Designing and Optimizing System Software, Elsevier,2010.

R2- Rajkamal,Embedded Systems Architecture, Programming and Design, McGraw Hill Education, Third Edition,2015.

R3-Daniel W Lewis, —Fundamentals of Embedded Softwarel, Pearson Education, 2011.

R4- Steve Furber, ARM System-on-Chip Architecture, Pearson Education, 2nd Edition 2010.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5204	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3	0	0	3

Course Objective

The student should be made to:

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Understand the need for machine learning for various problem solving.
4. Understand the latest trends in machine learning.
5. Introduce the concepts of Expert Systems

Unit	Description	Instructional Hours
I	**INTRODUCTION AND PROBLEM SOLVING** Definitions of AI - Intelligent Agents. Problem solving by searching: Problem-solving agents- Example problems – Search for solutions- Uninformed Search Strategies – Informed search strategies – Heuristic functions. Local Search Algorithms and Optimization Problems	9
II	**PROBLEM SOLVING METHODS** Adversarial search: Games-Optimal decisions in games – Mini-Max Algorithm-Alpha-beta pruning-Constraint Satisfaction Problems(CSP):Defining CSP Problems-Constraint Propagation: Inference in CSPs - Backtracking search for CSPs	9
III	**INTRODUCTION TO MACHINE LEARNING** Machine Learning- Applications of Machine Learning-Types of Learning-Supervised, Unsupervised, reinforcement, Classification Learning-Important elements in Machine Learning: Data formats – Learnability-Statistical Learning Approaches-Elements of Information theory.	9
IV	**SUPERVISED AND UNSUPERVISED LEARNING** Classification: Introduction – Fundamentals of Classification-k-nearest neighbor Classifier-Classification with Support Vector Machines- Clustering: Introduction- K means Algorithm – Mean Shift Algorithm	9
V	**EXPERT SYSTEMS** Characteristics of Expert System- Components of an Expert System-Expert System Development- Knowledge Engineering-Applications of Expert System-Case Studies: A Simple Medical Expert System-Successful Expert Systems.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Identify problems that are amenable to solution by AI methods.

CO2: Identify appropriate AI methods to solve a given problem.

CO3: Differentiate between supervised, unsupervised, semi-supervised machine learning approaches.

CO4: Analyse and suggest appropriate machine learning approaches for various types of problems

CO5: Design and carry out case studies of Expert Systems.

TEXT BOOKS:

T1- Elaine Rich, Kevin Knight, Shivashankar B Nair-—Artificial Intelligence-, Tata Mc Graw-Hill, (Third edition)-2013.

T2- Tom M. Mitchell, -—Machine Learning, McGraw-Hill Education, 2013.

REFERENCE BOOKS:

R1- Vinod Chandra S.S and Anand Hareendran S, Artificial Intelligence and Machine Learning-PHI Learning Private Limited-2014.

R2- Zsolt Nagy, Artificial Intelligence and Machine Learning Fundamentals-Packt Publishing-(1st Edition) 2018.

R3- Giuseppe Bonaccorso, Machine Learning Algorithms, Packt Publishing,2017.

R4- Stuart Russell, Peter Norvig, -Artificial Intelligence: A Modern Approach,Pearson, 2016.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5205	DATA WAREHOUSING AND DATA MINING	3	0	0	3

Course Objective

The student should be made to:

1. To learn the concept of Data Ware housing and OLAP
2. To understand Data and Preprocessing Techniques
3. To acquaint with the techniques used for Knowledge Discovery in Databases.
4. To study Association rule mining and Classification for handling large data
5. To expose the concept of Clustering in data mining

Unit	Description	Instructional Hours
I	**DATA WAREHOUSING AND OLAP:** Basic Concepts - Operational database systems Vs Data warehouses- A Multi-tieredArchitecture – Data Warehouse Models- Transformation and Loading-Metadata Repository **Data Cube and OLAP:** A Multidimensional Data Model- Stars, Snowflakes and Fact Constellations, Dimensions and Measures, Typical OLAP Operations and Server Architecture	9
II	**KNOWING DATA AND DATA PREPROCESSING:** **Knowing Data**: Data objects and attributes - Statistical description of data - Data visualization. **Data preprocessing:** Data cleaning - Data integration and transformation - Data reduction	8
III	**DATA MINING** Introduction to Knowledge Discovery from Databases (KDD) process, Kinds of data, Datamining Functionalities, Technologies used - Issues – Applications: Mining Sequence data,Statistical data mining, Visual and Audio Data mining, Mining other kinds of data	9
IV	**ASSOCIATION RULE MINING AND CLASSIFICATION** Introduction - Association rule mining – Frequent Item Set Mining Methods: Apriori and FPGrowth Algorithm,Pattern EvaluationMethods. Classification:BasicConcepts – DecisionTree Induction - Bayesian Classification – Rule Based Classification	10
V	**CLUSTERING** ClusterAnalysis – Partitioning Methods: K-Means, K-Medioids- Hierarchical Methods:Agglomerative versus Divisive Hierarchical Clustering , BIRCH, Chameleon and Otherclustering Methods	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1:Identify the Concept of Data Warehousing And OLAP.
CO2:Implement Data Pre-processing For Mining Applications.
CO3:Use Data Mining in Business Applications.
CO4:Apply the Association Rules and Classification for Mining the Data.
CO5:Deploy Appropriate Clustering Techniques.

TEXT BOOKS:

T1: Jiawei Han and MichelineKamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
T2: Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining and OLAP, Tata McGraw – Hill Edition,21st Reprint 2011.

REFERENCE BOOKS:

R1: Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining,Person Education, 2007.
R2. K.P. Soman, ShyamDiwakar and V. Aja, Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
R3: G. K. Gupta, Introduction to Data Mining with Case Studiesl, Eastern Economy Edition, Prentice Hall of India, 2014.
R4: Ian Witten, EibeFrank,Data mining: Practical Machine Learning Tools and Techniques,Morgan Kaufmann,Third edition,2011.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5001	MACHINE LEARNING LABORATORY	0	0	3	1.5

Course Objective

This course will enable students to

1. Provide a broad survey of approaches and techniques in Machine Learning.
2. Make use of Data sets in implementing the Machine Learning Algorithms.
3. Implement ML concepts and Algorithms in any suitable Language of choice.
4. Develop the basic skills necessary to pursue Research in Machine Learning.
5. Develop a deeper understanding of several major topics in Machine Learning

Exp. No	Description of the Experiments
1	Write a program to plot data points in a two-dimensional plane and execute the k-means algorithm on them to perform Clustering.
2	Write a program to illustrate Mean shift in 2D to perform Clustering.
3	Write a program to demonstrate the working of the Decision tree based ID3 Algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5	Write a program to implement the Naïve Bayesian Classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6	Assuming a set of documents that need to be classified, use the Naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7	Write a program to construct a Bayesian Network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8	Apply EM Algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means Algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9	Write a program to implement k-Nearest Neighbor Algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10	Implement the non-parametric Locally Weighted Regression Algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Total Practical Hours 45

Course Outcome

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

CO1: Understand the implementation procedures for the Machine Learning Algorithms. CO2: Design Java/Python programs for various Learning Algorithms.

CO3: Apply appropriate data sets to the Machine Learning Algorithms.

CO4: Identify and apply Machine Learning Algorithms to solve real world problems. CO5: Understand how to perform evaluation of Learning Algorithms and model selection

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5002	MOBILE APPLICATION DEVELOPMENT LABORATORY	0	0	3	1.5

Course Objective

This course will enable students to

1. Know the Components and Structure of Mobile Application Development Frameworks for Android and Windows OS based Mobiles.
2. Understand how to work with various Mobile Application Development Frameworks.
3. Learn the basic and important Design concepts and issues of Development of Mobile Applications.
4. Study the Capabilities and Limitations of Mobile Devices.

Exp. No	Description of the Experiments
1	Develop an application that uses GUI component, Font andColors.
2	Develop an application that uses Layout Managers and EventListeners.
3	Develop a Native CalculatorApplication.
4	Write an application that draws basic Graphical Primitives on theScreen.
5	Develop an application that makes use of Database.
6	Develop an application that makes use of RSSFeed.
7	Implement an application that implements Multi-threading.
8	Develop a Native Application that uses GPS LocationInformation.
9	Implement an Application that writes Data to the SD card.
10	Implement an Application that creates an Alert upon receiving aMessage.
11	Write a Mobile Application that creates AlarmClock
	Total Practical Hours 45

Course Outcome

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

CO1: Design and Implement various Mobile Applications using Emulators.

CO2: Deploy Applications to Hand-Held Devices.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE5071	SOFT SKILLS-I	1	0	0	1

Course Objective

The student should be made to:

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

Unit	Description	Instructional Hours
I	**Introduction to Soft Skills:** Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management-Critical Thinking-Reflectivethinking and writing- p2p Interaction	3
II	**Art of Communication:** Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbalCommunication - Importance of feelings in communication - dealing with feelings in communication.	4
III	**World of Teams:** Self Enhancement - importance of developing assertive skills-developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved – Workingwith Groups – Dealing with People- Group Decision Making.	3
IV	**Quantitative Aptitude:** Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	**Logical Reasoning:** Clocks - Calendars - Direction Sense - Data Interpretation: Tables,Pie Chart, Bar Graph - Data Sufficiency	2
	TOTAL INSTRUCTIONAL HOURS	**15**

Course Outcome

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

CO1:Students will have clarity on their career exploration process and to match their skillsand interests with a chosen career path.

CO2: Students will develop knowledge, skills, and judgment around human communication thatfacilitate 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, andpersevere in solving them.

CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implicationsto 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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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE5072	DESIGN THINKING	1	0	0	1

Course Objective

The student should be made to:

1. To expose students to the designprocess
2. To develop and test innovative ideas through a rapid iterationcycle.
3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
I	**DESIGN ABILITY** Asking Designers about what they Do – Deconstructing what Designers Do – Watchingwhat Designers Do – Thinking about what Designers Do – The Natural Intelligence ofDesign Sources	4
II	**DESIGNING TO WIN** Formula One Designing – Radical Innovations – City Car Design – Learning FromFailures – Design Process and Working Methods	4
III	**DESIGN TO PLEASE AND DESIGNING TOGETHER** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
IV	**DESIGN EXPERTISE** Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	3
	TOTAL INSTRUCTIONAL HOURS	**15**

Course Outcome

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

CO1: Develop a strong understanding of the Design Process

CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.

CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCE BOOKS:

R1 - Tom Kelley, "Creative Confidence", 2013.

R2 - 3. Tim Brown, "Change by Design", 2009

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6181	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

Course Objective

The student should be made to:

1. To Outline the Need for Software Project Management
2. To Learn the Concepts on Project Management and Evaluation.
3. To Plan and Monitor Projects for the Risk Management.
4. To Explore the Process of Monitoring and Controlling
5. To Manage People and Organization of Teams

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT** Project Definition - Importance of Software Project Management - Activities Methodologies-Categorization of Software Projects - Setting Objectives - Management Control – ManagementControl – Stepwise: An Overview of Project Planning.	9
II	**PROGRAM MANAGEMENT AND PROJECT EVALUATION** Introduction - Project Portfolio Management - Evaluation of Individual Projects - Cost Benefit Evaluation Techniques - Managing the Allocation of Resources withinProgrammes – StrategicProgramme Management - Creating a Programme - Aids to Programme Management - Benefits Management.	9
III	**ACTIVITY PLANNING AND RISK MANAGEMENT** Objective(s) – Project Schedule – Sequencing and Scheduling Activities – Network Planning Models– Forward Pass Backward Pass – Critical Path – Activity Float – Shortening Project Duration – Activity on Arrow Networks - Risk Identification, Assessment, Planning, Management -Evaluating Risks to the Schedule.	9
IV	**MONITORING AND CONTROL** Creating Framework – Collecting the Data – Visualizing Progress – Cost Monitoring – Earned ValueAnalysis– Prioritizing Monitoring – Getting Project Back to Target – Change Control – ManagingContracts Introduction – Types of Contract – Stages in Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance.	9
V	**MANAGING PEOPLE AND ORGANIZING TEAMS** Introduction – Understanding Behavior – Organizational Behavior: A Background – Selecting theRight Person for The Job – Instruction in The Best Methods – Motivation– The Oldman – Hackman Job Characteristics Model – Stress - Working in Groups – Becoming a Team –Decision Making – Leadership – Organizational Structures	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Construct and Realize Software Design or Software Deployment.

CO2: Develop a Budget, Schedule or Work Plan.

CO3: Apply Cost Monitoring and Control Strategies for Software Projects

CO4:Understand the Interdependencies between the Processes of the System.

CO5:Manage the Organizational Behaviour of People Working in Teams.

TEXT BOOKS:

T1 - Bob Hughes, Mikecotterell, Software Project Management, Tata McGraw Hill,Sixth edition, 2017

T2 - Adolfo Villafiorita, Introduction to Software Project Management, CRC Press,2014.

REFERENCE BOOKS:

R1 - Murali k. chemuturi, Thomas M. cagly, —Mastering Software Project Management - Best Practices Tools and Techniques, 2010.

R2 - Richard E. Fairly, —Managing and Leading Software Projects, Weilly and Sons, 2009.

R3 - Jalote, —Software Project Management in Practice, Pearson Education, 2014.

R4 - Walker Royce, Software Project Management: A Unified Framework, Addison-Wesley Professional, 2002

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6201	INTERNET OF THINGS	3	0	0	3

Course Objective

The student should be made to:

1. To understand the basics of IoT Technologies.
2. To study various Application Protocols related to IoT.
3. To infer the Design Methodologies of IoT.
4. To summarize various Packages, Frameworks and Cloud Services.
5. To listen to some of the application areas where Internet of Things can be applied.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Introduction -Definition and Characteristics of IoT - Physical design of IoT- Logical design of IoT -IoT enabling technologies- IoT levels and Deployment	9
	PROTOCOLS & THINGS IN IOTs	
II	Smart Objects: The —Thingsl in IoT -Sensors, Actuators, Smart Objects, Sensor Networks Protocols: M2M and WSN Protocols – SCADA and RFID Protocols – IEEE 802.15.4 – BACNet Protocol–Modbus – KNX – Zigbee – MQTT.	9
	DEVELOPING IOTs	
III	IoT design methodology - Motivation for using Python- Logical Design using Python — ControlFlow — Packages — File Handling — Classes — Packages used for connectivity-Python Packagesof Interest for IoT –Case Study on IoT System for Weather Monitoring	9
	IOT PHYSICAL DEVICES AND PHYSICAL SERVER	
IV	IoT Device — Raspberry Pi — Raspberry Interfaces — Programming Raspberry Pi with Python —Other IoT Devices —Cloud Storage Models and Communication APIs - WAMP — Xively Cloudfor IoT— Django — Amazon Web Services for IoT — SkyNet IoT Messaging Platform -Case Study	9
	DOMAIN SPECIFIC IOTs	
V	IoT Application- Home Automation- Smart and connected Cities - Public safety- Agriculture -Environment – Industry -Health and Lifestyle.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Explain the Characteristics and Enabling Technologies of IoT

CO2: Analyse the various Application Protocols related to IoT

CO3: Design IoT based simple applications using Python.

CO4: Describe the different Packages, Frameworks and Cloud Services.

CO5: Implement small IoT based Real Time applications

TEXT BOOKS:

T1 - Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015.

T2 - David Hanes, CCIE No. 3491, Gonzalo Salgueiro, CCIE No. 4541, Patrick Grossetete, Robert Barton, CCIE No. 6660, CCDE No. 2013:6, Jerome Henry, CCIE No. 24750, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things Cisco Press, Jun 13, 2017.

REFERENCE BOOKS:

R1- Gaston C.Hillar, —Internet of things with python,Packt Publishing Limited, 2016.

R2 - Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 1st edition, 2013

R3 - Andrian McEwen, Hakim Cassimally, —Designing the Internet of Things", John Wiley & Sons Ltd, 1st edition, 2014.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6202R	PRINCIPLES OF COMPILER DESIGN	3	0	0	3

Course Objective

The student should be made to:

1. To study the various phases of compiler and lexical analyzer.
2. To learn the various parsing techniques
3. To understand intermediate code generation
4. Gain knowledge about run time environment and storage allocations.
5. Learn how to optimize and effectively generate machine codes.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPILERS** The structure of a compiler - Role of Lexical Analyzer – Input Buffering –Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata – Minimizing DFA.	9
II	**SYNTAX ANALYSIS** Role of the Parser-Context Free Grammars -Writing a Grammar-Top Down Parsing - Recursive-Descent parsing-Non recursive Descent Parsing-Bottom up parsing-ShiftReduce Parser-LR Parser - LR (0) Item Construction of SLR Parsing Table - Introduction toLALR Parser - Error Handling and Recovery in Syntax Analyzer	9
III	**INTERMEDIATE CODE GENERATION** Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.	9
IV	**RUN–TIME ENVIRONMENT:**Storage Organization- StaticVersus DynamicStorage Allocation- Access to non-local Data on the Stack-Stack Allocation of Space- Heap Management-Introduction to Garbagecollection-Introduction to Trace based collection.	9
V	**CODE OPTIMIZATION AND GENERATION** **Code optimization:** Introduction, The principle sources of optimization Loop optimization and Peephole optimization, DAG- optimization of basic blocks. **Code generation:** Issues in Code Generation –Target Language –Address in the Target Code- Design of a simple Code Generator.	9
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome

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

CO1: Understand the different phases and lexical Analysis of compiler.
CO2: Apply different parsing algorithms to develop the parsers for a given grammar.
CO3: Understand syntax-directed translation in Intermediate code generation.
CO4: Gain knowledge on Run-time environment.
CO5: Apply code optimization techniques and understand code generation.

TEXT BOOKS:

T1-Aho, Ravi Sethi, JD Ullman, Compilers Principles, Techniques and Tools, Pearson Education/Prentice Hall of India, (2nd Edition), 2014

T2- Terence Halsey, Compiler Design: Principles, Techniques and Tools, 1st Edition, Larsen & Keller education, 2018

REFERENCE BOOKS:

R1 - V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers,5th Edition, 2017.

R2- Douglas Thain, Introduction to Compilers and Language Design, LULU Press, 1st Edition, 2019.

R3- Des Watson, A Practical Approach to Compiler Construction, Springer International Publishing AG, 1st Edition, 2017.

R4- Sebastian Hack, Reinhard Wilhelm, Helmut Seidl,Compiler Design: Code Generation and Machine-Level Optimization, Springer Berlin Heidelberg, 1st Edition, 2016.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6251	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	2	4

Course Objective

The student should be made to:

1. To understand the basic concept of OSI Security Architecture and Classical Encryption Techniques.
2. To identify the concept of Symmetric and Asymmetric Ciphers.
3. To learn how to understand the Hash Functions and Digital Signature.
4. To provide Symmetric and Asymmetric Algorithms related to Cryptography.
5. To understand the Security Applications in the field of Internet Security Protocols

Unit	Description	Instructional Hours
I	**INTRODUCTION AND SYMMETRIC CIPHERS** Computer Security Concepts - The OSI Security Architecture - Security attacks, services and mechanisms – A Model for Network Security– Classical Encryption Techniques (Substitution Techniques, Transposition Techniques, Steganography). **Program for Encryption and Decryption using the following Substitution Techniques(i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher**	5+4
II	**SYMMETRIC AND ASYMMETRIC CIPHERS** Fermat's and Euler's Theorems - The Chinese Remainder Theorem - Discrete Logarithms – DES – AES - Block Cipher Modes - Public Key Cryptography and RSA - Other Public-Key Cryptosystems. **Program for DES and RSA algorithm for practical applications.**	7+2
III	**AUTHENTICATION AND HASH FUNCTION** Cryptographic Hash Functions - Applications of Cryptographic Hash Functions - Hash Functions Based on Cipher Block Chaining - Secure Hash Algorithm (SHA)-Message Authentication Codes - Message Authentication Requirements - Message Authentication Functions - MACs Based on Hash Functions: HMAC - Digital Signatures. **To Calculate the message digest of a text using the SHA-1 algorithm**	7+2
IV	**MUTUAL TRUST** Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Asymmetric Encryption - Distribution of Public Keys - X.509 Certificates – Public Key Infrastructure User Authentication Protocols: Remote User **Demonstrate intrusion detection system (ids) using any tool e.g. Snort or any other s/w.**	5+4
V	**NETWORK AND INTERNET SECURITY PROTOCOLS** Basic Concepts, Secure Sockets Layer (SSL), - Transport Layer Security (TLS) - HTTPS - Secure Shell (SSH) –Electronic mail Security: Pretty Good Privacy (PGP)- S/MIME-IP SECURITY **Defeating Malware Function: i) Building Trojans ii) Rootkit Hunter**	7+2
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: To Classify the Symmetric Encryption Techniques

CO2: To be able Understand Symmetric and Asymmetric Ciphers key algorithm.

CO3: To Evaluate security mechanisms, hash functions and digital signature.

CO4: Summarize the intrusion detection and its solutions to overcome the attacks.

CO5: The student will able to apply Network and Internet security protocols

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TEXT BOOKS:

T1: William Stallings, Cryptography and Network Security: Principles and Practice, Pearson Publication, (7th Edition), 2017.

T2: Behrouz Forouzan, Debdeep Mukhopadhyay, Cryptography and Network Security, Tata McGraw Hill Publication, (3rd Edition), 2015.

REFERENCE BOOKS:

R1: Atul Kahate, —Cryptography and Network Security, Tata McGraw Hill Publication, 2019.

R2: Charles P Pfleeger, Shari Lawrence Pfleeger Jonathan Margulies Security in computing, Pearson Publication, 2018.

R3: Roberta Bragg, Mark Rhodes Ousley, Keith Strassberg, —Network Security: The Complete Reference, McGraw Hill Publication, 2017.

R4: Kaufman, Perlman and Speciner, Network Security: Private Communication in a public world, Pearson Publication, 2016.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6001	INTERNET OF THINGS LABORATORY	0	0	3	1.5

Course Objective

1. To physically recognize and understand the use cases of different sensors
2. To setup a Raspberry PI board
3. Understand the architecture of IoT solutions
4. Learn about various technologies helping IoT grow
5. Implement an IoT solution practically

Exp. No	Description of the Experiments
1	Case Study
1 a)	Run some python programs on Pi like:
1 b)	Read two numbers and print their sum, difference, product anddivision.
1 c)	Word and character count of a given string Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input Print a name 'n' times, where name and n are read from standard input, using for and whileloops.
1 d)	Handle Divided by Zero Exception.
1 e)	Print current time for 10 times with an interval of 10 seconds.
1 f)	Read a file line by line and print the word count of eachline.
2	Light an LED through Python program
3	Read the analog Data through sensors from physical environment (Use MCP3008)
4	Access an Image through a Piwebcam
5	Control a Light source using webpage
6	Machine to Machine Connectivity using MQTT Protocol
7	Create a Web Server using RESTFUL API
8	Network File Transfer using TCP (Wi-Fi)
9	Get the status of a bulb at a remote place (on the LAN) through web.
10	Study: Amazon Web Services
11	Implement an intruder system that sends an alert to the given mail using Node-Red.

Total Practical Hours 45

Course Outcome

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

CO1: Understand constraints and opportunities of wireless and mobile networks for Internet of Things.

CO2: Analyse real time data stored in a cloud server using data analytics tool.

CO3: Develop skills to integrate IoT devices

CO4: Design and implement solutions to IoT based problems.

CO5: Create an IoT based application

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6002	HARDWARE AND SOFTWARE CLINIC	0	0	3	1.5

Course Objective

1. To help the students look into the functioning of simple to complex devices and systems
2. To enable the students to design and build simple systems on their own
3. To help experiment with innovative ideas in design and team work
4. To create an engaging and challenging environment in the engineering lab

COURSE ASSESSMENT METHODS:

DIRECT

1. Project reviews50%
2. Workbookreport10%
3. Demonstration & Viva – voce 40%

IN-DIRECT

1. Course-end survey

Content:

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

GUIDELINES:

1.Practical based learning carrying credits.

2.Multi-disciplinary/ Multi-focus group of 5-6 students.

3.Groups can select to work on specific tasks, or projects related to real world problems.

4.Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.

5.The students have to display their model in the Engineering Clinics Expoat the end of semester.

6.The progress of the course is evaluated based on reviews and final demonstration of prototype.

Total Practical Hours 45

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE6071	SOFT SKILLS-II	1	0	0	1

Course Objective

1. To make the students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
2. To learn everything from equations to probability with a completely different approach.
3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	**GroupDiscussion&PresentationSkills:**GDskills–Understandingtheobjectiveand skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management– Mock Presentations & Feedback	4
II	**Interview Skills andPersonalitySkills:** Interview handling Skills – Self preparationchecklist–Groomingtips:do's&don'ts–mockinterview&feedback-Interpersonal skills-creative thinking-problem solving- analytical skills	3
III	**Business Etiquette & Ethics:** Etiquette – Telephone & E-mail etiquette – Diningetiquette – do's & Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	3
IV	**Quantitative Aptitude:** Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	3
V	**Logical Reasoning:** Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2
	TOTAL INSTRUCTIONAL HOURS	**15**

Course Outcome

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

CO1:Students will have learnt to keep going according to plan, coping with the unfamiliar,managing disappointment and dealing with conflict.

CO2: Students will Actively participate meetings, Group Discussions / interviews and prepare &deliver presentations

CO3: Students will define professional behaviour and suggest standards for appearance, actions andattitude in a Business environment

CO4: Students will be able to apply quantitative reasoning and mathematical analysis methodologiesto understand and solve problems.

CO5: Students will excel in complex reasoning.

REFERENCE BOOKS:

R1: Bridging The Soft Skills Gap: How To Teach The Missing Basics To Today's Young Talent- Bruce Tulgan

R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha

R3: How to crack test of Reasoning - Jaikishan and Premkishan

R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

Course Objective

The student should be made to:

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

Unit	Description	Instructional Hours
I	**INTRODUCTION TO INTELLECTUAL PROPERTY** Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights	3
II	**PATENTS** Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non -Patentable Subject Matter - Registration Procedure, Rights and Duties ofPatentee, Assignment and license.	3
III	**COPYRIGHTS** Purpose and Function of Trade Marks, Acquisition of Trade Mark Rights, Protectable Matter, Selecting and Evaluating Trade Mark, Trade Mark Registration Processes.	3
IV	**TRADEMARKS** Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks -Registration of Trademarks.	3
V	**DESIGN AND GEOGRAPHICAL INDICATION** Design: meaning and concept of novel and original -Procedure for registration.Geographical indication: meaning, and difference between GI and trademarks -Procedure for registration.	3
	TOTAL INSTRUCTIONAL HOURS	**15**

Course Outcome

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

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

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

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

CO4: Identify different types of trademarks and procedure for registration

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

TEXT BOOKS:

T1- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

T2- V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCE BOOKS:

R1- Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

R2- Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

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PROFESSIONAL ELECTIVES

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5351R	INTERNET AND WEB TECHNOLOGY	2	0	2	3

Course Objective

The student should be made:

To understand Basic HTML tags
To design web page using HTML and CSS
To learn about Client Side Scripting: Java Script

To have a knowledge in server side scripting-Servlet

To understand Server-Side Scripting -Node.js

Unit	Description	Instructional Hours
I	**HTML** Web Essentials: Clients, Servers, Basic Terminologies – HTML: Introduction - HTML Basic Tags – Elements - Attributes - Basic Formatting, Fonts and Colors, Images, Hyperlink – Entity- Grouping Using Div and Span, Lists, Tables, Frames, Form – HTML5 features-Audio-Video. **Illustrative programs: Design a static web page using HTML – Mark Sheet, Curriculum Vitae, College Website; Design a Registration Form using HTML**	9
II	**CASCADING STYLE SHEET** **CSS: Introduction to Cascading Style Sheets-Features- Syntax - Types of Style Sheets – Selectors - CSS Background, Font, Text, Images-List, Tables, CSS Layout: Box Model-Normal Flow-Flexbox-Grids- Positioning.** **Illustrative programs: Apply CSS for a Chess Board design using DIV, Apply CSS for the Curriculum vitae, College Web site and Drop Down Menu design**	9
III	**CLIENT SIDE SCRIPTING: JAVA SCRIPT** Introduction to JavaScript -Data Types, Variables, Operators, Conditional Statement, Iteration, Switch Case, Arrays, Dialog boxes- Functions: reduce, spread, rest – Event handling-Objects: Built-in -Global object - DOM-Object Properties – Asynchronous Programming. **Illustrative programs: Mobile Number Validation, Rupee to Dollar & Dollar to Rupee Conversion using DOM, RGB Range Selector.**	9
IV	**SERVER SIDE SCRIPTING: SERVLET AND JSP** Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies-DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example. JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code **Illustrative programs: Create a web application with Login Operation, Session Treacking**	9
V	**SERVER SIDE SCRIPTING: NODE JS** Introduction to Node.js -Node.js Module- HTTP module- Express Framework-Request & Response-Basic Routing-Serving Static Files- Sessions & Cookies- DB Connection Setup with mongo DB. **Illustrative programs: Create a web application with sessions and CRUD operations**	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

CO1: Design simple web pages using mark-up languages like HTML.

CO2: Develop a web page HTML and CSS.

CO3: Creation of dynamic web page using Client Side Scripting

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CO4: Design a Server Side web application using servlet and JSP.

CO5: Creation of simple web application using node.js Framework

TEXT BOOKS:

T1- Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

T2- Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.

T3- https://nodejs.dev/.

REFERENCE BOOKS:

R1- 1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.

R2- 2. Mike Cantelon, Marc Hartert, T.J. Holowaychuk, Nathan Rajlich" Node.js in Action", Manning Publications, 2014.

R3- 3. David Gutman, Fullstack Node.js The Complete Guide to Building Production Apps with Node.js , Fullstack.io 2019

R4- https://javascript.info/

R5- https://www.tutorialspoint.com/

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5352	ADVANCED JAVA PROGRAMMING	2	0	2	3

Course Objective

The student should be made to:

1. Understand the basic concepts of Inheritances, packages and interfaces inJAVA Programming.
2. Identify the need for advanced Java concepts like Enumerations andCollections.
3. Adapt Servlets to build Server-Side Programs.
4. Gain knowledge on Spring Core Framework.
5. Construct Database Queries and Understand the Mechanism of JDBC.

Unit	Description	Instructional Hours
I	**OVERVIEW OF JAVA PROGRAMMING:** Introduction to Java Programming-Features of Java Language, JVM, Inheritance, Interfaces and Packages, Exception Handling, Multithreaded Programming. **Programs to demonstrate use of implementing Interfaces andPackages**	9
II	Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values () and valueOf() Methods, Java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean andcharacter values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations,Annotation basics, specifying retention policy, Obtaining Annotations at run time by use ofreflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations. **Program to implement Wrapper Classes and their Methods.**	9
III	**SERVLETS:** Introduction to Servlets: The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.httppackage;Handling HTTPRequests andResponses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects. **Programs to Demonstrate the use of Servlet Program.**	9
IV	**JAVA SPRING FRAMEWORK**: Spring Introduction: What is Spring and Its Features, How Spring Fits in to Enterprise Edition? Spring Beans: What is Spring Bean-Bean Scope- Bean Lifecycle, IOC Containers: Core Container- J2EE Container-Web Container, Dependency Injection -Setter DI and Constructor DI, Auto wiring: ByType-ByName. **Create a Program using Bean Development Kit and JAR files.**	9
V	**JAVA DATABASE CONNECTIVITY**: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database,Statement Objects; ResultSet;Transaction Processing; Metadata, Data types; Exceptions. **Programs to Illustrate the use of JDBC Connection.**	9
	TOTAL INSTRUCTIONAL HOURS	45

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Course Outcome	CO1: Design program using user defined Packages and Interfaces. CO2: Interpret the need for advanced Java concepts like Enumerations and Collections in developing. CO3: Execute programs on basic concepts of JSP and Build Applications usingJSP and deploy the Project using Tomcat Server. CO4: Work on concepts of Spring. CO5: Illustrate Database access and details for managing information using theJDBC API.

TEXT BOOKS:

T1 - Herbert Schildt: JAVA the Complete Reference, Eleventh Edition, Tata McGraw Hill, 2018.T2 - Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2015.

REFERENCE BOOKS:

R1 - Cay S. Horstmann: Core Java, Volume II—Advanced Features, 11th Edition, Prentice Hall,2019. R2 - Y. Daniel Liang: Introduction to JAVA Programming, Eleventh Edition, Pearson Education, 2017.

R3- Markus Eisele: Modern Java EE Design Patterns: Building Scalable Architecture for Sustainable Enterprise Development, O'Reilly Media, Online Edition, 2016.

R4-Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5353	C# AND NET PROGRAMMING	2	0	2	3

Course Objective

The student should be made:

1. To learn Basics of C# Language.
2. To interpret the Advanced Features of C#.
3. To utilize the .Net Framework to develop Distributed Applications.
4. To gain Basic Knowledge on Database Programming.
5. To know the terminologies of ASP.Net in Web Applications Development.

Unit	Description	Instructional Hours
I	**C# LANGUAGE BASICS** Introducing C#, Understanding .NET, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations. **Programs using Arrays and strings**	7+2(P)
II	**C# ADVANCED FEATURES** Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Console I/O Operations, Errors and Exceptions, Multithread. **Programs using Interfaces and Exception Handling**	7+2(P)
III	**.NET FRAMEWORK** Common language Runtime (CLR), Common Type System (CTS), Common language Specification (CLS), Compilation Process, Assemblies, Versioning, Reflection, Namespaces, Command line compiler, Marshaling, Remoting. **Client Server Programming**	7+2(P)
IV	**DATABASE PROGRAMMING** Data Access with ADO.NET, Architecture, Data Reader, Data Adapter, Command, Connection, Data set, Data Table, Data Row, Data Column, Data binding, Data Grid Control, XML based Data sets. **Database Applications using ADO.Net**	5+4(P)
V	**WEB APPLICATIONS** Web Development and ASP.NET, Architecture Web Forms, Web Form Controls, Life time Management, Application, Session, ASP with ADO.NET Validation Controls, Website Security. **Web Applications using ASP.Net**	5+4(P)
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

Upon completion of this course, the students will be able to CO1: Understand the Basic Terminologies of C# Languages.CO2: Express the advanced features of C#.
CO3: Enhance the skills on Developing Client Server Applications.CO4: Discover the ideas on Database Applications Development.
CO5: Exhibit Web Applications using ASP.Net.

TEXT BOOKS:

T1 E. Balagurusamy, Programming in C#: A Primer, Tata McGraw-Hill (4th Edition), 2015.
T2 Andrew Troelsen, Philip Japikse, C# 6.0 and the .NET 4.6 Framework, A Press publication (7th

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Edition), 2015.

REFERENCE BOOKS:

R1-Andrew Troelsen and Philip Japikse, —Pro C# 7: With .NET and .NET Core, A Presspublication, (8th Edition) 2017.

R2- Adrew Stellman and Jennifer Greene, —Head First C#, O'Reilly (3rd Edition), 2013.

R3-Ian Griffiths, Matthew Adams, and Jesse Liberty, —Programming C# 4.0, O'Reilly (6thEdition), 2010.

R4- Herbert Schildt, —C# 4.0: The Complete Reference, Tata McGraw-Hill, 2010.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5354	ADVANCED DATA STRUCTURE	2	0	2	3

Course Objective

The student should be made:

1. To understand basic Data Structures such as Stacks and Queues.
2. To introduce a variety of Data Structures such as Hash Tables, Search Trees,Tries, Heaps, Graphs.
3. Exploring the Advanced Data Structure Algorithms such as Red Black,Splay Trees etc.,
4. To apply sorting such as Heap Sort, Merge Sort etc.
5. To learn the various Pattern Matching Algorithm.

Unit	Description	Instructional Hours
I	**Introduction to Data Structures,** Abstract data types, Linear list – Singly linked list implementation, Insertion, Deletion and searching operations on linear list, Stacks-Operations, Array and linked Representations of Stacks, Stack Applications, Queues-Operations. **Programs using Singly Linked List, Stacks and Queues.**	5+4(P)
II	**Dictionaries:** Linear list representation, Skip list representation, Operations - Insertion, Deletion and Searching. **Hash TableRepresentation:** Hash functions, Collision resolution- Separate Chaining, Open Addressing-Linear probing, Quadratic probing, Double hashing, Rehashing, Extendible Hashing. **Programs using Hash.**	7+2(P)
III	**Search Trees**: Binary Search Trees, Definition, Implementation, Operations-Searching, Insertion and Deletion, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Red –Black, Splay Trees. **Program using Search Trees.**	5+4(P)
IV	**Graphs:** Graph Implementation Methods. Graph Traversal Methods.Sorting: Heap Sort, External Sorting- Model for external sorting, Merge Sort. **Program using Graph Traversal Methods and Sorting.**	5+4(P)
V	**Pattern Matching and Tries:** Pattern Matching Algorithms-Brute Force, The Boyer –Moore Algorithm, The Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix Tries. **Program using Pattern Matching.**	7+2(P)
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Ability to select the Data Structures that efficiently model the Information ina problem.

CO2: Ability to assess efficiency trade-offs among different Data Structure implementations orcombinations.

CO3: Implement and know the various Graph Traversal Methods.

CO4: Implement and know the application of algorithms for Sorting and PatternMatching.

CO5: Design programs using a variety of data structures, including Hash tables,

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Binary and general Tree Structures, Search Trees, Tries, Heaps, Graphs, and AVL-trees.

TEXT BOOKS:

T1: E. Horowitz, S. Sahni and Susan Anderson Freed "Fundamentals of Data Structures in C,Universities Press (2nd Edition), 2008.

T2: A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, "Data Structures using C, PHI/Pearson Education, 2008.

REFERENCE BOOKS:

R1- R. F. Gilberg and B.A.Forouzan, Cengage,A Pseudocode Approach with C, (2nd Edition),2014. R2-Seymour Lipschutz, —Data Structures Schaum's Outlines,McGraw Hill(Revised 1st Edition), 2014.

R3- Jean-Paul Tremblay & Paul G. Sorenson,An Introduction to Data Structures with Applications, McGraw Hill, (2nd Edition), 2013.

R4- ReemaThareja, —Data Structures using C, Oxford press (3rd Edition), 2012.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT5355	ADVANCED DATABASE TECHNOLOGY	2	0	2	3

Course Objective

The student should be made:

1. To understand the basics of Distributed and Parallel Databases Architectures.
2. To familiar with Object Oriented Relational Databases.
3. To learn how to create XML documents with DTD and XML schema.
4. To understand the concepts of Data Mining and Data warehousing.
5. To study the applications of Intelligent Database Technologies

Unit	Description	Instructional Hours
I	**PARALLEL AND DISTRIBUTED DATABASES** Database SystemArchitectures:CentralizedandClient-Server Architectures–Parallel Systems-Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database: Homogeneous and Heterogeneous DatabasesDistributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control. **Implementation of client server application and 2 phase locking algorithms**	9
II	**OBJECT AND OBJECT RELATIONAL DATABASES** Concepts for Object Databases: Object Identity – Objects versus Literals– Complex Type Structuresfor Objects and Literals– Encapsulation of Operations –Persistence of Objects -Type Hierarchiesand Inheritance -ODMG Model – ODL – Object Database Conceptual Design- OQL-ObjectRelational features in SQL / Oracle **Creating Object Oriented Database using PL/SQL oracle**	9
III	**XML DATABASES AND MOBILE DATABASES** XML Databases: XML Hierarchical Data Model– XML Documents,DTD – XML Schema – XML Querying–MobileDatabases:System Architecture - Location and Handoff Management **Design XML document with DTD and XML Schema using Eclipse.**	9
IV	**QUERY PROCESSING AND OPTIMIZATION** Query Processing - SQL Query Translation - Pipelining - Query Optimization - Query Trees and Heuristics-Overview of Query Optimization in Oracle - Semantic Query Optimization	9
V	**INTELLIGENT DATABASE TECHNOLOGIES** Intelligent Databases: Active databases and Triggers – Temporal Database- Spatial Database- Multimedia Database- Deductive Databases- Information Retrieval concepts. **Implementation ofTriggers using PL/SQL.**	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: To understand the Design Fundamentals and Methodologies of the Software.CO2: To provide basic concepts of Software Design Principles.

CO3: To understand the Architecture Design and Quality Attributes of theSoftware. CO4: To learn the tools of Architectural Design for the current trends.

CO5: To Gain practical experience in the Architectural Design Process for learning-oriented software

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TEXT BOOKS:

T1 -Henry F Korth, Abraham Silberschatz and S. Sudharshan, Database System Concepts, SeventhEdition, McGraw Hill, 2019.

T2 - R. Elmasri, S.B. Navathe, Fundamentals of Database Systems, Seventh edition, Pearson; 2016.

REFERENCE BOOKS:

R1 - Subramaniam, Multimedia Databases, Morgan Kauffman Publishers, 2019.

R2 - Thomas Cannolly and Carolyn Begg, Database Systems, A Practical Approach to Design, Implementation and Management Pearson; 7th edition (2015)

R3- Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining and OLAP, Tata McGrawHill,2008.

R4- Vijay Kumar,Mobile Database systems A John Wiley & Sons, Inc., Publication 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19IT5356	ETHICAL HACKING	2	0	2	3

The student should be made:

Course Objective

1. To understand various hacking techniques and attacks
2. To be exposed to Foot Printing
3. To get familiarized with Data Security
4. To learn about the Network Protection System
5. To learn about the different Ethical Hacking Laws and Tests

Unit	Description	Instructional Hours
I	**ETHICAL HACKING** Types of Data Stolen From the Organizations, Elements of Information Security, Authenticity and NonRepudiation, Security Challenges, Effects of Hacking, Hacker – Types of Hacker, Ethical Hacker, Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors Illustrative programs: To study about Hacking tools and skills, Create a simple keylogger using python	9
II	**FOOT PRINTING AND SOCIAL ENGINEERING** Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking. Illustrative programs: To study about sniffing and its tools, Create a social networking website login using phishing techniques	9
III	**DATA SECURITY** Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking. Illustrative programs: Hide data using Snow Steganography, Perform SQL Injection	9
IV	**NETWORK PROTECTION SYSTEM & HACKING WEB SERVERS** Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking. Illustrative programs: Capture and Analyze Network traffic using Wireshark sniffer, Hacking Web Server	9
V	**ETHICAL HACKING LAWS AND TESTS** An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking. Illustrative programs: Study of Techniques for Web based Password Capturing, Perform Session Hijacking	9
	Total Instructional Hours	**45**

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Course Outcome	Upon completion of this course, the students will be able to CO1: Understand the basic of Ethical Hacking CO2: Gain the knowledge about Foot Printing CO3: Express fundamentals of Data Security CO4: Understand about the Network Protection System CO5:Know about Ethical Hacking Laws and Tests

TEXT BOOKS:

T1 Michael T. Simpson, Kent Backman and James E. Corley, Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2017.

T2 Patrick Engebretson, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy, Syngress publication, 2013.

REFERENCE BOOKS:

R1 DeFino, Barry Kaufman, Nick Valenteen, "Official Certified Ethical Hacker Review Guide", CENGAGE Learning, 2009-11-01.

R2 SPatrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Basics Series – Elsevier, 2011.

R3 Andrew Whitaker, Daniel P. Newman, "Penetration Testing and Network Defense" , Cisco Press, 2006.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6301	BUSINESS INTELLIGENCE AND ANALYSIS	3	0	0	3

Course Objective

The student should be made:

1. To Understand of Decision-Making, Practices of Business Intelligence.
2. To Design and Build Bi Applications Based on Users Needs
3. To Demonstrate the Limitations and Possibilities of Bi Technology
4. To Understand the Concept of Business Intelligent Models.
5. To Analyze the Business Environment with Related Tools.

Unit	Description	Instructional Hours
I	**Business Intelligence an Introduction:** Introduction, Definition, History and Evolution, Business Intelligence Segments, Difference between Information and Intelligence, Defining Business Intelligence Value Chain, Factors of Business Intelligence System, Real time Business Intelligence, Business Intelligence Applications, Types of Business Intelligence, Business Intelligence Platform, Dynamic roles in Business Intelligence, Roles of Business Intelligence in Modern Business- Challenges of BI.	9
II	**Architecting the Data:** Introduction, Enterprise Data and Subject Area Model, Enterprise Conceptual Model, Total Data Quality Management (TDQM). Definition of Data Mining, Data mining parameters, Statistical Perspective on Data Mining, Statistics-need, Similarity Measures, Decision Tree-Illustrations, Neural Network, Neural Network versus Conventional Computers, Data Warehouse, Data Mart, Aspects of Data Mart, Online Analytical Processing, Characteristics of OLAP, OLAP Tools, Data Modeling using Star Schema and Snowflake Schema.	9
III	**Types of Business Models:** B2B Business Intelligence Model, Electronic Data Interchange & E- Commerce Models, Systems for Improving B2B E-Commerce, B2C Business Intelligence Model, Need ofB2C model in Data warehousing, Different types of B2B intelligence Models Knowledge Management: Characteristics of Knowledge Management, Knowledge assets, Generic Knowledge Management Process, Essentials of Knowledge Management Process.	9
IV	**Data Extraction:** Introduction, Data Extraction, Role of ETL process, Importance of source identification, Various data extraction techniques, Change data capture Business Intelligence Life Cycle: Introduction, Business Intelligence Lifecycle, Enterprise Performance Life Cycle (EPLC) Framework Elements, Lifecycle Phases, Human Factors in BI Implementation, BI Development Stages and Steps, Parallel Development Tracks, BI Framework.	9
V	**Business Intelligence User Model:** Business Intelligence Opportunity Analysis Overview, Content Management System, End User Segmentation, Basic Reporting and Querying, Online Analytical Processing, OLAP Techniques, Benefits of using OLAP, Dashboard, Advanced/Emerging BITechnologies, Organization Culture, Managing Total Cost of Ownership for Business Intelligence, Total Cost of Ownership and Business Intelligence, Managing the TCO of the Business Intelligence, Factors that Affect Total Cost of Ownership.	9
	TOTAL INSTRUCTIONAL HOURS	45

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Course Outcome	Upon completion of this course, the students will be able to CO1: Demonstrate knowledge about and understanding of organizational andindividual decision- making and future trends of BI. CO2: Implement the concept of big data and analytics, data visualizationtechniques. CO3: Demonstrate the ability to use BI systems and technology to design and buildBI applications based on users_ needs CO4: Apply relevant theories, concepts and techniques to solve real-world BIproblems CO5: Critically evaluate the limitations and possibilities of BI technology

TEXT BOOKS:

T1 - Jena R K, IT & Business Intelligence 1st Edition, Excel Books-2015.

T2- Mike Davis, Patrick LeBlanc, Knight's Microsoft Business Intelligence 24-Hour Trainer johnWiley & Sons, 2011.

REFERENCE BOOKS:

R1 - Ramesh Sharda, DursunDelen,Business Intelligence: A Managerial Perspective on Analytics,3rdEdition, Pearson, 2010.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6302	INFORMATION SECURITY	3	0	0	3

Course Objective

The student should be made:

1. To provide the basic concepts of Information Security and its life cycle.
2. To understand about Legal, Ethical and Professional issues in Information Security
3. To learn various Risk Identification, Assessment and Managementtechniques.
4. To understand the various Security Standards in Information Security Management.
5. To develop various Security Tools and its Technologies

Unit	Description	Instructional Hours
I	**INTRODUCTION** Critical Characteristic of Information-CNSS Security Model- Components of an Information Systems-Securing the Components- Balancing Security and Access-The SDLC-The Security SDLC,Security Professional and the Organization, Communities of Interest.	9
II	**SECURITY INVESTIGATION** Need for Security-Business Needs-Threats-Attacks-Legal-Ethical and Professional Issues-Law and Ethics in Information Security-Relevant U S. Laws-International Laws and Legal Bodies-Ethics and Information Security-Codes of Ethics and Professional Organizations	9
III	**RISK MANAGEMENT** Risk Management: An Overview of Risk Management, RiskIdentification, Risk Assessment, Risk Control strategies, Selecting a Risk Control Strategy, Quantitative verses Qualitative Risk, Risk Management Discussion Points	9
IV	**SECURITY STANDARDS AND PRACTICES** Database Security -Introduction, Problems in Databases Security, Controls - OWASP Secure Coding Standards -VISA International Security Model-Design of Security Architecture-Planning for Continuity	9
V	**SECURITY TECHNOLOGY** Security Technology: Access Control, Firewalls, Security Technology: Intrusion Detection and Prevention Systems and other Security Tools: Honeypots, Honeynets, and Padded cell Systems, IDPS, Scanning and Analysis Tools, Cryptography-Techniques, Algorithms and Tools, Physical Security, and Security and Personnel.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Understand the principal concepts, major issues, technologies and basicapproaches in Information Security.

CO2: Familiar with the Legal, Ethical and Professional issues in InformationSecurity. CO3: Learn the process of Identifying, Assessing and treating Risks.

CO4: Understand various Security Standards in this area and focus on VISASecurity Model.

CO5: Understand the Technological aspects of Information Security.

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TEXT BOOKS:

T1. Michal E Whitman, Herbert J Mattord, Management of Information Security, Cengage Learning (6th edition), 2019

T2 Izzat Alsmadi, Robert Burdwell, Practical Information Security, Springer International Publishing, 2018.

REFERENCE BOOKS:

R1.Richard E.Smith,Elementary Information Security, Jones & Bartlett Learning,(3rd Edition),2019

R2.Richard O'Hanley-James S.Tiller,Information Security Management Handbook, CRC Press, (6th Edition), 2014. R3.Mayank Bhushan, Rajkumar Singh Rathore,Aatif Jamshed, Fundamental ofCyber Securityl, BPB Publications, (1st Edition),2017.

R4.Hassan A. Afyouni , Database Security and Auditing: Protecting Data Integrity and Accessibility, Cengage Learning Publishers,(1st Edition), 2013.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6303	SOFTWARE DESIGN	3	0	0	3

Unit	Description	Instructional Hours
I	**DESIGN FUNDAMENTALS:** The Basic Concepts of Design – Characteristics of Design Activities – Essential Elements ofDesign – The Factors that Affect the Design - Design Principles: Basic Rules of SoftwareDesign – Design Processes.	9
II	**SOFTWARE DESIGN PRINCIPLES:** The Nature of the Design Process - The Software Design Process -Design in the Software Development Process - Design Qualities.	9
III	**DESIGN METHODOLOGIES:** Design Practices – Stepwise Refinement – Incremental Design – Structured System Analysisand Design – Jackson Structured Programming – Jackson System Development – Designingwith Objects – Component-Based Design.	9
IV	**SOFTWARE ARCHITECTURE DESIGN:** Notion of Architecture – Notion of Software Architecture - Architectural Styles – DescriptionofSoftware Architecture –Visual Notation – Examples.	9
V	**ARCHITECTURAL DESIGN:** Typical Architectural Design – Data Flow – Independent Components – Call and Return – Using Styles in Design – Choices of Style – Combination of Styles – Architectural DesignSpace – Theory of Design Spaces – Design Space of Architectural Elements – Design Space of Architectural Styles.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Design the Software using Designs Fundamentals and Methodologies. CO1: To create a Good Software by using the Styles, Architectural Design Space.
CO1: To reconstruct the Software Architecture that can be used for an Applicationof your choice.
CO1: Analyze Specifications and Identify appropriate Design Strategies.CO1: Develop an appropriate Design for a given set of Requirements.

TEXT BOOKS:

T1: David Budgen, "Software Design", Pearson Publication, Second Edition, 2011. (Unit II, UnitIII).
T2: Hong Zhu, —Software Design Methodology from Principles to Architectural Styles, Elsevier, 2005. (Unit I, Unit IV, Unit V)

REFERENCE BOOKS:

R1: Eric J. Braude, Software Design: From Programming to Architecture, Wiley, 2017. R2: Carlos Otero, "Software Engineering Design: Theory and Practice", CRC Press, 2012.R3: Hassan Gomaa, "Software Modeling and Design", Cambridge University Press, 2011.
R4: John Robinson, Software Design for Engineers and Scientists, Newnes, 2004.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6304	NATURAL LANGUAGE PROCESSING	3	0	0	3

Course Objective

1. To understand the basics of NLP.
2. To provide knowledge of various levels of analysis involved in NLP
3. To study about Semantic Analysis and Discourse Processing.
4. To gain knowledge in automated Natural Language Generation and Machine Translation
5. To learn the concepts of Retrieving Information and Resources

Unit	Description	Instructional Hours
I	**OVERVIEW AND LANGUAGE MODELING** Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval- Language Modeling Introduction-Various Grammar-based Language Models- Statistical Language Model	9
II	**WORD LEVEL AND SYNTACTIC ANALYSIS** Introduction-RegularExpressions-Finite-StateAutomataorphological Parsing-Spelling Error Detection and Correction-Words and Word classes Part-of Speech Tagging. Syntactic Analysis Introduction-Context-freeGrammar-Constituency-Parsing-Probabilistic Parsing	9
III	**SEMANTIC ANALYSIS AND DISCOURSE PROCESSING** Introduction- Meaning Representation-Lexical Semantics-Ambiguity- Word Sense Disambiguation- Discourse Processing Introduction – Cohesion – Reference – Resolution - Discourse Coherence and Structure	9
IV	**NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION** Introduction-Architecture of NLG Systems-Generation Tasks and Representations-Application of NLG-Machine Translation Introduction-Problems in Machine Translation-Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages	9
V	**INFORMATION RETRIEVAL AND LEXICAL RESOURCES** Introduction-Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – Evaluation - Lexical Resources Introduction-WordNet-FrameNet-Stemmers-POS Tagger-Research Corpora	9
	TOTAL INSTRUCTIONAL HOURS	45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Able to understand the basics of NLP
CO2: Analyse the Natural Language Text.
CO3. Understand Semantic Analysis and Discourse Processing
CO4: Generate the Natural Language and do Machine Translation.
CO5: Apply Information Retrieval Techniques

TEXT BOOKS:

R1-Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, OxfordUniversity Press (Third Edition),2008.
R2- Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Pythonl, OReilly Media(First Edition),2009.

REFERENCE BOOKS:

R1- Daniel Jurafsky and James H Martin, Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognitionl, Prentice Hall(3rd Edition), 2019.

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R2- Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher,2015.
R3- Richard M Reese, Natural Language Processing with Javal, OReilly Media, 2015.
R4- Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Chapmanand Hall/CRC Press (Second Edition,), 2010.
R5- James Allen, Bejamin-Cummings, —Natural Language Understanding, Pearson Education(2ndEdition), 2007.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6305	SOFT COMPUTING	3	0	0	3

Course Objective

The student should be made:
CO1: Learn the various Soft Computing Frameworks CO2: Be familiar with design of various Neural NetworksCO3: Be exposed to Fuzzy Logic
CO4: Gain knowledge about Genetic Programming.CO5: Be exposed to Hybrid Systems

Unit	Description	Instructional Hours
	INTRODUCTION TO SOFT COMPUTING	
I	Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithmand Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch andPitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network- Madaline Network.	9
	ARTIFICIAL NEURAL NETWORKS	
II	Back propagation Neural Networks - Kohonen Neural Network - Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.	9
	FUZZY SYSTEMS	
III	Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations-Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base andApproximate Reasoning - Introduction to Fuzzy Decision Making.	9
	GENETIC ALGORITHMS	
IV	Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - InheritanceOperators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators - Convergence ofGenetic Algorithm.	9
	HYBRID SYSTEMS	
V	Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP -Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

Upon completion of this course, the students will be able toCO1: Apply various Soft Computing Frameworks.
CO2: Design of various Neural Networks.
CO3: Use Fuzzy Logic for Real Time Applications.CO4: Discuss Genetic Programming.
CO5: Assess Hybrid Soft Computing techniques

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TEXT BOOKS:

T1: S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, Thirdedition 2018.

T2: S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

REFERENCE BOOKS:

R1: James M. Keller, Derong Liu, David B. Fogel, —Fundamentals of Computational Intelligence:Neural Networks, Fuzzy Systems, and Evolutionary Computationl, Wiley-IEEE Press, 2016.

R2: J.S.R.Jang, C.T. Sun and E.Mizutani, —Neuro-Fuzzy and Soft Computing, PHI / PearsonEducation 2015.

R3: N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford UniversityPress, 2015.

R4: Melanie Mitchell, —Introduction to Genetic AlgorithmsPHI Learning, 2002

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.TECH.	19IT6307	VIRTUAL REALITY AND AUGMENTED REALITY	3	0	0	3

Course Objective

The student should be made:

CO1: To introduce the concept of basic input output devices used in VRtechnology.

CO2: To give an insight on the various modelling techniques used for VRdevelopment process.

CO3: To explore the methodology and terminologies used for content creation inVR.

CO4: To understand the possible applications of virtual reality and augmentedreality in engineering applications.

CO5: To know the basic building blocks of the VR on mobile and web.

Unit	Description	Instructional Hours
I	**INPUT/ OUTPUT DEVICES** The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.	9
II	**VR DEVELOPMENT PROCESS** Geometric modeling - kinematics modeling- physical modeling -behaviour modeling - model Management.	9
III	**CONTENT CREATION CONSIDERATIONS FOR VR** Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -sideeffects of exposures to virtual reality environment	9
IV	**VR ON THE WEB & VR ON THE MOBILE** JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android- cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics	9
V	**APPLICATIONS** Medical applications-military applications-robotics applications- Advanced Real time Tracking other applications- games, movies,simulations, therapy	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

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

CO1: Select the appropriate input output device for an application. CO2: Apply the suitable modelling for the given problem statement.CO3: Design appropriate VR content for an application.

CO4: Construct the building blocks for VR in mobile and web.

CO5: Analyse & Design VR systems for various applications.

TEXT BOOKS:

T1: C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, JohnWiley & Sons, Inc.,2008.

T2: Jason Jerald. 2015. The VR Book: Human-Centered Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

REFERENCE BOOKS

R1: Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575

R2: Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.

R3: Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.

R4: Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, O'Reilly Media; 1 edition, 2014.

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OPEN ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	19IT6401	CYBER SECURITY AND FORENSICS	3	0	0	3

The student should be made to:

Course Objective

1. Learn the security issues Cryptographic Techniques.
2. Be exposed to security issues of the MALICIOUS Code.
3. Learn Cyber forensics.
4. Be familiar with forensics tools.
5. Learn to analyze and validate forensics data

Unit	Description	Instructional Hours
I	**INTRODUCTION: Cyber Security Fundamentals:** Network and Security Concepts, Basic Cryptography, Symmetric Encryption, Firewalls, Virtualization, Microsoft Windows Security Principles **Attacker Techniques and Motivations:** Proxies, Tunneling Techniques, Fraud Techniques, and Threat Infrastructure.	9
II	**MALICIOUS CODE: Malicious Code:** Self-Replicating Malicious Code, Evading Detection and Elevating Privileges, Stealing Information and Exploitation Defense and Analysis Techniques: Memory Forensics, Honeypots, Malicious Code Naming, Automated Malicious Code Analysis Systems, Intrusion Detection Systems.	9
III	**INTRODUCTION TO CYBER FORENSICS:** The Goal of the Forensic Investigation: Why Investigate, Internet Exceeds Norm, How to Begin a Non–Liturgical Forensic Examination: Isolation of Equipment, Cookies, Cache, How to Correlate the Evidence, The Liturgical Forensic Examination: Tracing Activity on a Windows–Based Desktop, The Microsoft Windows–Based Computer.	9
IV	**EVIDENCE COLLECTION AND FORENSICS TOOLS:** Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9
V	**ANALYSIS AND VALIDATION:** Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the security issues in Cryptographic Techniques.
CO2: Apply security principles in the MALICIOUS Code.
CO3: Gain knowledge about cyber forensics.
CO4: To analyze digital evidence and use forensics tools.
CO5: Explain the principle of Network Forensics.

TEXT BOOKS:

T1 - James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials" CRC Press, Taylor and Francis Group, 2011.
T2 - Albert J. Marcella, Robert S. Greenfield "Cyber Forensics—A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, AUERBACH Publications, 2002

REFERENCE BOOKS:

R1 - John R.Vacca, "Computer Forensics", Cengage Learning, 2005
R2 - Richard E.Smith, "Internet Cryptography", 3rd Edition Pearson Education, 2008.
R3 - Marjie T.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall,2013.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5201	COMPUTER NETWORKS (COMMON TO CSE &IT)	3	0	0	3

Course Objective

1. Understand the functionalities into layers and networking devices.
2. Understand the techniques of channel access and data communication
3. Be expose to methods used for routing and concepts of Subnetting
4. Learn the flow control and congestion control algorithms
5. Have knowledge in different application protocols used in computer networks

Unit	Description	Instructional hours
I	**INTRODUCTION &DATA LINK LAYER** Building a network – Requirements – Layering and protocols – Internet Architecture – networking devices – modems, routers, switches, gateways; Link layer Services – Framing – Error Detection – Flow control- media access control.	10
II	**DATA COMMUNICATION** Signal characteristics – Data transmission – Physical links and transmission media – Signal encoding techniques - Channel access techniques – TDM – FDM-CDM	8
III	**NETWORK AND ROUTING** Circuit switching – packet switching – virtual circuit switching – Routing— RIP – OSPF - – IPv6-Metrics- IP – Global Address — Subnetting – CIDR - ARP – DHCP.	9
IV	**TRANSPORT LAYER** Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements	9
V	**APPLICATION LAYER** Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP	9
	Total Instructional Hours	45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Identify the components required to build different types of networks and aware of media access control
CO2: Understand the data communication system and the purpose of layered architecture
CO3: Understand the concepts of Routing methods and Subnetting.
CO4: Apply the Congestion control mechanism and Connection methods
CO5: Identify protocols used for various Application

TEXT BOOK:

T1: Larry L. Peterson, Bruce S. Davie, "Computer Networks: A SystemsApproach",Fifth Edition, Morgan Kaufmann Publishers,2011.
T2:Behrouz A. Forouzan, "Data communication and Networking", Fifth Edition, Tata McGraw – Hill, 2012.

REFERENCES:

R1: James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2017.
R2: Nader. F. Mir, "Computer and Communication Networks", Second Edition Pearson Prentice Hall Publishers, 2015.
R3: Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
R4: Andrew S Tanenbaum, David J. Wetherall "Computer Networks", Prentice Hall of India Pearson Education, New Delhi, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5202	WEB TECHNOLOGY	3	0	0	3

Course Objective

1. Understand the basics of HTML and CSS.
2. Familiar about client side scripting JavaScript
3. Learn about the Server side scripting language–Servlet
4. Learn about the Server side scripting language–PHP
5. Aware of XML and web services.

Unit	Description	Instructional Hours
I	**UNIT I HTML AND CSS** Web essentials -Basics of HTML, formatting and fonts, color, hyperlink, lists, tables, images, forms, frames and frame sets – HTML5 – CSS ,syntax and selectors, Inline, Embedded and External style sheet- background images, colors and properties, manipulating texts, using fonts, borders and boxes, positioning using CSS.	10
II	**UNIT II CLIENT SIDE TECHNOLOGY –Java script** Introduction to JavaScript, variables, conditions and loops, functions, Arrays- Built – in objects- DOM -Element access in java Script- Modifying Element Style- Event handling.	9
III	**UNIT III SERVER SIDE TECHNOLOGY : Servlet** Servlet Overview - Life cycle of a Servlet - – Generating Dynamic Content -Handling HTTP GET and POST request - parameter data-Using Cookies - Session tracking.-url rewriting.	8
IV	**UNIT IV SERVER SIDE TECHNOLOGY : PHP** Introduction and basic syntax of PHP, decision and looping, Arrays, Functions, String, file handling, PHP form handling-PHP Sessions.	9
V	**UNIT V XML and WEB SERVICES** Xml basics-Xml DTD – Xml scheme - XSL – XSLT- Web services-UDDI-WSDL- Case studies: creating a web application for online book store/online voting system for your own district.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Apply the basic knowledge of HTML and CSS in designing web pages.
CO2: Create an application using client side scripting language.
CO3: Create an application using server side scripting language-servlet
CO4: Create an application using server side scripting language-PHP
CO5: knowledge about the XML and web services

TEXT BOOK:

T1 Deitel H.M., Deitel P.J , "Internet & World Wide Web How To Program", Fourth Edition, Pearson Education, 2012.
T2 Robert. W. Sebesta, "Programming the World Wide Web", Eighth Edition, Pearson Education, 2014.

REFERENCES:

1. Marty Hall and Larry Brown, "Core Servlets And Javaserver Pages", SecondEdition
2. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education,2011
3. Gopalan N.P. and Akilandeswari J., "Web Technology" Prentice Hall of India,2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5203	INFORMATION SECURITY	3	0	0	3

Course Objectives

Upon completion of this course, the students will be familiar with

1. Basics of Information Security
2. Legal, ethical and professional issues in Information Security
3. Risk Management
4. Various standards in this area
5. Technological aspects of information security

Unit	Description	Instructional Hours
I	**INTRODUCTION** Content History-Critical Characteristic of Information-CNSS Security Model-Components of an Information Systems-Securing the components-Balancing security and Access-The SDLC-The Security SDLC, Security Professional and the Organization, communities of Interest.	9
II	**SECURITY INVESTIGATION** Need for security-Business needs-Threats-Attacks-secure Software development-Legal-Ethical and professional issues-Law and Ethics in Information Security-Relevant U S. Laws-International Laws and Legal Bodies-Ethics and Information Security-codes of ethics and professional Organizations	9
III	**RISK MANAGEMENT** Risk Management: An Overview of Risk Management, Risk Identification, Risk Assessment, Risk control strategies, selecting a Risk Control Strategy, Quantitative verses Qualitative-Risk control Practices, Risk Management Discussion Points	9
IV	**SECURITY STANDARDS AND PRACTICES** Database Security -Introduction, Problems in Databases Security, Controls -OWASP Secure Coding Standards -VISA International Security Model-Design of Security Architecture-Planning for Continuity	9
V	**SECURITY TECHNOLOGY** Security Technology : Access control, Firewalls, Protecting remote connections, Security technology: Intrusion detection and Prevention Systems and other security tools: Honeypots, Honeynets, and padded cell Systems ,IDPS, Scanning and Analysis Tools, Cryptography ,Access Control devices, Physical Security, and security and personnel.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Gain some basic knowledge about information security
CO2: Solve the legal, ethical and professional issues in information security
CO3: Understand Risk management
CO4: Construct Security architecture and understand various standards in this area.
CO5: Understand the technological aspects of Information security.

Text Books:

T1.Michal E Whitman and Herbert J Mattord," Principles of Information Security " vikas Publishing House ,New Delhi2012

Reference Books:

R1. Micki Krause, HaroldF. Tipton," Handbook of Information Security Management", Vol 1-3 CRC Press LLC,2004.
R2. Stuart McClure, Joel Scrambray George Kurtz," Hacking Exposed " Tata McGraw-Hill 2003.
R3. Matt Bishop," Computer Security art and Science", Pearson/PHI,2002
R4. Hassan A. Afyouni , "Database Security and Auditing: Protecting Data Integrity and Accessibility", 1st Edition, Cengage Learning Publishers, 2013
R5. https://www.owasp.org/index.php/OWASP_Secure_Coding_Practices_-_Quick_Reference_Guide

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5204	THEORY OF COMPUTATION (COMMON TO CSE & IT)	3	0	0	3

Course Objective

1. To understand and design various Computing models in Finite State Machines
2. To learn about regular expression and its equivalence with Finite Automata.
3. To recognize about the concepts of Pushdown Automata
4. To be aware of the concepts of Turing Machine
5. To analyze and aware of Decidability and Un-decidability of various problems

Unit	Description	Instructional Hours
I	**FINITE AUTOMATA** Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with €- moves- Equivalence o DFA an NFA- NFA to DFA conversion-Applications of finite automata.	9
II	**REGULAR EXPRESSIONS** Regular Languages- Regular Expression- Converting Regular Expression to FA- Converting FA to Regular Expression - Equivalence of finite Automata and regular expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.	9
III	**GRAMMARS AND PUSHDOWN AUTOMATA** Chomsky hierarchy of languages-Context-Free Grammar (CFG) - Parse Trees - Ambiguity in grammars and languages - Definition of the Pushdown automata - Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata- Normal forms for CFG – Chomsky Normal Form (CNF) – Greibach Normal Form (GNF) - Pumping Lemma for Context Free Language (CFL) - Closure Properties of CFL.	9
IV	**TURING MACHINE** Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines - The Halting problem – Partial Solvability – Problems on Turing machine.	9
V	**COMPUTATIONAL COMPLEXITY** Undecidability- Basic definitions- Decidable and undecidable problems-Properties of Recursive and Recursively enumerable languages – PCP – MPCP. Introduction to Computational Complexity: Definitions-Time and Space complexity of TMs–Complexity classes – Introduction to NP-Hardness and NP-Completeness	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Design finite state machine using basic concepts.
CO2: Prove the equivalence between regular expression and finite automata
CO3: Derive a grammar for the given language and to design pushdown automata for given language.
CO4: Design Turing machine for given language.
CO5: Apply the concepts of Decidability and Un-decidability for real time problems.

TEXT BOOKS:

T1- Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education

T2- John C Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Tata Mc Graw 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, 2004.

R2- Kamala Krithivasan, R Rama," Introduction to Formal Languages, Automata Theory and Computation. ",Pearson Education, New Delhi,2009

R3- Peter Linz, "An Introduction to Formal Language and Automata", Third Edition, Narosa Publishers, New Delhi, 2002.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5001	NETWORK LABORATORY (COMMON TO CSE & IT)	0	0	4	2

Course Objective	1.Be familiar with simulation tools 2.Learn socket programming 3.Have hands on experience on various networking protocols 4.Learn about the network simulation

Expt. No.	Description of the Experiments
1.	Implementation of Stop and Wait Protocol and Sliding Window Protocol
2.	Study of Socket Programming and Client – Server model
3.	Write a code simulating ARP /RARP protocols
4.	Write a code simulating PING and TRACEROUTE commands
5.	Create a socket for HTTP for web page upload and download
6.	Write a program to implement RPC (Remote Procedure Call)
7.	Implementation of Subnetting
8.	Applications using TCP Sockets like a. Echo client and echo server b. Chat c. File Transfer
9.	Applications using TCP and UDP Sockets like a. DNS b. SNMP c. File Transfer
10.	Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS
11.	Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and plot congestion window for different source / destination.
12.	Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. a. Link State routing b. Flooding c. Distance vector
Total Practical Hours	**45**

Course Outcome	Upon completion of this course, the students will be able to CO1:Use simulation tools CO2: Implement the various protocols CO3: Analyze the performance of the protocols in different layers CO4: Analyze various routing algorithms CO5: Learn about the network simulation

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5002	WEB TECHNOLOGY LABORATORY	0	0	4	2

Course Objective

1. Familiar with Web page design using HTML and stylesheets.
2. Learn to write scripting language.
3. Learn to create dynamic web pages using server side scripting.
4. Familiar with PHP
5. Learn to write XML document and create a web services

Expt. No.	Description of the Experiments	Hours
1.	Create the personal home page using HTML which has properly aligned paragraphs with images along with it	
2.	Implement a website for Information Technology department using i)Frameset ii)Tables iii)List iv)Internal linking v)Hyperlink	
3	Create a web page using CSS i. Text properties ii. Background images, colors iii. CSS positioning and borders	
4.	Create a Course Registration form with validation	
5	Develop a Java script program to get Register number and mark as input and print the student total mark and grades	
6	Create a sever side program to invoke servlet from HTML forms	
7	Create a server side program for session handling	
8	Create a web program using AJAX	
9	File handling using PHP	
10	Design and implementation of any one application using PHP connecting to the database.	
11	Write a Programs using XML – Schema – XSLT/XSL	
12	Write a program to implement web service for calculator application	
Total Practical Hours		**45**

Course Outcome

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

CO1: Design Web pages using HTML and CSS.
CO2: Apply and implement scripting languages in web pages using DOM.
CO3: Create dynamic web pages using server side scripting.
CO4: Implement applications using PHP.
CO5: Creating web services for an application

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5701	TECHNICAL SEMINAR	0	0	4	2

Course Objective

1. To encourage the students to study advanced technology developments.
2. To prepare and present technical reports.
3. To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative model.
4. To promote and develop presentation skills
5. To set the stage for future recruitment by potential employers.

Expt. No.	Description of the Experiments
1.	During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. Mock interview and GD Practices will be conducted and evaluation is based on performance. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
Total Practical Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Review, prepare and present technological developments
CO2: Gain confidence to face the placement interviews
CO3: Develops Communication Confidence skills
CO4: Present technical material using audiovisual aids.
CO5: Determine and develop personal presentation style.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6201	MOBILE COMPUTING	3	0	2	4

Course Objective

1. Explain the basic concepts of mobile computing.
2. Explain the architecture and components of Mobile Operating Systems
3. 3.Describe the various schemes in MAC protocols.
4. Explain the functionalities of Mobile IP protocols
5. Discuss on routing and security issues in Ad hoc and Sensor networks.

Unit	Description	Instructional Hours
I	**CELLULAR TECHNOLOGY** Mobile Computing – Mobile Computing Vs Wireless Networking- Mobile Computing Applications – Characteristics of Mobile computing – Structure of Cellular Mobile Communication –GSM – services – Architecture – GPRS – services – Architecture services – UMTS	9
II	**MOBILE APPLICATION DEVELOPMENT AND OPERATING SYSTEMS** Responsibilities of OS in Mobile device – Mobile O/S-Windows Mobile-PalmOS-Symbian OSAndroid and Blackberry OS-Mobile Devices as Web clients-WAP-Android Software Development Kit-M-Commerce-B2C and B2B applications-Security Issues	9
III	**MAC PROTOCOLS** Properties – Wireless MAC – Taxonomy – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes – 802.11 MAC standards, MAC protocols for AdHoc networks, Cognitive Radio ad-Hoc networks	8
	MOBILE INTERNET PROTOCOL AND MOBILE DATABASE Mobile IP – Terminologies of Mobile IP – Packet Delivery – Features of Mobile IP – Key Mechanism– Route optimization DHCP – Significance of DHCP, Transaction Processing in mobile Environment, Mobile Transaction models.	9
IV	**MOBILE ADHOC NETWORKS &WIRELESS SENSOR NETWORKS** MANET : Characteristics – Routing Protocols- VANET –Security issues in MANET – Attacks on Adhoc Networks – Sensor Networks: Characteristics -Routing Protocols.	9
	Total Instructional Hours	**44**

EXP. NO	MOBILECOMPUTING LAB	Practical Hours
	LIST OF EXPERIMENTS	
1	Develop an application that uses GUI components, Font and Colors	2
2	Develop an application that uses Layout Managers and eventlisteners.	2
3	Develop a native calculator application.	2
4	Write an application that draws basic graphical primitives on the screen.	2
5	Develop a native application that uses GPS location information.	2
6	Implement an application that creates an alert upon receiving a message.	2
7	Write a mobile application that creates alarm clock	2
8	Develop an application that makes use of database.	2

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Total Practical Hours 16

Course Outcome	Upon completion of this course, the students will be able to CO1: To learn the basic concepts of mobile computing and its applications. CO2: Execute and analyse the components of Mobile Operating Systems CO3 Understand the various schemes in MAC protocols. CO4: Understand and demonstrate the functionalities of Mobile IP protocols CO5: Understand the routing and security issues in Ad hoc and Sensor networks

TEXT BOOKS:

.T1- Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, Second Edition, New Delhi ,2015.
T2 - Jochen H. Schller, "Mobile Communications", Pearson Education, Second Edition, New Delhi, 2007

REFERENCE BOOKS:

R1 - Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, 2012.
R2- Asoke K Talukder, Hasan Ahmed and Roopa R Yavagal, "Mobile Computing – Technology, Applications and Service Creation", Tata McGraw Hill, New Delhi, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6202	MICROCONTROLLERS AND EMBEDDED SYSTEMS	3	0	0	3

Course Objective

1. To conceptualize the basics of organizational and architectural issues of microcontroller.
2. To learn programming techniques used in microcontroller.
3. To understand the basic concepts of ARM processor.
4. To understand the fundamentals of embedded computing and memory mechanisms.
5. To learn the software development tools.

Unit	Description	Instructional Hours
I	**THE MICROCONTROLLER ARCHITECTURE** Introduction to 8051 Microcontroller- Pin configuration -Architecture- Input /Output Ports- Addressing modes.	9
II	**INTERFACING MICROCONTROLLER** Timers- Serial Port - Interrupts - LCD & Keyboard Interfacing- ADC,DAC & Sensor Interfacing- External Memory Interface- Stepper Motor	9
III	**ADVANCED RISC MACHINES** ARM Embedded Systems- ARM Processor: Architecture, Registers, CPSR,Processor Operating modes-Brief introduction to Exceptions, Interrupts and Vector Table-Instruction set: Data processing, Load-Store, Branch-Addressing modes.	9
IV	**EMBEDDED COMPUTING AND MEMORY MANAGEMENT** Characteristics of Embedded Computing- Challenges of Embedded Systems- Embedded system design process-Memory System Mechanisms: Caches, Memory System Performance, MMU and Address Translation-Interrupts Handling.	9
V	**EMBEDDED SYSTEM DEVELOPMENT** Embedded software development tools-Emulators and debuggers, Design issues-Design methodologies-Case studies- Digital Camera, Smart card, Mobile phone software.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Ability to understand basic structure microcontroller.
CO2: Ability to program microcontroller.
CO3: Ability to understand ARM Processor architecture.
CO4: Ability to understand memory system mechanisms
CO5: Ability to design conceptual embedded system.

TEXT BOOKS:

T1-Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson Education, 2011.
T2-Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

REFERENCE BOOKS :

R1-ARM System Developer's Guide: Designing and Optimizing System Software,Elsevier,2004.
R2- Rajkamal,"Embedded Systems Architecture, Programming and Design",Second Edition,2011.
R3-Daniel W Lewis, "Fundamentals of Embedded Software", Pearson Education Asia, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6203	SOFTWARE TESTING AND QUALITY ASSURANCE	3	0	0	3

COURSE OBJECTIVE

1. Understand basic concepts of software testing.
2. Understand the levels of testing and types of testing.
3. Learn the testing and debugging policies with the types of review.
4. Study about basics of software quality.
5. Learn various metrics of software quality.

UNIT	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
I	**INTRODUCTION** Testing as an Engineering activity -Testing as process- Testing Principles- Testing axioms, The tester's role in software development organization- Origins of Defects- Costs of defects- defect classes- defect prevention strategies.	8
II	**SOFTWARE TESTING METHODS AND TESTING LEVELS** Testing Fundamentals - White box and its types -Black box and its types-Need for levels of testing-unit testing- Integration testing- system testing-acceptance testing-performance testing- regression testing -alpha and beta testing	9
III	**VERIFICATION, VALIDATION AND REVIEWS** Verification Testing - Requirement phase Testing – Design phase testing – Programming phase testing – Test during requirement- Design and Programming Phase - Validation Testing - Build test data – Execute Results - Record Test Results. Measurement and milestones for controlling and monitoring-Reports and control issues-criteria for test completion-SCM-Reviews-Testing Tools- Load Runner-Win Runner.	10
IV	**INTRODUCTION TO SOFTWARE QUALITY** Basis for Software quality-Quality attribute-quality assurance-TQM principles – software processes and methodologies-Quality standards, practices and convention-improving quality with methodologies-measuring customer satisfaction-software quality engineering-defining quality requirements-management issues for software quality-data quality control-bench marking and certification.	9
V	**SOFTWARE QUALITY METRICS AND RELIABILITY** Writing software requirements and design specification-analyzing software documents using inspections and walkthroughs-software metrics-lines of code, Cyclomatic complexity, function points, Feature points-software cost estimation-Reliability models-OO Metrics.	9
	TOTAL INSTRCTIONAL HOURS	45

COURSE OUTCOME

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

CO1: Describe the basic principles and techniques of software testing.
CO2: Apply the right testing methods for various applications.
CO3: Assess the design using verification and validation testing.
CO4: Analyse software quality using inspections and walkthrough.
CO5: Relate various software metrics to context.

TEXT BOOKS:

T1. Srinivasan Desikan and Gopalaswamy Ramesh,"software Testing–Principles and practices", Pearson education,2007.
T2. Stephen Kan, "Metrics and Models in Software Quality", Addison-Wesley, Second Edition, 2004.

REFERENCE BOOKS:

R1. Ron Patton, *Software Testing*, second edition. Pearson Education.ISBN-13:978-0-672-32798-8.2007.
R2. Ilene Burnstein, "Practical Software Testing", Springer International Edition, Chennai, 2003.
R3. Milind Limaye, "Software Quality Assurance", McGraw Hill, 2011.
R4. M G Limaye, "Software Testing – Principles, Techniques and Tools", McGraw Hill,2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6204	PROFESSIONAL ETHICS	3	0	0	3

Course Objective

1. To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues.
2. To provide basic familiarity about Engineers as responsible Experimenters, Codes of Ethics.
3. To provide basic knowledge on Industrial Standards, Exposure to Safety, Risk Benefit Analysis.
4. To have an idea about the Collegiality and Loyalty, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.
5. To have an adequate knowledge about MNC's, Business, Environmental, Computer Ethics, Honesty, Moral Leadership, sample Code of Conduct.

Unit	Description	Instructional Hours
I	**HUMAN VALUES** Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management	9
II	**ENGINEERING ETHICS** Senses of „Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral dilemmas – MoralAutonomy–Kohlberg"stheory–Gilligan"stheory–ConsensusandControversy–Modelsof professionalroles-Theoriesaboutrightaction–Self-interest–CustomsandReligion–Usesof Ethical Theories	9
III	**ENGINEERING AS SOCIAL EXPERIMENTATION** Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	9
IV	**SAFETY, RESPONSIBILITIES AND RIGHTS** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	9
V	**GLOBAL ISSUES** Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: The students will understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories.

CO2: The students will understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.

CO3: The students will be aware of responsibilities of an engineer for safety and risk benefit analysis.

CO4: The students will be aware of professional rights and responsibilities of an engineer.

CO5: The students will acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

TEXT BOOKS:

T1 - Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
T2 - Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS :

R1 - Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
R2 – Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
R3 - John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6001	EMBEDDED SYSTEMS LABORATORY	0	0	4	2

Course Objective

1. Study the architecture of 8051microcontroller.
2. Write ALP for arithmetic and logical operations in 8051.
3. Provide in depth knowledge of 8051 Assembly Language Programming.
4. Learn the design aspects of interfacing circuits.
5. Give the knowledge and practical exposure on connectivity and execute of interfacing devices with ARM kit like LED displays, ADC/DAC and various other devices.

Expt. No.	Description of the Experiments
	8051 Programs using Kits
1.	Basic Arithmetic and Logical operations in 8051.
2.	Square and Cube of a number in 8051.
3.	1's and 2's complement of a number in 8051.
4.	Unpacked BCD to ASCII in 8051.
	Interfacing Experiments in 8051
5.	DAC Interfacing with 8051.
6.	Stepper motor interfacing with 8051
7.	Parallel Communication Interface with 8051.
	ARM Processor Experiments
8.	Flashing of LEDS.
9.	Interfacing ADC
10.	Interfacing LED and PWM.
	Total Practical Hours **45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Develop ALP for fixed point and Arithmetic operations using 8051 Microcontroller.
CO2: Work with standard 8051 real time interfaces including DAC and Stepper motor.
CO3: Model parallel interfacing of 8051 Microcontroller.
CO4: Become familiar with programming environment used to develop embedded systems.
CO5: Know functioning of hardware devices and interfacing them with ARM processor.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6002	OPEN SOURCE SOFTWARE LABORATORY	0	0	4	2

Course Objective

1. Learn to write small programs using PHP and PYTHON
2. Be Create User defined functions in PHP programming.
3. Have hands on experience on a Open source software Installation.
4. Have a good understanding of error handling techniques of PHP.
5. Learn to Use GitHub tool to communicate with Open source community.

Expt. No.	Description of the Experiments
1.	**Basic PHP Program:** a) Write a PYTHON script to display Welcome message b) Write a PYTHON script for simple calculator c) Write PYTHON Script to print Fibonacci series
2.	a) Write PHP Script to find maximum number out of three given numbers. b) Create student registration form using text box, check box, radio button, select, submit button. And display user inserted value in new PHP page c) Write a PHP Program to find the Sum and Average of five subject marks and display the result
3.	a) Write a PHP Program to find the biggest of n numbers using arrays b) Write a PHP Program to calculate factorial of a given number using function c) Write a PHP program to print prime number up to n numbers
4.	Write a server side PHP program that displays marks, total, grade of a student in tabular format by accepting user inputs for name, number and marks from a HTML form.
5.	Write a PHP script to connect MySQL server from your website and access the data stored in a table
6.	a) Write a PHP program using classes to create a table b) Write a PHP program to upload a file to the server.
7.	Write a PHP program to create a directory, and to read contents from the directory.
8.	Install Open source software- Linux OS, GitHub
9.	a) Write a shell program to find the details of user session. b) Write a shell program to change the extension of a given file.
10.	Create a MySQL table and execute queries to read, add, remove and modify a record from that table.
11.	Design student online application form and store in database and display
12.	Using GitHub tool to download a file, modify and upload the file.
	Total Practical Hours 45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Create small programs using basic PHP and PYTHOIN languages. CO2: Apply In-Built and Create User defined functions in PHP programming.
CO3: Design and develop a Web site using form controls for presenting web based content.
CO4: Debug the Programme by applying concepts and error handling techniques of PHP.
CO5: Create dynamic Website/ Web based Applications, using PHP, MySQL database

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PROFESSIONAL ELECTIVES

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5301	GRAPHICS AND MULTIMEDIA	3	0	0	3

Course Objective

1. To understand the basics of computer graphics system and line drawing algorithms,
2. To understand two dimensional transformations and clipping algorithms.
3. Students familiar with three dimensional graphics and three dimensional transformations.
4. To implement activities involving in design, development and testing
5. Learn Multimedia and various compression techniques.

Unit	Description	Instructional Hours
I	**Introduction:** Raster scan displays, Pixels, frame buffer, Vector & Character generation, random scan systems, Graphics Primitives, Display devices, Display file structure, Scan Conversion techniques, line drawing: simple DDA, Bresenham's Algorithm, Circle Drawing Algorithms. Scan line polygon fill algorithm, boundary-fill and flood-fillalgorithms	9
II	**2D transformation:** Translation, Rotation, Scaling, Shearing, Reflection. Inverse Transformation, Homogenous coordinate system, Matrices Transformation, Composite Transformation. Windowing & Clipping: World Coordinate System, Screen Coordinate System, Viewing Transformation, Line Clipping, Cohen Sutherland, Midpoint Line clipping algorithms, Polygon Clipping: Sutherland –Hodgeman, Weiler-Atherton algorithms.	9
III	**3D transformations:** translation, rotation, scaling. Parallel & Perspective Projection, Types of Parallel & Perspective Projection. Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painters algorithm, Z-buffer algorithm. Curve generation, Bezier and B-spline methods.	9
IV	**Reflections and Shading**: Diffuse reflection, Specular reflection, Phong Shading Gourand shading, ray tracing, color models like RGB, YIQ, CMY, HSV.	9
V	**Multimedia System:** An Introduction, Multimedia hardware, Multimedia System Architecture. Data & File Format standards. i.e RTF, TIFF, MIDI, JPEG, DIB, MPEG, Audio: digital audio, MIDI, processing sound, sampling, compression. Video: Avi, 3GP, MOV, MPEG, compression standards, compression through spatial and temporal redundancy. Multimedia Authoring.	9
	Total Instructional Hours	**45**

CourseOut come

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

CO1: Understand about computer graphics system, and Line drawing algorithms two dimensional transformations.

CO2: familiar with techniques of clipping, Two dimensional transformation graphics

CO3: The computer graphics course prepares students for activities involving in design, development and testing of modeling, rendering, shading and animation.

CO4: To understand about various latest interactive multimedia devices, the basic concepts about images and image format.

CO5: To understand about data, image and video compression techniques and animation.

TEXT BOOKS:T1 - Donald Hearn and M.P. Becker "Computer Graphics" Second Edition, Pearson Publications, 2008.T2- Rogers, "Procedural Elements of Computer Graphics", new Edition, Tata McGraw Hill.

REFERENCE BOOKS:

R1 -FolayVandam, Feiner, Hughes "Computer Graphics Principle & Practice", new Edition, Pearson Publications.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5302	SOFT COMPUTING	3	0	0	3

Course Objective

1. To introduce the ideas of Neural networks and use of heuristics based on human experience.
2. Toprovidethemathematicalbackgroundforcarryingouttheoptimizationassociated with neural network learning
3. To Understand basics of Fuzzy Set.
4. To introduce the concepts of Genetic algorithm and its applications
5. To introduce case studies utilizing the all the soft computing techniques

Unit	Description	Instructional Hours
I	**Introduction** Introduction – Fundamental concept – Evolution of Neural Networks and Fuzzy Logic– Basic Models of ArtificialNeural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Reparability – Herb Network.	9
II	**Artificial Neural Network** Supervised Learning Network: Perceptron Networks – Adaline – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network. Unsupervised Learning Networks: Fixed weight Competitive Nets – Kohonen Self-Organizing Feature Maps – Learning Vector Quantization – Counter propagation Networks – Adaptive Resonance Theory Networks	9
III	**Fuzzy Set Theory** Introduction to Classical Sets and Fuzzy sets – Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations – Noninteractive Fuzzy sets – Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods	9
IV	**Genetic Algorithm** Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem – Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming. Optimization of Travelling Salesman Problem using Genetic Algorithm Approach	9
V	**Applications of Computational Intelligence** Printed Character Recognition - Inverse Kinematics Problems - Automobile Fuel Efficiency Prediction - Soft Computing for Color Recipe Prediction.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, you should be able to:
CO1: Identify and describe soft computing techniques and their roles in building intelligent machines
CO2: Apply neural networks to pattern classification and regression problems.
CO3: Understand fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
CO4: Apply genetic algorithms to combinatorial optimization problems.
CO5: Understand the applications to solve real problems using a soft computing approach.

TEXT BOOKS:

T1 - S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2011. ISBN: 10: 81-265-1075-7.
T2 - J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004

REFERENCE BOOKS :

R1 - Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 3rd edition 2016.
R2 – S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
R3 - R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5303	SYSTEM SOFTWARE	3	0	0	3

Course Objective

1. To understand about the basics of system software and machine architecture
2. To know the design and implementation of assemblers
3. To know the design and implementation of linkers and loaders.
4. To have an understanding of microprocessors.
5. To have an understanding of system software tools.

Unit	Description	Instructional Hours
I	**INTRODUCTION** System software and machine architecture–The Simplified Instructional Computer (SIC)-Machine architecture-Data and instruction formats- addressing modes- instruction sets- I/O and programming.	8
II	**ASSEMBLERS** Basicassemblerfunctions-AsimpleSICassembler–Assembleralgorithmanddata structures-Machine dependent assembler features-Instruction formats and addressing modes–Program relocation-Machine independent assembler features-Literals– Symbol-defining statements–Expressions-One pass assemblers and Multi pass assemblers- Implementation example- MASM assembler.	10
III	**LOADERSAND LINKERS** Basic loader functions-Design of an Absolute Loader–A Simple Bootstrap Loader- Machine dependent loader features -Relocation–Program Linking–Algorithm and Data Structures for Linking Loader-Machine-independent loader features-Automatic Library Search –Loader Options-Loader design options-Linkage Editors–Dynamic Linking–Bootstrap Loaders-Implementation example- MSDOS linker.	9
IV	**MACRO PROCESSORS** Basic macro processor functions-Macro Definition and Expansion–Macro Processor Algorithm and data structures-Machine-independent macro processor features- Concatenation of Macro Parameters–Generation of Unique Labels –Conditional Macro Expansion– Keyword Macro Parameters-Macro within Macro-Implementation example- MASM Macro Processor–ANSIC Macro language.	9
V	**SYSTEMSOFTWARETOOLS** Text editors- Overview of the Editing Process-User Interface –Editor Structure- Interactive debugging systems-Debugging functions and capabilities–Relationship with other parts of the system – User-Interface Criteria	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Familiarize about the basics of system software and machine architecture
CO2: Analyze the assemblers
CO3: Design of linkers and loaders.
CO4: Work with the macro processors.
CO5: understand the system software tools

TEXT BOOKS:

T1 – Leland L.Beck, "System Software–An Introduction to Systems Programming" ,3rd Edition, Pearson Education Asia, 2000.

REFERENCE BOOKS:

R1 - D.M.Dhamdhere, "Systems Programming and Operating Systems", Second Revised Edition, Tata McGraw-Hill, 1999.

R2 – John J.Donovan "SystemsProgramming", Tata McGraw-Hill Edition,2001.

R3 – John R.Levine, Linkers & Loaders– Harcourt India Pvt.Ltd.,Morgan Kaufmann Publishers, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5304	HIGH SPEED NETWORKS	3	0	0	3

Course Objective

1. To understand the need for high speed networks
2. To explain QoS requirements and compare different approaches to QoS
3. To Compare various Virtual Private Network
4. To learn advantages and operations of Optical networks.
5. To provide students an exposure to software defined networking

Unit	Description	Instructional Hours
I	**UNIT I INTERNETWORKING :** IPv6 - Design issues - Scalability - Addressing - Headers - Routing - Auto configuration - Transition from IPv4 to IPv6 - Interoperability - QoS in IPv6 - Multicast support - ICMPv6 - Security in IPv6	9
II	**UNIT II QUALITY OF SERVICE :**QoS taxonomy - Resource allocation - Scheduling - Queuing disciplines - Delay Analysis -Integrated services - Differentiated services - RSVP.	9
III	**UNIT III MPLS AND VPN :** MPLS Architecture - MPLS to GMPLS - Traffic engineering with MPLS - QoS -Network recovery and restoration with MPLS – VPN L2 – VPN L3 .	9
IV	**UNIT IV OPTICAL NETWORKS :** Photonic Packet switching - WDM network design - Introduction to optical networks -optical layer - SONET/SDH - Optical packet switching - Client layers - Signaling protocols and network operation	9
V	**UNIT V SOFTWARE DEFINED NETWORKING :** Introduction to SDN - Network Function Virtualization - Data Plane- Control Plane - SDN software stack - Data center Traffic Management	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Students able to differentiate IPV4 and IPV6 and security
CO2: Students can Allocate resources and schedule efficiently
CO3:Work with various Virtual Private Networks
CO4: Determine the various issues of Optical Networks
CO5: Student can Experience the function of Software Defined Networking.

TEXT BOOKS:

T1-LarryL.Peterson,BruceS.Davie,—ComputerNetworks:ASystemsApproach|,FifthEdition,Elsevier/ Morgan Kaufmann Publishers, 2011.
T2-BruceS.Davie,AdrianFarrel,—MPLS:NextSteps|,MorganKaufmannPublishers,2011.
T3- Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki, "Optical Networks A Practical Perspective " , Third Edition, Morgan Kaufmann,2010.

REFERENCE BOOKS :

R1 - William Stallings, " High-speed networks and internets ", Second Edition Pearson Education India, 2002.
R2 - "MPLS Configuration Examples and TechNotes " , www.cisco.com.
R3 - Ying-Dar Lin , Ren-Hung Hwang , Fred Baker , "Computer Networks: An Open Source Approach", McGraw-Hill Higher Education, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5305	DATA WAREHOUSING AND DATA MINING	3	0	0	3

Course Objective

1. Study the concept of data ware housing architecture and Business Analysis
2. Be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. Learn to use Association rule mining for handling large data
4. Study Classification and Clustering for better Organization and retrieval of data
5. Expose the business applications and advanced topics in datamining

Unit	Description	Instructional hours
I	**INTRODUCTION TO DATA WAREHOUSING :** Need for Data warehousing - Operational database systems vs Data warehouses - Data warehouse architecture – Data warehousing components –Building a Data warehouse — Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support	8
II	**DATA WAREHOUSING AND BUSINESS ANALYSIS :** Data Extraction, Cleanup, and Transformation Tools –Metadata.– Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multi relational OLAP – Categories of Tools – OLAP Tools and the Internet.	9
III	**DATA MINING** Introduction to KDD process - Knowledge discovery from databases - Data mining functionalities - Technologies used - Applications - Issues - Knowing Data: Data objects and attributes - Statistical description of data - Data visualization - Data preprocesšing: Data cleaning - Data integration and transformation - Data reduction	9
IV	**ASSOCIATION RULE MINING AND CLASSIFICATION** Introduction - Association rule mining -Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction-BasicConcepts-DecisionTreeInduction-BayesianClassification–Rule Based Classification – Classification by Back propagation.	10
V	**CLUSTERING AND ADVANCED DATA MINING** Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Outlier Analysis – Data Mining Applications. Advanced topics –Web mining-web content mining-Structure and Usage mining-Time series and sequence mining.	9
	Total Instructional Hours	45

Course Outcome

CO1:Identify the components of data warehousing architecture
CO2:Implement data preprocessing for mining applications
CO3:Apply the association rules for mining the data
CO4:Deploy appropriate classification and clustering techniques
CO5:Use Advanced Topics of Data mining in business applications

TEXT BOOK:

T1:Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition,21st Reprint 2011.
T2: Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

REFERENCES :

R1:.DunhamM."Data mining: Introductory andAdvancedTopics",Prentice Hall, New Delhi,2002.
R2: Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction toDataMining", Person Education, 2007.
R3.K.P.Soman,ShyamDiwakarandV.Aja,"InsightintoDataMiningTheoryandPractice",EasternEconomyEdition, Prentice Hall of India,2006.
R4: G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2014.
R5: Ian Witten, EibeFrank,"Data mining: Practical Machine Learning Tools and Techniques",Morgan Kaufmann,Third edition,2011

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5306	SOFTWARE DESIGN PATTERNS	3	0	0	3

Course Objective

1. How to add functionality to designs while minimizing complexity?
2. What code qualities they need to maintain to keep code flexible.
3. Understanding the common design patterns.
4. Identifying the appropriate patterns for design problems.
5. Refactoring the badly designed program properly using patterns.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction–Design Patterns in Smalltalk MVC–Describing Design patterns–Catalog of Design Patterns-Organizing the Catalog–How Design Patterns Solve Design Problems–How to select a Design Pattern–How to use a Design Pattern–What makes a pattern?–Pattern Categories–Relationship between Patterns–Patterns and Software Architecture	9
II	**DESIGN PATTERNS FROM POSA1** Whole Part–Master Slave–Command Processor–View Handler–Forward Receiver– Client Dispatcher Server	9
III	**CREATIONAL AND STRUCTURAL DESIGN PATTERNS** Abstract Factory-Factory Method–Prototype-Singleton–Builder Adapter Pattern–Decorator–Façade–Proxy-Bridge	9
IV	**BEHAVIORAL DESIGN PATTERNS AND IDIOMS** Chain of Responsibility–Mediator–Observer–Strategy–Memento Idioms–Pattern Systems	9
V	**CASE STUDY** Case Study Designing a Document Editor-What to expect from Design Patterns–A brief History of Design Patterns–The Pattern Community–Where will Patterns Go?–The Past, Present and the Future of Patterns-Anti Patterns	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Design and implement codes with higher performance and lower complexity
CO2: Be aware of code qualities needed to keep code flexible
CO3: Understand core design principles and be able to assess the quality of a design with respect to these principles.
CO4: Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary.
CO5: Understand and apply refactoring techniques in the context of design patterns.

TEXT BOOKS:

T1- Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable object-oriented software", Pearson, 2002.
T2- Frank Bachmann, Regine Meunier, Hans Rohnert "Pattern Oriented Software Architecture"–Volume 1, 1996.

REFERENCE BOOKS:

R1- William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.
R2- Eric Braude, Software Design: From Programming to Architecture, Wiley, 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6301	MULTIMEDIA COMMUNICATIONS	3	0	0	3

Course Objective

1. To develop, design and implement two and three dimensional graphical structures
2. To enable students to acquire knowledge Multimedia compression and animations
3. To learn about various data file formats
4. To learn about various protocols
5. To learn Creation, Management and Transmission of Multimedia objects

Unit	Description	Instructional Hours
I	**MULTIMEDIA BASICS** Introduction and definitions elements – text- images-animation audio-video- Encoding & Decoding- Moving graphics and images. Multimedia applications – Multimedia System Architecture Multimedia Data interface standards – Multimedia Databases	9
II	**MULTIMEDIA COMPRESSION** Compression – Types of Compressions: Lossless – Lossy compression– .Binary Image Compression Schemes – Color, Gray Scale, And Still-video Image compression – Video Image Compression – Audio Compression	9
III	**MULTIMEDIA DATA & FILE FORMAT STANDARDS** Rich-Text Format – TIFF - RIFF – MIDI – JPEG – AVI – MPEG- TWAIN- Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.	9
IV	**PROTOCOLS** Traditional protocols: Problems with traditional protocols-protocols for multimedia- multicast protocols throughput of reliable protocols - Protocol implementation- scaling and efficiency issues.	9
V	**MULTIMEDIA AUTHORING AND APPLICATIONS** Creating interactive multimedia – Multimedia Authoring Systems – Multimedia Authoring Software Applications – Video On demand – Virtual Reality – Augmented Reality – Content based retrieval in digital libraries	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Explain fundamentals of concepts of Multimedia
CO2: Understanding audio and video data compression techniques
CO3: Describe different multimedia data in digital formats and compare text, audio, image and video data.
CO4: Summarize protocols for interconnection technologies
CO5: Explain the various multimedia application and their authentications

TEXT BOOKS:

T1 - Prabhat K Andleigh, KiranThakrar, "Multimedia systems design", First Edition, PHI, 2007.

T2 - Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards", Addison- Wesley Publishing, Edition,2009.

REFERENCE BOOKS:

R1 - John F Koegel Buford, "Multimedia Systems", Addison-Wesley, USA, 2003.

R2 - Judith Jeffcoate, "Multimedia in practice technology and Applications", Prentice Hall of India, New Delhi, 2009.
R3 - Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia", First Edition, Pearson Education, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6302	ARTIFICIAL INTELLIGENCE	3	0	0	3

Course Objective

1. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
2. Study the concepts of Artificial Intelligence.
3. Learn the methods of solving problems using Artificial Intelligence.
4. Implement a small AI system in a team environment.
5. Introduce the concepts of Expert Systems and Machine learning.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE** Meaning and definition of artificial intelligence, Various types of production systems, Characteristics of production systems, Study and comparison of breadth first search and depth first search. Techniques, other Search Techniques like hill Climbing, Best first Search. Add Constraint satisfaction and Heuristics	9
II	**REPRESENTATION OF KNOWLEDGE** Game playing- Knowledge representation-Knowledge representation using propositional and predicate logic-Comparison of propositional and predicate logic-Resolution, Refutation.	9
III	**KNOWLEDGE INFERENCE** Knowledge representation-Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory	9
IV	**PLANNINGAND MACHINE LEARNING** Basic plan generation systems – Strips - Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.	9
V	**EXPERT SYSTEMS** Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition –Meta knowledge. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyze problems that are amenable to solution by AI methods.
CO2: Analyze appropriate AI methods to solve a given problem.
CO3: Apply a given problem in the language/framework of different AI methods.
CO4: Apply basic AI algorithms.
CO5: Analyze an evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

TEXT BOOKS:

T1-Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill- 2008.(Units-,II,VI&V)
T2-Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.(Unit-III).

REFERENCE BOOKS :

R1-Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education 2013.

R2-Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6303	COMPILER DESIGN	3	0	0	3

Course Objective

1. Learn the design principles of a Compiler.
2. Understand about the automata concepts and symbol table generations.
3. Learn the various parsing techniques in syntax analysis.
4. Gain knowledge about different levels of translation and storage allocations.
5. Learn how to optimize and effectively generate machine codes.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPILERS** Loaders and Linkers-Basic Loader functions- A Simple Bootstrap Loader -Compilers and translators- Why do we need translators? The structure of a compiler, The Grouping of Phases - The Phases of Compiler-Errors Encountered in Different Phases- Compiler Construction Tools - Programming Language basics.	7
II	**LEXICAL ANALYSIS** Need and Role of Lexical Analyzer-Specification and Recognition of Tokens-Expressing Tokens by Regular Expressions-Finite Automata- Converting Regular Expression to DFA-MinimizationofDFA-LexicalErrors-TheLexical-AnalyzerGeneratorLEX-CaseStudy: Design of a Lexical-Analyzer Generator	9
III	**SYNTAX ANALYSIS** Need and Role of the Parser-Context Free Grammars -Writing a Grammar-Top Down Parsing - Recursive-Descent parsing-Non recursive Descent parsing-Bottom up parsing-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Case Study: Design of a syntax Analyzer for a Sample Language	10
IV	**SYNTAX DIRECTED TRANSLATION AND RUN TIME ENVIRONMENT** **Syntax – Directed Translation**: Syntax – directed translation schemes, Implementation of Syntax-directed translators, Intermediate code, Postfix notation, Parse trees and syntax trees, **Run – time Storage Administration**: – Storage Organization- Static Versus Dynamic Storage Allocation- Stack Allocation of Space- Heap Management-Introduction to Garbage and Tree-based collection	10
V	**CODE OPTIMIZATION AND CODE GENERATION** **Code optimization:** Introduction, The principle sources of optimization, Loop optimization, and Peephole optimization, optimization of basic blocks. **Code generation:** Design issues, object code forms, A simple code generator, Register allocation and assignment, DAG representation of Basic Blocks , Code generation using DAG.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Learn the basic concepts in phases of compiler
CO2: Create lexical rules and grammars for a programming language.
CO3: Implement a parser such as a Top-Down and bottom-up SLR parsers.
CO4: Learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
CO5: Design a compiler for a concise programming language

TEXT BOOKS:

T1 - Aho, Ravi Sethi, JD Ullman, 'Compilers Principles, Techniques and Tools', Pearson Education/Prentice Hall of India, 2nd Edition, 2008

REFERENCE BOOKS :R1 - Leland.L.Beck, 'System Software', 3rd Edition, Addison-Wesley, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6304	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

Course Objective

1. Understand OSI security architecture and classical encryption techniques.
2. Acquire fundamental knowledge on the concepts of finite fields and number theory.
3. Describe the principles of public key cryptosystems, hash functions and digital signature.
4. Describe symmetric and asymmetric algorithms related to cryptography.
5. Explain the purpose of security mechanism for different computing environment and information systems

Unit	Description	Instructional hours
I	**INTRODUCTION** OSI Security Architecture - Classical Encryption Techniques – Classical Encryption techniques - Symmetric cipher model, substitution techniques, transposition techniques, and steganography. **FINITE FIELDS AND NUMBER THEORY**: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms	9
II	**ASYMMETRIC CIPHERS** Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public Key Cryptography and RSA Algorithm - Diffie-Hellman Key Exchange – Elliptic Curve Architecture and Cryptography.	9
III	**AUTHENTICATIONAND HASH FUNCTION** Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS .	9
IV	**SECURITY PRACTICE AND SYSTEM SECURITY** Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Asymmetric Encryption - Distribution of Public Keys - X.509 Certificates - Public Key Infrastructure User Authentication Protocols: Remote User Authentication Principles – Kerberos	9
V	**NETWORK AND INTERNET SECURITY PROTOCOLS:** Basic Concepts, Secure Sockets Layer (SSL), - Transport Layer Security (TLS) - HTTPS - Secure Shell (SSH) –Electronic mail Security: Pretty Good Privacy (PGP)-S/MIME-IP SECURITY	9
	Total Instructional Hours	45

Course Outcome

Upon completion of this course, the students will be able to
CO1:Introduce fundamental concepts and techniques in Cryptography
CO2: Understand the basic knowledge on the concepts of finite fields and number theory.
CO3: Study the principles of public key cryptosystems, hash functions and digital signature.
CO4: Outline the symmetric and asymmetric algorithms related to cryptography.
CO5:Study the Network and Internet security protocols

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 McGrawHillPublishing Company, New Delhi,2007.

REFERENCES :

R1:. Behrouz Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill Publishing Company, New Delhi, 2010
R2: Roberta Bragg, Mark Rhodes Ousley, Keith Strassberg, "Network Security: The Complete Reference", McGraw Hill Publishing Company, Singapore, 2004.
R3: Kaufman, Perlman and Speciner, "Network Security: Private Communication inapublic world", Prentice Hall of India/ Pearson Education, NewDelhi,2004.
R4. Charles P Pfleeger, "Security in computing", Pearson Education, New Delhi, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6305	BUSINESS INTELLIGENCE	3	0	0	3

Course Objective

1. Knowledge and understanding of decision-making, practices of business intelligence.
2. Ability to design and build BI applications based on users 'needs
3. Demonstrate the limitations and possibilities of BI Technology
4. To understand the concept of business Intelligent Models.
5. To analyze the business environment with related tools.

Unit	Description	Instructional Hours
I	**Business Intelligence an Introduction:** Introduction, Definition, History and Evolution, Business Intelligence Segments, Difference between Information and Intelligence, Defining Business Intelligence Value Chain, Factors of Business Intelligence System, Real time Business Intelligence, Business Intelligence Applications, Types of Business Intelligence, Business Intelligence Platform, Dynamic roles in Business Intelligence, Roles of Business Intelligence in Modern Business-Challenges of BI.	9
II	**Architecting the Data:** Introduction, Enterprise Data and Subject Area Model, Enterprise Conceptual Model, Total Data Quality Management (TDQM). Definition of Data Mining, Data mining parameters, Statistical Perspective on Data Mining, Statistics-need, Similarity Measures, Decision Tree-Illustrations, Neural Network, Neural Network versus Conventional Computers, Data Warehouse, Data Mart, Aspects of Data Mart, Online Analytical Processing , Characteristics of OLAP, OLAP Tools, Data Modeling using Star Schema and Snowflake Schema.	9
III	**Types of Business Models:** B2B Business Intelligence Model, Electronic Data Interchange & E-Commerce Models, Systems for Improving B2B E-Commerce, B2C Business Intelligence Model, Need of B2C model in Data warehousing, Different types of B2B intelligence Models Knowledge Management: Characteristics of Knowledge Management, Knowledge assets, Generic Knowledge Management Process, Essentials of Knowledge Management Process.	9
IV	**Data Extraction:** Introduction, Data Extraction, Role of ETL process, Importance of source identification, Various data extraction techniques, Change data capture Business Intelligence Life Cycle: Introduction, Business Intelligence Lifecycle, Enterprise Performance Life Cycle (EPLC) Framework Elements, Life Cycle Phases, Human Factors in BI Implementation, BI Development Stages and Steps, Parallel Development Tracks, BI Framework.	9
V	**Business Intelligence User Model:** Business Intelligence Opportunity Analysis Overview, Content Management System, End User Segmentation, Basic Reporting and Querying, Online Analytical Processing, OLAP Techniques, Benefits of using OLAP, Dashboard, Advanced/Emerging BI Technologies, Organization Culture, Managing Total Cost of Ownership for Business Intelligence, Total Cost of Ownership and Business Intelligence, Managing the TCO of the Business Intelligence, Factors that Affect Total Cost of Ownership.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Demonstrate knowledge about and understanding of organizational and individual decision-making and future trends of BI.

CO2: Implement the concept of big data and analytics, data visualization techniques.

CO3: Demonstrate the ability to use BI systems and technology to design and build BI applications based on users' needs

CO4: Apply relevant theories, concepts and techniques to solve real-world BI problems

CO5: Critically evaluate the limitations and possibilities of BI technology

TEXT BOOKS:

T1 - Jena R K,"IT & Business Intelligence" 1st Edition, Excel Books-2015.

T2- Mike Davis, Patrick LeBlanc," Knight's Microsoft Business Intelligence 24-Hour Trainer" john Wiley & Sons, 2011.

REFERENCEBOOKS:

R1 - Ramesh Sharda, DursunDelen,"Business Intelligence: A Managerial Perspective on Analytics", 3rdEdition, Pearson Education,2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6306	HUMAN COMPUTER INTERFACE	3	0	0	3

Course Objective

The student should be made to:

1. Understand the concept of usability, design principles, guidelines, heuristics and other fundamentals of Human-Computer Interaction.
2. Describe and explain the user interface design process
3. Learn how to design Screen
4. Learn various theories and models used to design interface.
5. Understand Web interface with virtual reality.

Unit	Description	Instructional Hours
I	**INTRODUCTION :** Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. **The graphical user interface** – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface	9
II	**DESIGN PROCESS** – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions- Business Definition and Requirements Analysis- Design Standards or Style Guides- SYSTEM Training and Documentation Needs	9
III	**SCREEN DESIGNING :** Interface Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.	9
IV	**MODELS AND THEORIES :** Cognitive Models : Goal And Task Hierarchies, Linguistic Models: The Challenge Of Display-Based Systems, Physical And Device Models, Cognitive Architectures, Communication And Collaboration Models:: Face-To-Face Communication, Conversation, Text-Based Communication, Group Working.	9
V	**VIRTUAL REALITY AND WEB INTERFACE** Ubiquitous computing applications research, Virtual and augmented reality, Information and data visualization, WEB INTERFACE :Understanding hypertext, Finding things, Web technology and issues, Static web content , Dynamic web content	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Apply design principles, guidelines and heuristics to create a user-interaction strategy that solves a real-world problem.

CO2: Design a usable and compelling user-interface given a set of requirements and available technologies.

CO3: Communicate effectively the designed user-interface

CO4: Understand the various theories and models used to design interface.

CO5: Design Web interface with virtual reality .

TEXT BOOKS:

T1 - The Essential guide to User Interface Design, Wilbert O Galitz, Wiley Dreama Tech. 2007

T2 - Human Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Beale, Pearson. Third Edition 2009

REFERENCE BOOKS :

R1 – NPTEL : http://nptel.ac.in

R2 - User Inteface Design, Soren Lauesen , Pearson Education, 2005.

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OPEN ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT6401	CYBER SECURITY AND FORENSICS	3	0	0	3

The student should be made to:

Course Objective

1. Learn the security issues Cryptographic Techniques.
2. Be exposed to security issues of the MALICIOUS Code.
3. Learn Cyber forensics.
4. Be familiar with forensics tools.
5. Learn to analyze and validate forensics data

Unit	Description	Instructional Hours
I	**INTRODUCTION: Cyber Security Fundamentals:** Network and Security Concepts, Basic Cryptography, Symmetric Encryption, Firewalls, Virtualization, Microsoft Windows Security Principles **Attacker Techniques and Motivations:** Proxies, Tunneling Techniques, Fraud Techniques, and Threat Infrastructure.	9
II	**MALICIOUS CODE: Malicious Code:** Self-Replicating Malicious Code, Evading Detection and Elevating Privileges, Stealing Information and Exploitation Defense and Analysis Techniques: Memory Forensics, Honeypots, Malicious Code Naming, Automated Malicious Code Analysis Systems, Intrusion Detection Systems.	9
III	**INTRODUCTION TO CYBER FORENSICS:** The Goal of the Forensic Investigation: Why Investigate, Internet Exceeds Norm, How to Begin a Non–Liturgical Forensic Examination: Isolation of Equipment, Cookies, Cache, How to Correlate the Evidence, The Liturgical Forensic Examination: Tracing Activity on a Windows–Based Desktop, The Microsoft Windows–Based Computer.	9
IV	**EVIDENCE COLLECTION AND FORENSICS TOOLS:** Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9
V	**ANALYSIS AND VALIDATION:** Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the security issues in Cryptographic Techniques.
CO2: Apply security principles in the MALICIOUS Code.
CO3: Gain knowledge about cyber forensics.
CO4: To analyze digital evidence and use forensics tools.
CO5: Explain the principle of Network Forensics.

TEXT BOOKS:

T1 - James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials" CRC Press, Taylor and Francis Group, 2011.

T2 - Albert J. Marcella, Robert S. Greenfield "Cyber Forensics—A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, AUERBACH Publications, 2002

REFERENCE BOOKS :

R1 - John R.Vacca, "Computer Forensics", Cengage Learning, 2005

R2 - Richard E.Smith, "Internet Cryptography", 3rd Edition Pearson Education, 2008.

R3 - Marjie T.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall,2013.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7201	DATA ANALYTICS	3	0	0	3

Course Objective

1. To understand the Basic concepts of Big Data, Analytics and Technology landscape
2. To learn Map Reduce Programming and Hive
3. To study the Mongo DB and Cassandra for formulating the data
4. To learn the analytics and visualizations.
5. To learn basics of R programming Languages

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BIG DATA, ANALYTICS AND TECHNOLOGY LANDSCAPE** Classification of Digital Data - Introduction to Big Data- Big Data Analytics: Classification of Analytics – Challenges – Importance of Big Data Analytics - Data Science - Data Scientist - Terminologies used in Big Data Environments - Basically Available Soft State Eventual Consistency - Top Analytics Tools Big Data Technology Landscape: NoSQL, Hadoop	9
II	**MAPREDUCE PROGRAMMING AND HIVE** MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions –Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having - RCFile Implementation-HiveUserDefinedFunction-SerializationandDeserialization-HiveAnalytic Functions	9
III	**INTRODUCTION TO MONGODB AND CASSANDRA** MongoDB: Introduction to Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language - Cassandra: Features - CQL Data Types – CQLSH – Keyspaces - CRUD Operations – Collections - Using a Counter - Time to Live - Alter Commands - Import and Export - Querying System Tables	9
IV	**DATA ANALYTICS** Predictive Analytics- Simple Linear regression-Multiple linear regression-Interpretation of regression coefficients. Visualizations-Visual data analysis techniques-Interaction techniques-Systems and applications.	9
V	**INTRODUCTION TO R PROGRAMMING LANGUAGE** Learning R Basics-R Data Structures-Vectors- Scalars-Matrices- Arrays-Data Frames-Lists-Exporting R data objects. Importing data from different formats, Exploratory data analysis. Data aggregation and consistency tables.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Explore the big data landscape and analytics
CO2: Work on MapReduce framework and Hive
CO3: Implement CRUD operations using MongoDB and Cassandra
CO4: Work in data analytics and visualizations.
CO5: Gain Knowledge about R programming basics

TEXT BOOKS:

T1-Seema Acharya, SubhashiniChellappan, "Big Data and Analytics", Wiley Publications, First Edition,2015
T2-Simon Walkowiak , "Big Data Analytics with R",Packet publishing, 2016

REFERENCE BOOKS:

R1-Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc. (2013)
R2-Tom White, "Hadoop The Definitive Guide", O'Reilly Publications, Fourth Edition, 2015
R3-Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, "Hadoop For Dummies", Wiley Publications, 2014
R4-Bart Baesens, "analytics in a Big Daa World: The Essential Guide to Data Science and its Aplications (WILEY Big Data Series)", John Wiley & sons, 2014.
R5-Michael Berthold, David J.Hand, "Intelligent Data Analysis", Springer, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7202	DISTRIBUTED AND CLOUD COMPUTING	3	0	0	3

Course Objective

1. To learn distributed communication
2. To understand distributed resource management
3. To study the basics of cloud computing
4. To study about virtualization and Hadoop environment
5. To gain insight on cloud security.

Unit	Description	Instructional Hours
I	**Distributed Communication:** Introduction to Distributed Systems-Characterization of Distributed Systems–Distributed Architectural Models–Remote Invocation–Request-Reply Protocols –Remote Procedure Call-Remote Method Invocation–Group Communication–Coordination in Group Communication–Ordered Multicast	7
II	**Distributed Resource Management**: Time Ordering–Physical Clock Synchronization–Logical Time and Logical Clocks-Global States–Distributed Mutual Exclusion–Election Algorithms–Distributed Deadlock–Distributed File System Architecture	11
III	**Cloud Computing Fundamentals:** Cloud Computing definition, Types of cloud, Benefits and challenges of cloud computing- Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service-Service providers- Google App Engine, Amazon EC2-Cloud Environments: Introduction to Eucalyptus - Nimbus - Open Nebula, CloudSim.	9
IV	**Virtualization:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V-Introduction to MapReduce - GFS - HDFS - Hadoop Framework.	9
V	**Security in Clouds:** Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Upon completion of this course, the students will be able to CO1: understand distributed communication
CO2: design distributed resource management
CO3: Familiar with basics of cloud computing
CO4: design virtualization
CO5: understand cloud securities and standards

TEXT BOOKS:

T1- George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education Asia, 2012.
T2 - Kal Hwang. Geoffeiy C.Fox. Jack J.Dongarra, "Distributed and Cloud Computing", Elsevier,2012.

REFERENCE BOOKS

R1-Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing for Dummies" (Wiley India Edition),2010 (UNIT-III)
R2- John Rittinghouse & James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press, 2010.(UNIT-III)
R3- Antohy T Velte ,Cloud Computing : "A Practical Approach", McGraw Hill,2009(UNIT-IV)
R4- James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.(UNIT-IV)
R6- http://cloud-standards.org/wiki/index.php?title=Main_Page(UNIT - V)

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7203	INTERNET OF THINGS	3	0	0	3

Course Objective

1. To understand the basics of IOT technologies.
2. To study various application protocols related to IOT.
3. To understand the design methodologies of IOT.
4. To study various packages, frameworks and cloud services.
5. To get an idea of some of the application areas where Internet of Things can be applied.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction -Definition and Characteristics of IoT —Physical design of IoT- Logical design of IoT- Web 3.0 View of IoT- IoT enabling technologies- IoT levels and Deployment.	9
II	**IOT PROTOCOLS** Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Generic web based Protocols – IEEE 802.15.4– BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security	9
III	**DEVELOPING IOTS** IoT design methodology - Motivation for using Python- Logical Design using Python — Control Flow — Packages — File Handling — Classes — Packages used for connectivity-Python Packages of Interest for IoT – Server side programming, Protocols for IOT--Case Study.	9
IV	**INTEGRATED** IoT Device — Raspberry Pi — Raspberry Interfaces — Programming Raspberry Pi with Python — Other IoT Devices —Cloud Storage Models and Communication APIs - WAMP — Xively Cloud for IoT— Django — Amazon Web Services for IoT — SkyNet IoT Messaging Platform -Case Study on smart parking and air pollution monitoring.	9
V	**DOMAIN SPECIFIC IOTs** Home Automation — Smart and connected Cities — Public safety- Agriculture - Environment — Industry —Health and Lifestyle. Case study.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Explain the characteristics and enabling technologies of IOT
CO2: Analyze various application protocols related to IOT
CO3: Design IOT based simple applications using Python.
CO4: Describe about packages, frameworks and cloud services.
CO5: Design IOT based real time applications.

TEXT BOOKS:

T1 - ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
T2 - Gaston C.Hillar,"Internet of things with python",Packt*Publishing* Limited, 2016.

REFERENCE BOOKS :

R1-David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things , Published Jun 13, 2017 byCisco Press.
R2 - Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st edition, CRC Press, 2013
R3 - Andrian McEwen, Hakim Cassimally, " Designing the Internet of Things", 1st edition, John Wiley & Sons Ltd, 2014.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7001	APPLICATION DEVELOPMENT LABORATORY	0	0	4	2

Course Objective

1. To physically recognize and understand the use cases of different sensors
2. To setup a Raspberry PI board
3. Understand the architecture of IoT solutions
4. Learn about various technologies helping IoT grow
5. Implement an IoT solution practically

Expt. No. **Description of the Experiments**

1. Case Study:
   Raspberry Pi Installation
   Various OS Installation
   Linux Environment

   Run some python programs on Pi like:
   i) Read two numbers and print their sum, difference, product and division.
   ii) Word and character count of a given string Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input Print a name 'n' times, where name and n are read from standard input, using for and while loops.
   iii) Handle Divided by Zero Exception.
   iv) Print current time for 10 times with an interval of 10seconds.
   v) Read a file line by line and print the word count of each line.
2. Light an LED through Python program
3. Read the analog Data through sensors from physical environment (Use MCP3008)
4. Access an Image through a Pi webcam
5. Control a Light source using web page
6. Machine to Machine Connectivity using MQTT Protocol
7. Create a Web Server using RESTFUL API
8. Network File Transfer using TCP (Wi-Fi)
9. Get the status of a bulb at a remote place (on the LAN) through web.
10. Study: Amazon Web Services
11. Implement an intruder system that sends an alert to the given mail using Node-Red.
12. Ping the devices

Total Practical Hours **45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
CO2: Analyze real time data stored in a cloud server using data analytics tool.
CO3: Develop skills to integrate IoT devices
CO4: Design and implement solutions to IoT based problems.
CO5: Create an IoT based application

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7002	DISTRIBUTED AND CLOUD COMPUTING LAB	3	0	0	3

Course Objective

1. To understand basics, techniques and tools for Cloud Computing
2. To know the concepts of Cloud Infrastructure and services
3. To understand about virtualization concept
4. To use Hadoop environment
5. To use Cloud Sim environment

Expt. No.	Description of the Experiments
1.	Implement a method to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
2.	Show the virtual machine migration based on the certain condition from one node to the other.
3.	Create a VM image which has a C compiler along with an operating system and do the following experiments a.Fibonacci Series b.File Operations
4.	Install Virtualbox with different flavours of Linux or windows OS on top of windows OS
5.	Install GAE and run a quicksort using python
6.	Install and run Eucalyptus Faststart .
7.	Create two nodes in Eucalyptus and exchange data.
8.	Installation and configuration of Hadoop
9.	Write a word count program to demonstrate the use of Map and Reduce tasks.

MINI PROJECT:

10.	Simulate a cloud scenario using CloudSim and run a scheduling algorithm not present in CloudSim

Total Practical Hours **45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Understand the Basic Requirements of cloud environment
CO2: Design and implement applications on the Cloud Infrastructure
CO3: Understand about virtualization concept
CO4: Use Hadoop Environment
CO5: Use CloudSim simulation environment

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PROFESSIONAL ELECTIVES

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7301	MULTIMEDIA DESIGN AND STORAGE	3	0	0	3

Course Objective

1. Understand Multimedia system architecture
2. Understand various compression techniques
3. Understand various file formats
4. Understand storage media
5. Learn multimedia design in various applications

Unit	Description	Instructional Hours
I	**MULTIMEDIA SYSTEM DESIGN: AN INTRODUCTION** Multimedia Elements, Multimedia Applications, Multimedia System Architecture, Evolving Technologies for Multimedia Systems, Multimedia Databases.	9
II	**COMPRESSION AND DECOMPRESSION TECHNIQUES** Types of Compression, Binary Image Compression Schemes, Color, gray scale, still-video image compression, Discrete Cosine Transform, Video Image compression, MPEG Coding methodology, Audio Compression, Data and File format standards- RTF, TIFF,RIFF, MIDI, JPEG, AVI, JPEG, TWAIN Architecture.	9
III	**MULTIMEDIA INPUT AND OUTPUT TECHNOLOGIES** Key Technology Issues, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Video Images and Animation, Full Motion Video.	9
IV	**STORAGE AND RETRIEVAL TECHNOLOGIES** Magnetic Media Technology, RAID Level-0 To 5, Optical Media, WORM optical drives, Hierarchical Storage Management, Cache Management for storage systems.	9
V	**MULTIMEDIA APPLICATIONDESIGN** Types of Multimedia systems - Virtual Reality Design - Components of Multimedia system - Distributed Application Design Issues – Multimedia Authoring and User Interface - Hypermedia Messaging – Distributed Multimedia Systems	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Apply Multimedia system architecture
CO2: Design various compression techniques
CO3: Apply various file formats
CO4: Use various storage media
CO5: Design multimedia systems for various applications

TEXT BOOKS:

T1 - Andleigh PK and Thakrar K, "Multimedia Systems Designs", Addison Wesley Longman, 1999.

T2 - Ralf Steinmetz, Klara Nahrstedt, "Multimedia, computing, communications and applications", Prentice Hall, 2009.

REFERENCE BOOKS:

R1 - Fred Halsall, "Multimedia Communications", Addison Wesley, 2001.
R2 - Tay Vaughan, "Multimedia making It work", TMH 5th Edition 2011.
R3 - Weixel, Fulton, Barksdale.Morse, "Multimedia Basics", Easwar Press 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7302	KNOWLEDGE BASED DECISION SUPPORT SYSTEM	3	0	0	3

Course Objective

1. The concepts and experience in various modern decision support models with applications in courier and freight management;
2. The knowledge of scenario articulation values, strategy formulation, and case examples.
3. Arrange data for storage and further analysis in computerized Decision Support Systems.
4. Identify appropriate data to intelligent decision support systems.
5. Define the conceptual foundations of decision making in E-Business

Unit	Description	Instructional Hours
I	**DECISION MAKING AND COMPUTERIZED SUPPORT:** Management Support Systems: An Overview - Decision Making, Systems, Modeling, and Support.	9
II	**DECISION SUPPORT SYSTEMS:** Decision Support Systems: An Overview - Modeling and Analysis - Business Intelligence: Data Warehousing, Data Acquisition, Data Mining, Business Analysis, and Visualization - Decision Support System Development.	9
III	**COLLABORATION, COMMUNICATION, ENTERPRISE DECISION SUPPORT SYSTEMS, AND KNOWLEDGE MANAGEMENT:** Collaborative Computing Technologies: Group Support Systems - Enterprise Information Systems - knowledge Management.	9
IV	**INTELLIGENT DECISION SUPPORT SYSTEMS:** Artificial Intelligence and Expert Systems: Knowledge-Based System - Knowledge Acquisition, Representation, and Reasoning - Advanced Intelligent Systems – Intelligent Systems over the Internet.	9
V	**IMPLEMENTING IN THE E-BUSINESS ERA :** Electronic Commerce - Integration, Impacts, and the Future of the Management Support Systems	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Apply the basic skills and concepts of various decision support models in business and logistics environments

CO2: Recognize scenario articulation values, strategy formulation and implementation;

CO3: Solve logistics problems using tools and methodologies associated with decision support theories and applications.

CO4: Development of the Artificial Intelligence and business intelligence Technical

CO5: Implementation of Electronic Commerce

TEXT BOOKS:

T1 Efraim Turban, Jay Aronson E., Ting-Peng Liang, "Decision Support Systems and Intelligent Systems", 7th Edition, Pearson Education, 2006.

T2. Efraim Turban, Ramesh Sharda, Dursun Delen, "Business Intelligence and Analytics: Systems for Decision Support, 10th Edition, Pearson Education Limited, 2014

REFERENCE BOOKS :

R1 - George M .Marakas , "Decision Support Systems in the 21st century",2nd Edition, PHI, 2009. 2. Janakiraman V.S., Sarukesi K., " Decision Support Systems", PHI,2009.

R2. Efraim Turban, Jay Aronson E., Ting-Peng Liang, Ramesh Sharda "Decision Support And Business Intelligence Systems, 8th Edition, Pearson Education, 2007.

R3. Vicki L. Sauter, "Decision Support Systems for Business Intelligence" A John Wiley & Sons, Inc. Publication, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7303	COMPUTER HARDWARE AND PERIPHERALS	3	0	0	3

Course Objective

1. Outline the CPU and Memory essentials and logical organization.
2. Operate the various Input / Output video peripherals and illustrate its standards.
3. Generalized the concept of storage devices and standards.
4. Describe the PC architecture and its interfacing with peripheral devices.
5. Enumerate the concept of PC troubleshooting

Unit	Description	Instructional hours
I	**MICROCOMPUTER SYSTEMS AND MEMORIES** Computer organization and functions of Different subsystems-Micro processor organization and Bus concept-Advanced system concepts Interrupt Types-data Transfer Techniques-Multi tasking and Multiprogramming -Memory concepts- memory organizations- Memory chips and modules – ROM types- RAM Modules–DRAM-SRAM- -Special Memories types Custom Chips- Virtual memory –Cache Memory.	10
II	**I/O AND VIDEO PERIPHERALS** Input- Output devices - Keyboard and mouse Interface standards.– Keyboard Layouts and Connectors. - CRT Display Monitor - Printer Function and Characteristics ,Types-Graphics controller- Audio / Video cards -Video Adapters – characteristics, video standards. Audio Subsystems –Audio	9
III	**STORAGE DEVICES** Magnetic Storage Devices -Standards Floppy Disks drive -Hard disks drive -Winchester and Non Winchester Disk Drive –Mouse and Track ball –Modem - Optical Storage Devices – Optical storage media, CD ROM drives. CD-RW drive-Scanner-Special peripherals .DVD ROM drives – DVD. High capacity Magnetic storage techniques – RAID.	9
IV	**PC HARDWARE AND PERIPHERAL INTERFACES** Hardware –BIOS –DOS Interaction-PC family- OG,NG PC hardware OG -New generation PC hardware –Motherboard Logic –Memory spaces and I/O Port addresses-Interrupts-DMA channel –Peripheral interfaces and Controllers- PC Bus and Motherboard function	8
V	**PC TROUBLESHOOTING** Troubleshooting Tools and Techniques-Tools of the Trade-Basic Hardware Tools-Advanced Tools-Software Tools, Basic PC Handling Techniques-Handling the Power Supply-ESD(Electrostatic Discharge) Handling Techniques-Component Connections-Connecting the PC to the External Environment, Basic Data Recovery and Disaster Recovery-Disk Structure and Data Recovery-Disaster Recovery	9
	Total Instructional Hours	45

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Course Outcome	Upon completion of this course, the students will be able to CO1:Memorize the CPU essentials and memory concepts.. CO2:Demonstrate the various Input and output video peripherals test the performance on PC workstation.. CO3:Inentify the various storage devices standards and distinguish its performance. CO4:Summarize the PC hardware organization and interfacing with peripheral Devices. CO5:Infer the PC troubleshooting.

TEXT BOOKS:

T1: IBM PC and Clones: Hardware, Troubleshooting and Maintanence – B. Govindarajalu, Tata McGraw-Hill

T2: Stephen J-Bigelow-"Troubleshooting-Maintaining & repairing of PCs"- TMH,2007.

REFERENCE BOOKS :

R1: Mueller-S- Upgrading and repairing PCS- 4th Edition- Prentice Hall- 2011

R2: Troubleshooting, Maintaining and Repairing PCs, 5thEdn – Stephen J.Bigelow,Tata McGraw- Hill.

R3: The complete PC Upgrade and Maintenance Guide – Mark Minasi, WileyIndia

R4: The Indispensable PC Hardware Book – Hans-Peter Messmer,Addison-Wesley

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7304	WIRELESS SECURITY	3	0	0	3

Course Objective

1. To describe the need for Wireless security
2. To describe the evolution of wireless security methods
3. To identify common authentication and encryption technologies used in wireless security
4. To explain the benefits and weakness of the various security in cloud computing
5. To study various security issues related to GPRS and3G

Unit	Description	Instructional Hours
	Security Issues in Mobile Communication	
I	Mobile Communication History, Security– Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application –level Security	9
II	**Security of Device, Network, and Server Levels** Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications	9
III	**Application Level Security in Cellular Networks** Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications,3G security for applications, Some of Security and authentication Solutions.	9
IV	**Application Level Security in MANETs** MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions. Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC.	9
V	**Security challenge** Data Center Operations -Security challenge, implement "Five Principal Characteristics of Cloud Computing, Datacenter Security Recommendations Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Familiarize with the issues and technologies involved in designing a wireless and mobile system that is robust against various attacks.

CO2: Gain knowledge and understanding of the various ways in which wireless networks can be attacked and tradeoffs in protecting networks.

CO3: Have a broad knowledge of the state-of-the-art and open problems in wireless and mobile security.

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thus enhancing their potential to do research or pursue a career in this rapidly developing area.

CO4: Learn various security issues involved in cloud computing

CO5: Learn various security issues related to GPRS and 3G

TEXT BOOKS:

T1. PallapaVenkataram, SatishBabu: "Wireless and Mobile Network Security", 1st Edition, TataMcGrawHill,2010.

T2. Frank Adelstein, K.S.Gupta: "Fundamentals of Mobile and Pervasive Computing", 1st Edition, Tata McGraw Hill 2005.

REFERENCE BOOKS :

R1 Randall k. Nichols, Panos C. Lekkas: "Wireless Security Models,Threats and Solutions", 1stEdition, Tata McGraw Hill,2006.

R2. Bruce Potter and Bob Fleck: "802.11 Security", 1stEdition, SPD O'REILLY 2005.

R3. JamesKempf: "Guide to Wireless Network Security, Springer.Wireless Internet Security-Architecture and Protocols", 1stEdition, Cambridge University Press, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7305	SOCIAL NETWORK ANALYSIS	3	0	0	3

Course Objective

The student should be made to:

1. Understand the concept of semantic web and related applications.
2. Learn knowledge representation using ontology.
3. Understand human behavior in social web and related communities.
4. Learn visualization of social networks.
5. Learn Real time applications

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis	9
II	**WEB DATA AND KNOWLEDGE REPRESENTATION** Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis. Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language-Comparison with UML, E/R model, XML and XML Schema. .	9
III	**MODELLING AND AGGREGATING** Modeling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data -Developing social-semantic applications: Building Semantic Web applications with social network features.	9
IV	**MINING COMMUNITIES IN WEB SOCIAL NETWORKS** Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi – Relational characterization of dynamic social network communities.	9
V	**VISUALIZATION AND APPLICATIONS** Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations –Matrix and Node-LinkDiagrams–Hybridrepresentations–Applications–Covernetworks–Community welfare–Collaboration networks – Co-Citation networks.	9
	Total Instructional Hours	**45**

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Course Outcome	Upon completion of the course, you should be able to: CO1: Develop semantic web related applications. CO2: Represent knowledge using ontology. CO3: Predict human behavior in social web and related communities. CO4: Visualize social networks. CO5: Understand Real time applications of social network analysis.

TEXT BOOKS:

T1 - Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.

T2 - Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

REFERENCE BOOKS :

R1 - Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.

R2 - Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7306	SERVICE ORIENTED ARCHITECTURE	3	0	0	3

Course Objective

1. Learn XML fundamentals and able to build applications based on XML
2. Understand the key principles behind SOA.
3. Familiarize with the web services technology elements for realizing SOA.
4. Learn the various web service standards.
5. Understand the web service security concepts

Unit	Description	Instructional Hours
I	**INTRODUCTION TO XML** XML document structure – Well-formed and valid documents – Namespaces – DTD – XML Schema – X-Files- Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.	9
II	**SERVICE ORIENTED ARCHITECTURE** Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA -- Principles of Service orientation – Service layers.	9
III	**WEB SERVICES** Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.	9
IV	**BUILDINGSOA-BASEDAPPLICATIONS** Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines -- Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE.	9
V	**WEB SERVICES SECURITY** WS overarching concern, Core concepts, Challenges, Threats and remedies, Securing the communication layer, Message level security, WS security framework, WS security policy, WS trust, WS secure conversion, Data level security, XML encryption, XML signature.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Build applications based on XML.
CO2: Apply the key principles of SOA
CO3: Develop web services using technology elements.
CO4: Build SOA-based applications for intra-enterprise and inter-enterprise applications.
CO5: Apply security models in web services

TEXT BOOKS:

T1 - Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2009.
T2 - Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.

REFERENCE BOOKS :

R1 - Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002.
R2 - Eric NewComer, "Understanding Web services: XML,WSDL,SOAP and UDDI", Addison Wesley, USA 2004.
R3 - SandeepChatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.
R4 - James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "Java Web Services Architecture", Morgan Kaufmann Publishers, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7307	DIGITAL IMAGE PROCESSING	3	0	0	3

Course Objective

1. Able to learn basic concepts, principles and methods of Digital Image Processing
2. To learn about Image transforms.
3. Gain Knowledge about Filters used in frequency domain and spatial domains for image smoothing and sharpening
4. Gain knowledge about the concepts of Image Segmentation, Representation and Object identification techniques.
5. Learn the Image compression techniques.

Unit	Description	Instructional Hours
I	**DIGITAL IMAGE FUNDAMENTALS** Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, Mach Band effect, Image sampling, Quantization, Dither, Two dimensional mathematical preliminaries. Basic relationships between pixels, An introduction to the mathematical tools used in digital image processing.	9
II	**IMAGE TRANSFORMS** Basic intensity transformation functions, Histogram processing, 1D DFT, 2D transforms - DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet transform.	9
III	**IMAGE ENHANCEMENT AND RESTORATION** Histogram modification, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic and YP mean filters. Design of 2D FIR filters, Image sharpening using frequency domain filters. Image restoration - degradation model, Unconstrained and Constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations, Gray Level interpolation.	9
IV	**IMAGE SEGMENTATION AND RECOGNITION** Image segmentation - Point, Line and Edge detection, Edge linking and boundary detection, Region growing, Region splitting and Merging, Image Recognition - Recognition based on decision-theoretic methods, Structural methods. Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation., Neural networks-Back propagation network and training, Neural network to recognize shapes.	9
V	**IMAGE COMPRESSION** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding, Transform coding, JPEG standard, JPEG 2000, MPEG, Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Acquire the knowledge on fundamentals of Digital image processing and tools used.

CO2: Acquire the knowledge about filtering, transforms, morphology, image analysis and compression.

CO3: Apply and implement frequency domain and spatial domains filters for image smoothing and sharpening in MATLAB

CO4: Analyze the Image Segmentation, Representation and Object identification technique

CO5: Learn and apply Image Compression Techniques, Image Morphing Methods for digital images

TEXT BOOKS:

T1 - Rafael C. Gonzalez and Richard E. Woods "Digital Image Processing",Prentice Hall, Fourth Edition, 2017.

T2- Anil K. Jain," Fundamentals of Image Processing", First Edition, Prentice-Hallof India, 1995.

REFERENCE BOOKS :

R1-Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, second edition.,2010.

R2-B.Chanda & D.Dutta Majunder, "Digital Image Processing & Analysis", , Prentice Hall of India 2ndEdition, 2011

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7308	GENETIC ALGORITHMS	3	0	0	3

Course Objective

1. Understand and appreciate the basic concepts of Genetic algorithms and the use of various GA operators.
2. Learn in detail about the Evolutionary Combinatorial Optimization
3. Learn the various genetic programming and Evolutionary algorithms
4. Understand the collective systems such as ACO and its application principles
5. Understand the collective systems such as PSO and its applications

Unit	Description	Instructional hours
I	**INTRODUCTION TO GENETIC ALGORITHM** Introduction – Biological Background – Operators in GA-Classifications of GA – Applications of GA.	9
II	**EVOLUTIONARY COMBINATORIAL OPTIMIZATION** TSP - Evolutionary algorithms for TSPs -Hybrid evolutionary and local search algorithms Theoretical Analysis of Evolutionary Algorithm Schema theorems -Convergence of EAs – Computational time complexity of EAs -No free lunch theorem.	9
III	**MULTIOBJECTIVE EVOLUTIONARY OPTIMIZATION** Pareto Olimality -Mu/1iobjective evolutionary algorithms. Genetic Programming: Trees as individuals -Major steps of genetic programming- functional and terminal set initialization- fitness evaluation –Search operators on trees –Examples.	9
IV	**ANT COLONY OPTIMIZATION** Introduction – From real to artificial ants- Theoretical considerations – Convergence proofs – ACO Algorithm – ACO and model based search – Application principles of ACO.	9
V	**PARTICLE SWARM OPTIMIZATION** Introduction – Principles of bird flocking and fish schooling – Evolution of PSO – Operating principles – PSO Algorithm – Neighborhood Topologies – Convergence criteria – Applications of PSO.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of this course, the students will be able to
CO1:Discover the knowledge to develop Genetic algorithm
CO2:Know the various Evolutionary algorithms and theorems.
CO3:Study the different Genetic programming and Evolutionary algorithms
CO4:Implement the ACO collective Intelligence systems for various applications
CO5:Implement and apply the PSO collective Intelligence systems

TEXTBOOKS:

T1:GoldbergandDavidE,"GeneticAlgorithmsinSearch.OptimizationandMachinelearning",PearsonEducation, New Delhi,2007
T2: Kalyamoy Deb, "Multi objective Optimization using Evolutionary Algorithms", John Wiley & Sons, Wiley (2010)

REFERENCES :

R1: S.N.Sivanandam and S.N.Deepa, "Introduction to Genetic Algorithms",Springer International Edition,2013
R2: Marco Dorigo and Thomas Stutzle, "Ant Colony optimization", Prentice Hall of India, New Delhi, 2005.
R3: Kennedy J and Russel C Eberhart, "Swarm Intelligence", Morgan Kaufmann Publishers, USA, 2001.
R4: Koza, John, Wolfgang Banzhaf, Kumar Chellapilla, Kalyanmoy Deb, Marco Dorigo, David-Fogel, Max Garzon, David Goldberg, Hitoshi Iba, and Rick Riolo(Eds.), "Genetic Programming", Academic Press.Morgan Kaufmann, USA, 1998.
R5: John R.Koza, Forrest H Bennett III, David Andre, Martin A Keane, "Genetic Programming 111:Darwinian Invention and Problem Solving" Morgan Kaufmann, USA, 1999.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7309	ADVANCED DATA STRUCTURES	3	0	0	3

Course Objective

1. Ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
2. To learn variety of advanced abstract data type(ADT).
3. To understand the concepts data structures and their implementations.
4. To Study different algorithm design and problem solving techniques.
5. Ability to understand the trees and graphs concepts.

Unit	Description	Instructional Hours
I	**Complexity Analysis:** Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms. **Linear List :**Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, exception and iterator classes for lists, doubly linked lists, circular lists, linked lists through simulated pointers.	9
II	**Stacks and Queues:** Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, towers of Hanoi, wire routing in a circuit, finding path in a maze, simulation of queuing systems, equivalence problem. **Hashing:** Search efficiency in lists and skip lists, hashing as a search structure, hash table, collision avoidance, linear open addressing, chains, uses of hash tables in text compression, LZW algorithm.	9
III	**Trees:** Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, heaps as priority queues, heap implementation, insertion and deletion operations, heap sort, heaps in Huffman coding, leftist trees, tournament trees, use of winner trees in merge sort as an external sorting algorithm, bin packing.	9
IV	**Search Trees:** Binary search trees, search efficiency, insertion and deletion operations, importance of balancing, AVL trees, searching insertion and deletions in AVL trees, red-black trees, comparison with AVL trees, search insert and delete operations. **Multiway Trees:** Issues in large dictionaries, m-way search trees, B-trees, search insert and delete operations, height of B-tree, 2-3 trees, sets and multi sets in STL.	9
V	**Graphs:** Definition, terminology, directed and undirected graphs, properties, connectivity in graphs, applications, implementation –adjacency matrix and linked adjacency chains, graph traversal – breadth first and depth first, spanning trees.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.

CO2: Master a variety of advanced abstract data type (ADT) and data structures and their implementations.

CO3: Master different algorithm design techniques (brute-force, divide and conquer, greedy, etc.)

CO4: Ability to apply and implement learned algorithm design techniques and data structures to solve problems

CO5: Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.

TEXT BOOKS:

T1 - Sahni, S., "Data Structures, Algorithms, and Applications in C++", Orient BlackSwan 2005

T2- Michael T. Goodrich,"Data structures and algorithms in C++",John Wiley & Sons ,Second edition-2011

REFERENCE BOOKS:

R1 - Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser., "Data Structures and Algorithms in Python", John Wiley & Sons-2013.

R2- Mark A. Weiss "Data Structures and Algorithm Analysis in C++" Pearson Publications, 4th Edition Aug 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7310	WIRELESS COMMUNICATION	3	0	0	3

Course Objective

1. It deals with the fundamental cellular radio concepts such as frequency reuse and handoff
2. It presents different ways to radio propagation models and predict the large–scale effects of radio propagation in many operating environments.
3. It provides idea about analog and digital modulation techniques used in wireless communication.
4. It deals with the different types of equalization techniques and diversity concepts
5. It provides idea about various wireless systems and standards

Unit	Description	Instructional Hours
I	**INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS** Introduction, frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and Grade of Service, Improving coverage &Capacity in cellular systems, multiple accesses in cellular System- TDMA- FDMA-CDMASDMA.	9
II	**WIRELESS CHANNELS** Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters- Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.	9
III	**WIRELESS TRANSCEIVERS** Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.	9
IV	**CAPACITY, DIVERSITY AND EQUALIZATION IN WIRELESS SYSTEM** Capacity in AWGN – Capacity of Flat fading channels – Channel and System Model Channel Distribution Information known – CSI at Receiver. Diversity technique – Selection combining – Equal Gain Combining – Maximum ratio combining – Feedback – Time –Frequency – Rake Receiver – Interleaving. Equalization – Linear Equalization – Nonlinear (DFE & MLSE) – AlgorithmofAdaptiveEqualization–ZeroForcingalgorithm–LMSalgorithm–RecursiveLeast Square algorithm	9
V	**WIRELESS SYSTEMS AND STANDARDS** GSM System – Services and features – Architecture – Radio Subsystem – GSM Call –Frame Structure –Signal Processing. CDMA Digital Cellular Standard (IS-95) – Frequency & Channel Specification – Forward CDMA channel – Reverse CDMA channel. Introduction to OFDM system – Cyclic prefix – Matrix representation, Case study: IEEE 802.11a wireless LAN.	9
	Total Instructional Hours	

Course Outcome

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

CO1: Illustrate the concept of cellular communication and the multiple access techniques.

.CO2: Analyze the large scale fading channels and to predict the received signal strength. And analyze the multipath channels and categorize the various types of fading.

CO3: Analysis the analog and digital modulation techniques used in wireless communication

CO4: Comprehend the techniques to improve the signal quality.

CO5: Discuss the various wireless systems and standards .

TEXT BOOKS:

T1.Rappaport T.S, "Wireless Communications: Principles and Practice", Pearson Education, 2nd Edition, 2010.

T2. William Stallings, "Wireless Communication & Networking",Pearson Education Asia,2009.

REFERENCE BOOKS:

R1 Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.

R2.Lee W.C.Y., "Mobile Communications Engineering: Theory & Applications", McGraw Hill, New York, 2nd Edition,1997.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7311	SEMANTIC WEB	3	0	0	3

Course Objective

1. Understand the fundamentals of semantic web technology
2. Learn and appreciate RDF and its taxonomy and ontology
3. Describe OWL and its usage in semantic web
4. Understand various technologies related to semantic web services
5. Discuss about the various applications of semantic web

Unit	Description	Instructional Hours
I	**THE BASICS OF SEMANTIC** Traditional web to semantic web – WWW and its usage- metadata and its creation, addition in the web page; metadata tools - search engines for semantic web –search engine for web page markup problem and query building problem.	9
II	**RESOURCE DESCRIPTION FRAME WORK** RDF and its basic elements-Why we need RDF-RDF triples-RDF tools- Fundamental rules of RDF-relationship between DC and RDF and XML and RDF core elements of RDF- ontology and taxonomy inferencing based on RDF.	9
III	**WEB ONTOLOGY LANGUAGE** The basics idea of Web ontology language– OWL to define classes- OWL to define properties-set operators-Three faces of OWL-Ontology Matching and Distributed Information- Validating OWL ontology.	9
IV	**SEMANTIC WEB SERVICES** Web services – web services standards – web services to semantic web services- UDDI and its usage-Concept of OWL-S and its building blocks - mapping OWL-S to UDDI- WSDL-S overview and its usage.	9
V	**REAL WORLD EXAMPLES AND APPLICATIONS OF SEMANTIC WEB** Swoogle- architecture, usage and examples of using Swoogle; FOAF – Explanation, vocabulary-creating FOAF documents – overview of semantic markup – semantic web search engines.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Apply the fundamentals of semantic web technology
CO2: Apply and appreciate RDF and its taxonomy and ontology
CO3: Describe OWL and its usage in semantic web
CO4: Apply the various technologies related to semantic web services
CO5: Develop various applications of semantic web

TEXT BOOKS:

T1 - Liyang Yu , "Introduction to the Semantic Web and Semantic web services" Chapman & Hall / CRC, Taylor & Francis group, 2007.
T2 - Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", MIT Press, 2012.

REFERENCE BOOKS :

R1 - Johan Hjelm, "Creating the Semantic Web with RDF " , Wiley, 2001
R2 - John Davies, Rudi Studer and Paul Warren,"Semantic Web Technologies: Trends and Research in Ontology based Systems", Wiley; 1 edition (December 10, 2007).
R3 - Karin K. Breitman K., Marco Antonio Casanova, Walt Truszkowski, "Semantic web: concepts, Technologies and applications", Walt Truszkowski - 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7312	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

Course Objective

1. To outline the need for Software Project Management
2. To learn the concepts on project management and evaluation.
3. To plan and monitor projects for the risk management.
4. To explore the process of monitoring and controlling
5. To manage people and organization of teams

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT** Project Definition-Importance of Software Project Management-Activities Methodologies-Categorization of Software Projects-Setting Objectives-Management Principles-Management control-Overview of Project Planning – Stepwise Project Planning.	9
II	**PROGRAM MANAGEMENT AND PROJECT EVALUATION** Introduction- Program Management-Managing the allocation of resources within programmes - Strategic programme Management-Creating a programme - Aids to Programme management-Benefits management-Evaluation of individual projects- Cost Benefit Evaluation Techniques.	9
III	**ACTIVITY PLANNING** Objective(s) – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks- Risk Identification, Assessment, Planning, Management-Evaluating Risks to the Schedule- Monitoring and control.	9
IV	**MONITORING AND CONTROL** Creating Framework – Collecting the Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts Introduction – Types of Contract – Stages in Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance.	9
V	**MANAGING PEOPLE AND ORGANIZING TEAMS** Introduction – Understanding Behavior – Organizational Behavior: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation–The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming a Team –Decision Making – Leadership – Organizational Structures – Stress –Health and Safety.*Case Study.*	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Construct and realize software design or software deployment.
CO2: Develop a budget, schedule or work plan.
CO3: Apply cost monitoring and control strategies for software projects
CO4:Understand the interdependencies between the processes of the system.
CO5:Manage the organizational behavior of people working in teams.

TEXT BOOKS:

T1 - Bob Hughes, Mikecotterell, Software Project Management, Tata McGraw Hill, 2012 .
T2 -Adolfo Villafiorita, Introduction to Software Project Management, CRC Press,2014.

REFERENCE BOOKS :

R1 - Murali k. chemuturi, Thomas M. cagly, Mastering softwareprojectmanagement- best practices tools and Techniques,2010.
R2 - Richard E. Fairly, Managing and Leading Software projects, weilly and sons, 2009.
R3 - Jalote, Software Project Management in Practice, Pearson Education, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8301	VIRTUAL AND AUGMENTED REALITY	3	0	0	3

Course Objective

1. To introduce virtual reality and input and output devices.
2. To acquire knowledge on computing architectures and modeling.
3. To explore VR programming and human factors.
4. To learn various applications of VR.
5. To get exposure on augmented reality

Unit	Description	Instructional Hours
I	**INTRODUCTION TO VIRTUAL REALITY AND INPUT AND OUTPUT DEVICES.** Introduction: The three F's of Virtual Reality - A short history of early virtual reality - Early commercial VR technology - VR becomes an industry - The five classic components of a VR system. Input devices: Three Dimensional position trackers - tracker performance parameters - ultrasonic trackers - optical trackers - Navigation and manipulation interfaces - gesture interfaces. Output devices: graphics displays - large-volume displays - sound displays.	9
II	**COMPUTING ARCHITECTURES AND MODELING OF A VR SYSTEM.** The rendering pipeline - The graphics rendering pipeline - The haptics rendering pipeline - PC graphics architecture - PC graphics accelerators - Graphics benchmarks – Distributed VR architectures - Multipipeline synchronization - Colocated rendering pipelines. Modeling: geometric modeling - kinematics modeling - physical and behavior modeling	9
III	**VR PROGRAMMING AND HUMAN FACTORS** Toolkits and scene graphs – World Toolkit - Model geometry and appearance - The WTK scene graph - Sensors and action functions - WTK networking - Java 3D - Model geometry and appearance - Java 3D scene graph - Sensors and behaviors - Java 3D networking - WTK and Java 3D performance comparison - Methodology and terminology - user performance studies - VR health and safety issues - VR and society	9
IV	**APPLICATIONS OF VR** Medical applications of VR - Virtual anatomy - Triage and diagnostic - Surgery - VR in education - VR and the Arts - Entertainment applications of VR - military VR applications - Army use of VR - VR applications in the Navy - Air force use of VR - Applications of VR in Robotics - Robot programming - Robot teleoperation	9
V	**AUGMENTED REALITY** Augmented reality: An overview: Introduction - History - Augmented reality technologies - Computer vision methods in AR - AR devices - AR interfaces - AR systems. Visualization techniques for augmented reality: data integration - Depth perception - Augmenting pictorial depth cues - Occlusion handling - Image based X ray visualization - Scene manipulation - Rearranging real world objects - Space-distorting visualization.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Explore different input and output devices used in virtual reality system.
CO2: Model the VR system.
CO3: Create scene graph using different toolkits.
CO4: Apply VR in various fields.
CO5:Apply visualization techniques for AR

TEXT BOOKS:
T1. – Grigore C. Burdea, Philippe Coiffet, "Virtual reality technology", Wiley, Second Edition, 2006.
T2 - Borko Furht ,"Handbook of augmented reality", Springer, 2011.

REFERENCE BOOKS :
R1 - Sherman, William R & Craig, Alan B, "Understanding Virtual reality", Elsevier India Private Limited, Noida, 2008

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8302	NATURAL LANGUAGE PROCESSING	3	0	0	3

Course Objective

1. To provide the student with knowledge of various levels of analysis involved in NLP
2. To understand language modeling.
3. To study about semantic analysis and discourse processing.
4. To gain knowledge in automated natural language generation and machine translation
5. To learn the concepts of retrieving information and resources

Unit	Description	Instructional Hours
I	**OVERVIEW AND LANGUAGE MODELING** OVERVIEW: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. LANGUAGE MODELING: Introduction-Various Grammar-based Language Models-Statistical Language Model	9
II	**WORD LEVEL AND SYNTACTIC ANALYSIS** WORD LEVEL ANALYSIS: Introduction- Regular Expressions-Finite-State Automata Morphological Parsing-Spelling Error Detection and Correction-Words and Word classes Part-of Speech Tagging. SYNTACTIC ANALYSIS: Introduction-Context-free Grammar-Constituency-Parsing-Probabilistic Parsing	9
III	**SEMANTIC ANALYSIS AND DISCOURSE PROCESSING** SEMANTIC ANALYSIS: Introduction- Meaning Representation-Lexical Semantics-Ambiguity-Word Sense Disambiguation. DISCOURSE PROCESSING: Introduction- cohesion-Reference Resolution-Discourse Coherence and Structure	9
IV	**NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION** NATURAL LANGUAGE GENERATION: Introduction-Architecture of NLG Systems-Generation Tasks and Representations-Application of NLG. MACHINE TRANSLATION: Introduction-Problems in Machine Translation-Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages	9
V	**INFORMATION RETRIEVAL AND LEXICAL RESOURCES** INFORMATION RETRIEVAL: Introduction-Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval - Evaluation LEXICAL RESOURCES: Introduction-WordNet-FrameNet-Stemmers-POS Tagger-Research Corpora	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Be able to understand the basics of NLP
CO2: Analyze the natural language text.
CO3: Generate the natural language.
CO4: Do machine translation.
CO5: Apply information retrieval techniques.

TEXTBOOKS:

T1- Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press,2008.

REFERENCE BOOKS:

R1- Daniel Jurafsky and James H Martin," Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2ndEdition, 2008.
R2- James Allen, Bejamin/cummings, "Natural Language Understanding", Pearson Education; 2 edition (2002)

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8303	ADVANCED DATABASE TECHNOLOGY	3	0	0	3

Course Objective

The student should be made to:

1. Be familiar with the basics of Distributed and Parallel Databases Architectures
2. Be familiar with object oriented relational databases.
3. Be familiar with XML databases to create Webpages.
4. Understand the concepts of Data Mining and Data warehousing.
5. Understand the applications of Advanced Databases

Unit	Description	Instructional Hours
I	**PARALLEL AND DISTRIBUTED DATABASES** Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control.	9
II	**OBJECT AND OBJECT RELATIONAL DATABASES** Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems : Object Relational features in SQL / Oracle – Case Studies.	9
III	**XML DATABASES AND MOBILE DATABASES** XML Databases: XML Data Model – DTD – XML Schema – XML Querying –Mobile Databases: Location and Handoff Management – Effect of Mobility on Data Management – Location Dependent Data Distribution	9
IV	**DATA WAREHOUSING AND DATA MINING** Data Warehousing: Introduction, Definitions, and Terminology - Characteristics of - Data Modeling for Data Warehouses - Building a Data Warehouse - Problems and Open Issues in Data Warehouses. Data Mining :Overview of Data Mining Technology - Association Rules -Classification - Clustering -Applications of Data Mining -Commercial Data Mining Tools	9
V	**Intelligent Database Technologies and Applications** Intelligent Databases : Active databases – Deductive Databases – Applications : Mobile Databases - Multimedia Databases -Geographic Information Systems - Genome Data Management	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, you should be able to:

CO1: Understand the basics of Distributed and Parallel Databases Architectures
CO2: Understand and apply object oriented concept into the relational databases.
CO3: Apply XML databases to create Web pages.
CO4: Understand the concepts of Data Mining and Data warehousing
CO5: Understand the applications of Advanced Databases to solve real world problems

TEXT BOOKS:

T1 -Henry F Korth, Abraham Silberschatz and S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2011.
T2 - R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson; 6 edition (April 9, 2010)
T3- Vijay Kumar , "Mobile Database systems" A John Wiley & Sons, Inc., Publication 2006

REFERENCE BOOKS :

R1 - Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management Pearson; 6 edition (January 18, 2014)
R2 - Subramaniam, " Multimedia Databases", Morgan Kauffman Publishers, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8304	MOBILE AND ADHOC NETWORKS	3	0	0	3

Course Objective

1. Understand the design issues in ad hoc and sensor networks.
2. Learn the different types of MAC protocols.
3. Be familiar with different types of adhoc routing protocols.
4. Be expose to the TCP issues in adhoc networks.
5. Learn the architecture and protocols of wireless sensor networks.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.	9
II	**MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS** Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11.	9
III	**ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS** Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.	9
IV	**WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS** Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.	9
V	**WSN ROUTING, LOCALIZATION & QOS** Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1:Describe the challenges in ad-hoc/sensor networks.

CO2:Describe current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks

CO3:Describe the unique issues in designing a MAC Protocol

CO4:Discuss the issues in designing a routing and Transport Layer protocol for Ad hoc networks

CO5:Discuss the various sensor network Platforms, tools and applications.

TEXT BOOKS:

T1- Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley-Interscience; 1 edition (October 8, 2007

T2- C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson Education India; 1 edition (2006)

REFERENCE BOOKS :

1. Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks: An Information Processing Approach" (Morgan Kaufmann,2004).

2. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, "Mobile ad hoc Networking", Wiley-IEEE press,2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8305	MEDIA ANALYTICS	3	0	0	3

Course Objective

1. To understand Social Media Analytics
2. To Collecting, analyzing, deriving of Social Media Analytics
3. Practical analytical and technical skill that different in Social Media Analytics
4. Real world Social Media Application
5. Gain knowledge about Social Media Analytics

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SOCIAL MEDIA ANALYTICS** Social Media Analytics: An Overview, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Introduction to Social Media: World Wide Web, Core Characteristics of Social Media, Types of Social Media.	9
II	**SOCIAL MEDIA TEXT & NETWORK ANALYTICS** Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Case Study: Tapping into Online Customer Opinions Social Media Network Analytics: Network, Common Social Media Network Types, Types of Networks, Node-Level Properties, Network-Level Properties.	9
III	**SOCIAL MEDIA ACTIONS & MOBILE ANALYTICS** Common Social Media Actions, Actions Analytics Tools, Mobile Analytics: Types of Apps, Characteristics of Mobile Apps, Developing Your Own App, Case Study: Mobile Analytics to Optimize Process.	9
IV	**SOCIAL MEDIA HYPERLINK & LOCATION ANALYTICS** Types of Hyperlinks, Hyperlink Analytics, Types of Hyperlink Analytics, Location Analytics: Sources of Location Data, Categories of Location Analytics, Uses of Social Media-Based Location Analytics.	9
V	**SEARCH ENGINES ANALYTICS & BUSINESS ALIGNMENT** Types of Search Engines, Search Engine Optimization, Search Trend Analytics, Business Alignment: Role of CIO and IT Management, Steps in Formulating a Social Media Strategy, Managing Social Media Risks.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Explain the characteristics of social media analytics.
CO2: Explain the characteristics of network Analytics.
CO3: Analyze various protocols related media action and mobile analytics.
CO4: Design social media analytics based real time applications.
CO5: Implementation of media analytics in Business Alignment

TEXT BOOKS:

T1 - Gohar F. Khan "Seven Layers of Social Media Analytics: Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data" Create Space Independent , 2015.
T2 - Marshall Sponder, "Social Media Analytics: Effective Tools for Building, Interpreting, and using Metrics" McGraw-Hill Education (1 March 2014)

REFERENCE BOOKS :

R1 - Matthew Ganis, Avinash Kohirkar, Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Ed Brill, 2015.
R2 - Mariantonietta Noemi La Polla, Social Media Analytics and Open Source Intelligence: The Role of Social Media in Intelligence Activities : Tesi Di Dottorato Di Ricerca, Università di Pisa, 2014.
R3 - Derek Hansen, Ben Shneiderman, Marc A. Smith "Analyzing Social Media Networks with NodeXL: Insights from a Connected World" Morgan Kaufman, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8306	ENTERPRISE RESOURCE PLANNING	3	0	0	3

Course Objective

1. Study the basic concept of ERP and its related technologies
2. Understand the life cycle stages of any ERP implementation
3. Be familiar with the various Business models
4. Expose the various Market trends and software related to ERP in business world.
5. Describe the concepts of Systems software associates in ERP.

Unit	Description	Instructional hours
I	**ERP AND RELATED TECHNOLOGY** Introduction – Basic ERP concepts-Risks of ERP-Benefits of ERP-ERP and Related Technologies – Business Intelligence – Business Process Reengineering – Data Warehousing – Data Mining –OLAP – Product life Cycle management – Supply Chain Management.	9
II	**ERP IMPLEMENTATION** ERP Implementation Strategies – Life Cycle –Requirements Definition – Methodologies – Package selection – Process Definitions – Vendors and Consultants – Data Migration – Project management – Post Implementation Activities.	9
III	**ERP IN ACTION & BUSINESS MODULES** Operation and Maintenance – Performance of the ERP systems – Business Modules – Finance – Manufacturing – Human Resources – Plant maintenance –Materials Management – Quality management – Marketing – Sales, Distribution and service.	9
IV	**ERP MARKET** Marketplace – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc. –SSA Global – Lawson Software – Epicor – Intuitive.	9
V	**SYSTEM SOFTWARE ASSOCIATES** Turbo Charge the ERP system-Enterprise Application Integration – ERP and E-Business – ERP and Internet– Total quality management – Future Directions in ERP.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Demonstrate the technologies such as Data warehousing, Datamining and OLAP with respect to ERP.
CO2:Illustrate all the concepts of ERP implementation process
CO3:Discover the ERP system performance and various ERP business modules
CO4:Summarize the market trends and software related to ERP in business world CO5:InferTotal quality management concepts and Future Directions in ERP.

TEXT BOOKS:

T1: Alexis Leon, "ERP DEMYSTIFIED", Tata McGraw Hill, Second Edition, 2008.
T2: Mary Sumner, "Enterprise Resource Planning", Pearson; 1 edition (3 October2013).

REFERENCES:

R1: Jim Mazzullo,"SAP R/3 for Everyone", Pearson,2007.
R2: Jose Antonio Fernandz, " The SAP R /3 Handbook", Tata McGraw Hill, 1998.
R3: Biao Fu, "SAP BW: A Step-by-Step Guide", First Edition, Pearson Education; First edition (2003)

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8307	MULTIMEDIA MINING	3	0	0	3

Course Objective

1. To study the fundamental concepts that provide the foundation of Multimedia mining
2. To study the characteristics of the Multimedia data.
3. To understand the Multimedia Data Indexing and Retrieval
4. To study the implementation described in the Multimedia
5. Understand the application of multimedia mining

Unit	Description	Instructional Hours
I	**INTRODUCTION.** Introduction into Multimedia Data Mining and Knowledge Discovery – Multimedia Data Mining: An Overview-Multimedia Data Mining Architecture – Representative Features for Mining - SupervisedConceptMining-ConceptMiningThroughClustering-ConceptMiningUsing Contextual Information - Events and Feature Discovery.	9
II	**MULTIMEDIA DATA EXPLORATION AND VISUALIZATION** A New Hierarchical Approach for Image Clustering – Multi resolution Clustering of Time Series and Application to Images - Mining Rare and Frequent Events in Multi-camera Surveillance Video - Density-Based Data Analysis and Similarity Search - Feature Selection for Classification of Variable Length Multi attribute Motions	9
III	**MULTIMEDIA DATA INDEXING AND RETRIEVAL** FAST: Fast and Semantics-Tailored Image Retrieval - New Image Retrieval Principle: Image Mining and Visual Ontology - Visual Alphabets: Video Classification by End Users.	9
IV	**MULTIMEDIA DATA MODELING AND EVALUATION** Cognitively Motivated Novelty Detection in Video Data Streams - Video Event Mining via Multimodal Content Analysis and Classification- Identifying Mappings in Hierarchical Media Data - A Novel Framework for Semantic Image Classification and Benchmark Via Salient Objects - Extracting Semantics Through Dynamic Context - More Efficient Mining Over Heterogeneous Data Using Neural Expert Networks.	9
V	**APPLICATIONS AND CASE STUDIES** Supporting Virtual Workspace Design Through Media Mining and Reverse Engineering - A Time-Constrained Sequential Pattern Mining for Extracting Semantic Events in Videos - Multiple-Sensor People Localization in an Office Environment - Analyzing User's Behavior on a Video Database.	9
	Total Instructional Hours	

Course Outcome

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

CO1: Gave a good knowledge of the fundamental concepts that provide the foundation of Multimedia mining

CO2: To understand the characteristics of multimedia data.

CO3: Discus the multimedia data indexing and data modeling.

CO4:Discuss the data modeling and evaluation:

CO5:Understand the application of multimedia mining

TEXT BOOKS:

T1 Petrushin, Valery A.; Khan, Latifur (Eds.),"Multimedia Data Mining and Knowledge Discovery", Springer, 2007.

T2.Petra Perner, "Data Mining on Multimedia Data", Springer, 2003

REFERENCE BOOKS :

R1 Michael Granitzer , "Multimedia Semantics — The Role of Metadata " Springer, 2008.

R2.http://www.booki.cc/methods-in-multimedia-scholarship/data-visualization

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8308	SPEECH PROCESSING	3	0	0	3

Course Objective

1. To introduce speech production and related parameters of speech.
2. To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
3. To understand different speech modelling procedures such as Markov and their implementation issues.
4. To introduce methods of predictive analysis of speech
5. To learn various speech synthesis techniques

Unit	Description	Instructional Hours
I	**MECHANICS OF SPEECH** Speech production: Mechanism of speech production, Acoustic phonetics – Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM – Auditory perception: psycho acoustics.	9
II	**TIME DOMAIN METHODS FOR SPEECH PROCESSING** Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function.	9
III	**FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING** Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder - Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders.	9
IV	**LINEAR PREDICTIVE ANALYSIS OF SPEECH** Basic Principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.	9
V	**APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING** Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification – Voice response system – Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis – VOIP	9
	Total Instructional Hours	45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Model speech production system and describe the fundamentals of speech.
CO2: Extract and compare different speech parameters.
CO3: Choose an appropriate statistical speech model for a given application.
CO4: Design a speech recognition system.
CO5: Use different speech synthesis techniques.

TEXT BOOKS:

1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc., Singapore,2004.
2. R. Rabiner and R. W. Schaffer, "Digital Processing of Speech signals", PrenticeHall,1978.

REFERENCE BOOKS:

1. Quatieri, "Discrete-time Speech Signal Processing", Prentice Hall,2001.
2. L.R. Rabiner and B. H. Juang, "Fundamentals of speech recognition", Prentice Hall, 1993. UNITII

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8309	INFORMATION STORAGE AND RETRIEVAL	3	0	0	3

Course Objective

1. Familiarize the fundamentals of IR
2. Learn the concepts behind IR
3. Understand the operation of web search engines
4. Design and implement an innovative feature in a search engine
5. Learn the algorithms related to classification and clustering in Text Mining

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction -History of IR- Components of IR - Issues –Open source Search engine Frameworks, The impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Versus Web Search - Components of a Search engine- Characterizing the web	9
II	**INFORMATION RETRIEVAL MODELS** Boolean and vector-space retrieval models- Term weighting - TF-IDF weighting- cosine similarity – Preprocessing - Inverted indices - efficient processing with sparse vectors – Language Model based IR - Probabilistic IR –Latent Semantic Indexing – Relevance feedback and query expansion	9
III	**WEB SEARCH ENGINE** Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement - search engine optimization/spam – Web Search Architectures - crawling - meta-crawlers- Focused Crawling - XML retrieval- Link Analysis	9
IV	**TEXT CLASSIFICATION AND CLUSTERING** Information filtering; organization and relevance feedback – Text Mining –Text Classification and clustering - Categorization algorithms: naive Bayes; decision trees; and nearest neighbor - Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM)	9
V	**INFORMATION EXTRACTION AND INTEGRATION** Recommender Systems: Collaborative filtering and content-based recommendation of documents and products - Extracting data from text; XML; semantic web; collecting and integrating specialized information on the web- Crowd-sourcing - micro-task platforms : Data Annotation, Label Generation, and Feature extraction -Quality control techniques-Case Study.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Apply the fundamentals of IR
CO2: Design and implement IR concepts
CO3: Use an open source search engine framework and explore its capabilities
CO4: Build an innovative feature in a search engine
CO5: Design a smart information management system with Information Retrieval components

TEXT BOOKS:

T1 - C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
T2 - Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, Addison Wesley; 1st edition 2009

REFERENCE BOOKS :

R1 - Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
R2 - OphirFrieder Information Retrieval:Algorithms and Heuristics (The Information Retrieval Series)(2nd Edition), Springer; 2nd edition, 2004
R3 - Manu Konchady, Building Search Applications: Lucene, LingPipe, and Gate Mustru Publishing; First edition,2008
R4 - Mark Levene, An Introduction to Search Engines and Web Navigation, Wiley; 2nd edition, 2010
R5 - Ricardo Baeza-Yates and BerthierRibeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search (2nd Edition) (ACM Press Books) 20

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8310	PERVASIVE COMPUTING	3	0	0	3

The course should enable the students to:

Course Objective

1. Learn the basic concepts of pervasive computing.
2. Understand various device technologies.
3. Learn device connectivity and Web Application Concepts.
4. Analyze WAP and voice technologies in detail.
5. Understand pervasive web application architecture.

Unit	Description	Instructional Hours
I	**Introduction:** Mobile Adaptive Computing – Mechanisms for Adaptation – Mobile Management – Data Dissemination and Management: Mobile data Caching – Mobile Cache Maintenance – Mobile web Caching, Context – Aware Computing – Middleware support.	9
II	**PERVASIVE COMPUTING:** Past, Present and Future Pervasive Computing - Pervasive Computing Market - m-Business - Application examples: Retail, Airline check-in and booking - Sales force automation - Health care - Tracking - Car information system - E-mail access via WAP.	9
III	**DEVICE TECHNOLOGY** Device Technology: Hardware - Human Machine Interfaces - Biometrics – Operating Systems - Java for Pervasive devices	9
IV	**DEVICE CONNECTIVITY AND WEB APPLICATION CONCEPTS:** Device Connectivity: Protocols - Security - Device Management Web Application Concepts: WWW architecture - Protocols - Transcoding - Client authentication via internet.	9
V	**PDA AND PERVASIVE WEB APPLICATION ARCHITECTURE:** PDA: Device Categories - PDA operation Systems - Device Characteristics – Software Components - Standards - Mobile Applications - PDA Browsers Pervasive Web Application architecture: Background - Scalability and availability - Development of Pervasive Computing web applications - Pervasive application architecture	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Explain the history of pervasive computing and its applications.
CO2: Implement the hardware, software and interfaces.
CO3: Develop the web architecture for pervasive computing.
CO4: Design and develop WAP architecture, infrastructure and the security issues.
CO5: Have an understanding the PDA device categories, characteristics, software, browsers and various mobile applications.

TEXT BOOKS:

T1 - Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff "Pervasive Computing, Technology and Architecture of Mobile Internet Applications", Pearson Education, 2009.
T2 - Taniar, David Mobile Computing: Concepts, Methodologies, Tools, and Applications: Concepts, Information Science Reference, 2008.

REFERENCE BOOKS :

R1 - Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw Hill edition, 4th ed., 2008.
R2 - Khaldoun Al Agha, Guy Pujolle, Tara Ali Yahiya, Mobile and Wireless Networks, John Wiley & Sons, 2016.
R3 - Alkhatib, Ghazi I. "Integrated Approaches in Information Technology and Web Engineering advancing Organizational Knowledge sharing", Information Science Reference , 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8311	GRID COMPUTING	3	0	0	3

Course Objective

1. Understand various methods of analysis in electromagnetic spectrum
2. Study important methods of analysis of in chromatography
3. Introduce pollution monitoring instruments
4. To learn about pH meters
5. Gain knowledge about Microscopic techniques

Unit	Description	Instructional Hours
I	**INTRODUCTION** Grid computing-key issues-potential applications and benefits-grid types, topologies-comparison with other approaches-motivations for grid computing-brief history (communication, computation, grid technology).	9
II	**GRID COMPUTING SYSTEMS AND ARCHITECTURES** Overview-Basic Constituent Elements functional view-Grid Security Infrastructure (User Security, Node Security, Broker Function, Scheduler Function, Data Management, Job Management and Resource Management, User submission blocks)- Basic constituent elements physical view.	9
III	**OPEN GRID SERVICES INFRASTRUCTURE** Introduction-Architectural constructs-OGSI/OGSA service elements and layered model (Key Aspects, Ancillary Aspects, Implementations of OGSI)-Grid service-WSDL extensions and conventions- service data-core grid service properties.	9
IV	**OPEN GRID SERVICES ARCHITECTURE** Introduction-Functionality Requirements-OGSA service taxonomy-service relationships-OGSA services - Security considerations.	9
V	**GRID SYSTEM ECONOMICS AND COMMUNICATION SYSTEMS** Introduction-The chargeable grid service (CGS)-The Grid payment system-GPS Hold Service-The Grid currency exchange service- Security considerations-Communication systems for Local grids, National grids.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1. Students will understand the key concepts of Grid computing

CO2. Students will understand the Grid computing standards and its toolkits.

CO3. Students will be able to understand about Grid computing history ,evolution of Grid and its Security issues

CO4. Students will gain a basic knowledge on open Grid Services.

CO5. Students will be encouraged to adapt their research problem in a Grid environment as a project.

TEXT BOOKS:

T1 - Daniel Minoli, "A Networking Approach to Grid Computing ", A John Wiley & Sons Inc., Publication,Singapore, 2005.

T2 - Joshy Joseph and Craig Fallenstein, "Grid Computing", Pearson Education, New Delhi, 2011.

REFERENCE BOOKS:

R1 - Ahmar Abbas, "Grid Computing: Practical Guide to Technology & Applications", Firewall Media, 2004.

R2 - Vladimir Silva, "Grid Computing for Developers", Dreamtech Press, New Delhi, 2006.

R3 - http://www.redbooks.ibm.com/redbooks/pdfs/sg246895.pdf

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8312	E-COMMERCE	3	0	0	3

Course Objective

1. To understanding of the foundations and importance of E-commerce
2. To Analyze the impact of E-commerce on business models
3. To describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.
4. Understand the E-commerce issues.
5. To analyze and understand to implement the E-Commerce strategies.

Unit	Description	Instructional Hours
I	**Introduction to E-Commerce:** Benefits of E-Commerce –Impacts–Classification and Application of E-Commerce–Business Model–Architectural Framework.	8
II	**Network Infrastructure:** Local Area Network–Ethernet–Wide Area Network–Internet–TCP/IP Reference Model–Domain Name System–Internet Industry structure–Information Distribution and Messaging, FTP Application–Electronic Mail –World Wide Web Server –HTTP–Web Server Implementations.	9
III	**Information Publishing Technology:** Information Publishing–Web Browsers–HTML–CGI–Multimedia Content–Other Multimedia Objects–VRML–Securing the Business on Internet–Why Information on Internet is Vulnerable?–Security Policy–Procedures and Practices–Site Security–Protecting the Network–Firewalls–Securing the Web Service	10
IV	**Securing Network Transaction–Electronic Payment Systems:** Introduction–Online Payment Systems–Pre-paid Electronic Payment System–Post-paid Electronic Payment System– Requirement Metrics of a Payment System.	9
V	**Search Engines and Directory Services:** Information Directories – Search Engines–Internet Adverting–Agents in Electronic Commerce: Needs and Types of Agents –Agent Technologies–Agents Standards and Protocols–Agents Applications– Case Study.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Demonstrate an understanding of the foundations and importance of E-commerce
CO2: Analyze the impact of E-commerce on business models and strategy
CO3: Describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.
CO4: Discuss legal issues and privacy in E-Commerce
CO5: Recognize and discuss global E-commerce issues

TEXT BOOKS:

T1 - Bharat Bhasker, 'Electronic Commerce Framework Technologies and Applications', McGraw Hill (26 April 2013)
T2- Gupta & Gupta 'E-Commerce,'Khanna Book Publishing-new Delhi,2013.

REFERENCE BOOKS:

R1 - Ravi Kalakota and Andrew B Whinston, "Frontiers of Electronic Commerce", Pearson Education Asia, 1999.(Chapters 1,2,3,6–10,16)
R2- Marilyn Greenstein and Todd M Feinman, "ElectronicCommerce: Security, RiskManagement and Control",TataMcGrawHill, 2000.(Chapters 7,8,10–12).

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT7402	WEB DEVELOPMENT ESSENTIALS	3	0	0	3

Course Objective

1. Familiarize the markup language and stylesheets
2. Learn about XML and client side programming.
3. Know about PHP and web data representations
4. Learn Python Programming language
5. Familiarize server side programming

Unit	Description	Instructional Hours
I	**WEB ESSENTIALS** Clients, Servers and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. HTML: Designing Web Pages with HTML-Use of Tags, Hyperlinks, URLs, List, Tables, Text Formatting, Graphics & Multimedia, Image map, Frames and Forms in Web Pages. CSS: Use of Cascading Style Sheet in Web Pages.	9
II	**XML AND JAVA SCRIPT** XML: Extensible Markup Language (XML): Introduction-Using User-Defined Tags in Web Pages, Displaying XML Contents, XML DTDs - XML schema -DOM -SAX –XSL-Java script basics -form validation -java script objects and functions - Angular JavaScript -AJAX –JSON	9
III	**PHP AND MYSQL** 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 MYSQL database– PHP and LDAP	9
IV	**PYTHON PROGRAMMING BASED WEB DEVELOPEMNT** Strings -Operators -Decisions-Functions -Classes and Objects -Files and Directories -Modules -Text processing -Accessing Databases -Simple web application using Python	9
V	**SERVER SIDE TECHNOLOGIES** Servlet Overview – Life cycle of a Servlet – Handling HTTP request and response – Using Cookies – Session tracking – Java Server Pages – Anatomy of JSP – Implicit JSP Objects – JDBC	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Identify problems that are amenable to solution by AI methods.

CO2: Identify appropriate AI methods to solve a given problem.

CO3: Formalize a given problem in the language/framework of different AI methods.

CO4: Implement basic AI algorithms.

CO5: Design and carry out an empirical evaluation of different algorithms on a problem formalization,
and state the conclusions that the evaluation supports.

TEXT BOOKS:

T1-Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill- 2008. (Units-,II,VI&V)T2-Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.(Unit-III).

REFERENCE BOOKS:

R1-Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education 2013.
R2-Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

Chairman - BoS
IT - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF * Chairman

Dean (Academics)
HiCET

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

SEMESTER – I – R2019

Course Code & Name: 19HE1101 Technical English

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name: 19MA1101 Calculus

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

Course Code & Name: 19PH1151 Applied Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.3	-	-	-	-	-	1	2.4	2.4

Course Code & Name: 19CY1151 Chemistry for Engineers

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

Course Code & Name: 19CS1151 Python Programming and Practices

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

Course Code & Name: 19EC1154 Basics of Electron Devices and Electric Circuits

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

Semester – II

Course Code & Name: 19HE2101 Business English for Engineers

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

Course Code & Name: 19MA2104 Differential Equations and Linear Algebra

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

Course Code & Name: 19PH2151 Material Science

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Course Code & Name: 19CY2151 Environmental Studies

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

Course Code & Name: 19IT2151 Programming in C

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3.0	-	2	-	-	-	-	-	-	2	2	2

Course Code & Name: 19ME2154 Engineering Graphics

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

Course Code & Name: 19ME2001 Engineering Practices Laboratory

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

Semester – III

Course Code & Name: 19MA3151 Statistics and Queuing Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**-**	**1**	**-**	**2**	**3**	**1**	**1**
CO2	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
CO3	**3**	**3**	**2**	**-**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**
CO4	**3**	**2**	**-**	**1**	**3**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**
CO5	**3**	**2**	**3**	**1**	**2**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
Avg	**3**	**2.6**	**2.5**	**1.5**	**2.2**	**1**	**1**	**-**	**1**	**-**	**1.6**	**2.2**	**1**	**1**

Course Code & Name: 19IT3201 Data Structures and Algorithm Laboratory

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

Course Code & Name: 19IT3202 Object Oriented Programming using C++ Laboratory

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

Course Code & Name: 19IT3203 Computer Organization and Architecture

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

Course Code & Name: 19IT3251 Digital Principles and System Design

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

Course Code & Name: 19IT3001 Data Structures and Algorithm Laboratory

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

Course Code & Name: 19IT3002 Object Oriented Programming using C++ Laboratory

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

Semester – IV

Course Code & Name: 19MA4102 Discrete Mathematics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	3	2	-	-	-	-	-	-	3	2	3
CO2	2	3	3	3	3	-	-	-	-	-	-	3	2	3
CO3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	2	3	3	2	3	-	-	-	-	-	-	2	2	2
CO5	2	3	3	3	2	-	-	-	-	-	-	3	1	3
Avg	2	2.6	2.8	2.6	2.4	-	-	-	-	-	-	2.6	1.8	2.6

Course Code & Name: 19IT4201 Java Programming

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

Course Code & Name: 19IT4202 Database Management Systems

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

Course Code & Name: 19IT4203 Principles of Operating Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 19IT4251 Object Oriented Software Engineering

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

Course Code & Name: 19IT4001 Java Programming Laboratory

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

Course Code & Name: 19IT4002 Database Management Systems Laboratory

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

Semester – V

Course Code & Name: 19IT5201 Mobile Computing

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

Course Code & Name: 19IT5202 Computer Networks

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

Course Code & Name: 19IT5203 Microcontrollers and Embedded Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 19IT5204 Artificial Intelligence and Machine Learning

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

Course Code & Name: 19IT5205 Data Warehousing and Data Mining

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

Course Code & Name: 19IT5001 Machine Learning Laboratory

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

Course Code & Name: 19IT5002 Mobile Application Development Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	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: 19IT5351 Internet and Web Technology

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

Course Code & Name: 19IT5352 Advanced Java Programming

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

Course Code & Name: 19IT5353 C# and .Net Programming

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

Course Code & Name: 9IT5354 Advanced Data Structure

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

Course Code & Name: 19IT5355 Advanced Database Technology

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

Course Code & Name: 19IT5356 Ethical Hacking

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

Semester – VI

Course Code & Name: 19IT6181 Software Project Management

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

Course Code & Name: 19IT6201 Internet of Things

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

Course Code & Name: 19IT6202 Principles of Compiler Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 19IT6251 Cryptography and Network Security

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

Course Code & Name: 19IT6001 Internet of Things Laboratory

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

Course Code & Name: 19IT6002 Hardware and Software Clinic

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

Course Code & Name: 19IT6301 Business Intelligence and Analysis

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

Course Code & Name: 19IT6302 Information Security

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

Course Code & Name: 19IT6303 Software Design

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

Course Code & Name: 19IT6304 Natural Language Processing

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

Course Code & Name: 19IT6305 Soft Computing

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

Course Code & Name: 19IT6307 Virtual Reality and Augmented Reality

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

Course Code & Name: 19IT6402 Machine Learning for Engineers

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

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	I	**19HE1101**	Technical English	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4
		19MA1101	Calculus	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2
		19PH1151	Applied Physics	3	2.2	2	1.6	2	1.3	-	-	-	-	-	1	2.4	2.4
		19CY1151	Chemistry for Engineers	3	2	2	2	2	1	1	-	-	-	-	1	1	1
		19CS1151	Python Programming and Practices	2	3	3	-	2	-	-	-	2	-	-	2	2	2
		19EC1154	Basics of Electron Devices and Electric Circuits	3	2.8	2.8	2	2	1	1				1	2	2.8	2.2
I	II	**19HE2101**	Business English for Engineers	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1
		19MA2104	Differential Equations and Linear Algebra	3	3	3	2.4	2.4	-	-	-	-	-	-	2	2	2
		19PH2151	Material Science	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2
		19CY2151	Environmental Studies	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-
		19IT2151	Programming in C	2	3	3	-	2	-	-	-	-	-	-	2	2	2
		19ME2154	Engineering Graphics	3	3	3	2	2	-	-	-	-	-	-	2.8	1.8	1.8

		19ME2001	Engineering Practices Laboratory	3		3		3				1				1	2
II	**III**	**19MA3151**	Statistics and Queuing Theory	3	2.6	2.5	1.5	2.2	1	1	-	1	-	1.6	2.2	1	1
		19IT3201	Data Structures and Algorithm Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		19IT3202	Object Oriented Programming using C++ Laboratory	3	2	0	0	1	0	0	0	0	0	1	2	1	0
		19IT3203	Computer Organization and Architecture	2	2	1	0	0	0	0	0	0	0	1	2	1	2
		19IT3251	Digital Principles and System Design	3	3	2	2	2	2	0	1	0	1	1	2	0	1
		19IT3001	Data Structures and Algorithm Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		19IT3002	Object Oriented Programming using C++ Laboratory	3	2	0	0	1	0	0	0	0	0	1	2	1	0
II	**IV**	**19MA4102**	Discrete Mathematics	2	3	3	3	2	-	-	-	-	-	-	3	1	3
		19IT4201	Java Programming	3	2	2	0	2	0	0	0	0	0	1	2	1	1
		19IT4202	Database Management Systems	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		19IT4203	Principles of Operating Systems	3	2	2	2	2	2	0	1	1	0	2	2	1	0

		19IT4251	Object Oriented Software Engineering	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		19IT4001	Java Programming Laboratory	3	1	2	0	2	0	0	0	0	0	1	2	1	1
		19IT4002	Database Management Systems Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0
III	**V**	**19IT5201**	Mobile Computing	3	1	2	2	2	2	0	1	1	0	2	2	1	0
		19IT5202	Computer Networks	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19IT5203	Microcontrollers and Embedded Systems	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19IT5204	Artificial Intelligence and Machine Learning	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19IT5205	Data Warehousing and Data Mining	3	1	2	0	2	0	0	1	0	1	1	2	1	0
		19IT53XX	**Professional Elective-I**														
		19IT5001	Machine Learning Laboratory	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19IT5002	Mobile Application Development Laboratory	3	2	1	3	2	2	0	1	2	0	0	1	1	1
19IT53XX Professional Elective - I																	
III	**V**	**19IT5351**	Internet and Web Technology	3	2	2	0	2	0	0	1	0	1	1	2	1	0

		19IT5352	Advanced Java Programming	3	1	2	0	2	0	0	0	0	0	1	2	1	1
		19IT5353	C# and .Net Programming	3	2	2	0	2	0	0	0	0	0	1	2	1	1
		19IT5354	Advanced Data Structure	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		19IT5355	Advanced Database Technology	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		19IT5356	Ethical Hacking	3	2	1	3	2	2	0	1	2	0	0	1	1	1
III	**VI**	**19IT6181**	Software Project Management	3	1	1	0	2	0	0	1	0	1	1	2	1	0
		19IT6201	Internet of Things	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19IT6202	Principles of Compiler Design	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		19IT63XX	**Professional Elective II**														
		19XX64XX	**Open Elective I**														
		19IT6251	Cryptography and Network Security	3	2	1	0	2	0	0	1	0	1	1	2	1	0
		19IT6001	Internet of Things Laboratory	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19IT6002	Hardware and Software Clinic	3	3	1	1	0	0	0	0	0	2	2	2	2	0
19IT63XX Professional Elective - II																	
III	**VI**	**19IT6301**	Business Intelligence and Analysis	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		19IT6302	Information Security	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		19IT6303	Software Design	3	2	2	2	2	2	0	1	1	0	2	2	1	0

		19IT6304	**Natural Language Processing**	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		19IT6305	**Soft Computing**	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		19IT6307	**Virtual Reality and Augmented Reality**	3	2	1	3	2	2	0	1	2	0	0	1	1	1
19ITXX64XX Open Elective - I																	
III	**VI**	**19IT6402**	Machine Learning for Engineers	3	1	0	1	0	0	0	0	0	2	2	2	2	0

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

Chairman - BoS
IT - HiCET

Dean (Academics)
HiCET

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

SEMESTER – V – R2016

Course Code & Name: 16IT5201 Computer Networks

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

Course Code & Name: 16IT5202 Web Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	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: 16IT5203 Information Security

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	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: 16IT5204 Theory Of Computation

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

Course Code & Name: 16IT5001 Network Laboratory

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

Course Code & Name: 16IT5002 Web Technology Laboratory

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

Course Code & Name: 16IT5301 Graphics and Multimedia

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	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: 16IT5302 Soft Computing

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

Course Code & Name: 16IT5303 System Software

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

Course Code & Name: 16IT5304 High Speed Networks

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

Course Code & Name: 16IT5305 Data Warehousing and Data Mining

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 16IT5306 Software Design Patterns

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

Semester – VI

Course Code & Name: 16IT6201 Mobile Computing

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

Course Code & Name: 16IT6202 Microcontrollers and Embedded Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 16IT6203 Software Testing and Quality Assurance

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

Course Code & Name: 16IT6204 Professional Ethics

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

Course Code & Name: 16IT6001 Embedded Systems Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 16IT6002 Open Source Software Laboratory

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

Course Code & Name: 16IT6301 Multimedia Communications

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

Course Code & Name: 16IT6302 Artificial Intelligence

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

Course Code & Name: 16IT6303 Compiler Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	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: 16IT6304 Cryptography and Network Security

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	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: 16IT6305 Business Intelligence

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	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: 16IT6306 Human Computer Interface

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

Course Code & Name: 16IT6401 Cyber Security and Forensics

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

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Course Code & Name: 16IT7201 Data Analytics

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

Course Code & Name: 16IT7202 Distributed and Cloud Computing

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

Course Code & Name: 16IT7203 Internet of Things

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

Course Code & Name: 16IT7001 Application Development Laboratory

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

Course Code & Name: 16IT7002 Distributed and Cloud Computing Laboratory

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

Course Code & Name: 16IT7901 Project Work - Phase I

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

Course Code & Name: 16IT7301 Multimedia Design and Storage

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

Course Code & Name: 16IT7302 Knowledge Based Decision Support System

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

Course Code & Name: 16IT7303 Computer Hardware and Peripherals

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

Course Code & Name: 16IT7304 Wireless Security

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	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: 16IT7305 Social Network Analysis

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

Course Code & Name: 16IT7306 Service Oriented Architecture

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

Course Code & Name: 16IT7307 Digital Image Processing

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

Course Code & Name: 16IT7308 Genetic Algorithms

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

Course Code & Name: 16IT7309 Advanced Data Structures

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 16IT7310 Wireless Communication

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

Course Code & Name: 16IT7311 Semantic Web

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

Course Code & Name: 16IT7312 Software Project Management

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

Course Code & Name: 16IT7402 Web Development Essentials

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

Semester – VIII

Course Code & Name: 16IT8301 Virtual and Augmented Reality

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

Course Code & Name: 16IT8302 Natural Language Processing

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

Course Code & Name: 16IT8303 Advanced Database Technology

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

Course Code & Name: 16IT8304 Mobile and Adhoc Networks

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

Course Code & Name: 16IT8305 Media Analytics

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

Course Code & Name: 16IT8306 Enterprise Resource Planning

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

Course Code & Name: 16IT8307 Multimedia Mining

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	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: 16IT8308 Speech Processing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	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: 16IT8309 Information Storage and Retrieval

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

Course Code & Name: 16IT8310 Pervasive Computing

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

Course Code & Name: 16IT8311 Grid Computing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	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: 16IT8312 E-Commerce

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

Mapping of Course Outcome and Programme Outcome:

R2016

Year	Sem	Course code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
III	V	**16IT5201**	Computer Networks	3	1	2	2	2	2	0	1	1	0	2	2	1	0
		16IT5202	Web Technology	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT5203	Information Security	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT5204	Theory Of Computation	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT53XX	**Professional Elective-I**														
		16IT5001	Network Laboratory	3	1	2	0	2	0	0	1	0	1	1	2	1	0
		16IT5002	Web Technology Laboratory	3	2	2	2	2	2	0	1	1	0	2	2	1	0
19IT53XX Professional Elective - I																	
III	V	**16IT5301**	Graphics and Multimedia	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT5302	Soft Computing	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		16IT5303	System Software	3	1	2	0	2	0	0	0	0	0	1	2	1	1
		16IT5304	High Speed Networks	3	2	2	0	2	0	0	0	0	0	1	2	1	1
		16IT5305	Data Warehousing and Data Mining	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		16IT5306	Software Design Patterns	3	2	1	1	0	0	0	0	0	2	2	2	2	0
III	VI	**6IT6201**	Mobile Computing	3	1	1	0	2	0	0	1	0	1	1	2	1	0

		16IT6202	Microcontrollers and Embedded Systems	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT6203	Software Testing and Quality Assurance	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16IT6204	Professional Ethics	3	2	1	0	2	0	0	1	0	1	1	2	1	0
		16IT63XX	**Professional Elective II**														
		16XX64XX	**Open Elective I**														
		16IT6001	Embedded Systems Laboratory	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT6002	Open Source Software Laboratory	3	3	1	1	0	0	0	0	0	2	2	2	2	0
		16IT6801	Mini Project														
19IT63XX Professional Elective - II																	
III	**VI**	**16IT6301**	Multimedia Communications	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT6302	Artificial Intelligence	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		16IT6303	Compiler Design	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT6304	Cryptography and Network Security	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16IT6305	Business Intelligence	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT6306	Human Computer Interface	3	2	1	3	2	2	0	1	2	0	0	1	1	1
19ITXX64XX Open Elective - I																	
III	**VI**	**16IT6401**	Cyber Security and Forensics	3	1	0	1	0	0	0	0	0	2	2	2	2	0
IV	**VII**	**16IT7201**	Data Analytics	**3**	**3**	**1**	**3**	**2**	**2**	**0**	**1**	**2**	**0**	**0**	**1**	**1**	**1**
		16IT7202	Distributed And Cloud Computing	**3**	**1**	**2**	**2**	**2**	**2**	**0**	**1**	**1**	**0**	**2**	**2**	**1**	**0**
		16IT7203	Internet of Things	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT73XX	**Professional Elective III**														

		16IT73XX	**Professional Elective IV**															
		16XX74XX	**Open Elective II**															
		16IT7001	Application Development Laboratory	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16IT7002	Distributed and Cloud Computing Laboratory	3	2	0	1	0	0	0	0	0	2	2	2	2	0
		16IT7901	Project Work - Phase I	3	2	2	2	2	2	0	1	1	0	2	2	1	0
19IT73XX Professional Elective - III																		
IV	**VII**	**16IT7301**	Multimedia Design and Storage	3	2	1	0	2	0	0	1	2	0	0	1	1	1
		16IT7302	Knowledge Based Decision Support System	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16IT7303	Computer Hardware and Peripherals	2	2	1	0	1	1	0	1	0	0	2	1	2	1
		16IT7304	Wireless Security	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT7305	Social Network Analysis	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16IT7306	Service Oriented Architecture	2	2	1	0	1	1	0	1	0	0	2	1	2	1
19IT83XX Professional Elective - IV																		
IV	**VII**	**16IT7307**	Digital Image Processing	3	3	3	2	2	1	1	-	1	-	2	2	1	1
		16IT7308	Genetic Algorithms	3	2	0	0	0	0	1	0	0	2	2	2	2	0
		16IT7309	Advanced Data Structures	3	2	1	1	0	0	0	0	0	2	2	2	2	0
		16IT7310	Wireless Communication	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT7311	Semantic Web	3	2	1	0	2	0	0	1	2	0	0	1	1	1
		16IT7312	Software Project Management	3	2	1	1	0	0	0	0	0	2	2	2	2	0
19ITXX74XX Open Elective - II																		
IV	**VII**	**16IT7402**	Web Development Essentials	2	2	1	0	1	1	0	1	0	0	2	1	2	1
IV		**16IT83XX**	Professional Elective V															

	VII I	16IT83XX	Professional Elective VI														
		16IT8902	Project Work – Phase II	2	2	1	0	1	1	0	1	0	0	2	1	2	1
19IT83XX Professional Elective - V																	
IV	VII I	16IT8301	Virtual and Augmented Reality	2	2	0	0	1	1	0	1	0	0	2	1	2	1
		16IT8302	Natural Language Processing	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT8303	Advanced Database Technology	3	2	0	3	2	2	0	1	2	0	0	1	1	1
		16IT8304	Mobile and Adhoc Networks	2	2	1	0	1	1	0	1	0	0	2	1	2	1
		16IT8305	Media Analytics	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT8306	Enterprise Resource Planning	3	2	2	2	2	2	0	1	1	0	2	2	1	0
19IT83XX Professional Elective - VI																	
IV	VII I	16IT8307	Multimedia Mining	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT8308	Speech Processing	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT8309	Information Storage and Retrieval	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT8310	Pervasive Computing	3	2	0	2	2	2	0	1	1	0	2	2	1	1
		16IT8311	Grid Computing	3	2	1	3	2	2	0	1	2	0	0	1	1	1
		16IT8312	E-Commerce	3	2	2	2	2	2	0	1	1	0	2	2	1	0

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

Chairman - BoS
IT - HiCET

Dean (Academics)
HiCET