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

2019-2020

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.

Chairman - BoS
IT - HiCET

HINDUSTHAN ACADEMIC COUNCIL * Chairman * HINDUSTHAN COLLEGE OF ENGG & TECH

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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 2019-2020 and onwards

SEMESTER – I

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1101	Calculus	BS	3	1	0	4	25	75	100
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
7	19HE1071	Language Competency Enhancement Course – I	HS	0	0	2	1	100	0	100
Total Credits:				**13**	**0**	**10**	**20**	**350**	**350**	**700**

SEMESTER-II

S.No	Course Code	Name of the Course	L	T	P	C	CIA	ESE	TOTAL
1	19HE2101	Business English for Engineers	2	1	0	3	25	75	100
2	19MA2104	Differential Equations and Linear Algebra	3	1	0	4	25	75	100
3	19PH2151	Material Science	2	0	2	3	50	50	100
4	19CY2151	Environmental Studies	2	0	2	3	50	50	100
5	19IT2151	Programming in C	2	0	2	3	50	50	100
6	19ME2154	Engineering Graphics	1	0	4	3	50	50	100
7	19HE2071	Language Competency Enhancement Course – II	0	0	2	1	100	0	100

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8	19ME2001	Engineering Practices	0	0	4	2	50	50	100
Total Credits:			**12**	**2**	**16**	**22**	**400**	**400**	**800**

REGULATION-2016

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

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA3105	Discrete Mathematics and Graph Theory	3	1	0	4	25	75	100
2	16IT3201	Digital Principles and System Design	3	0	2	4	50	50	100
3	16IT3202	Data Structures	3	0	0	3	25	75	100
4	16IT3203	Database Management Systems	3	0	0	3	25	75	100
5	16IT3204	Operating System	3	0	0	3	25	75	100
PRACTICAL									
6	16IT3001	Data Structures Laboratory	0	0	4	2	50	50	100
7	16IT3002	Operating Systems Laboratory	0	0	4	2	50	50	100
8	16IT3003	Database Management Systems Laboratory	0	0	4	2	50	50	100
Total Credits:			**15**	**1**	**14**	**23**	**300**	**500**	**800**

SEMESTER IV

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA4108	Probability And Queuing Theory	3	1	0	4	25	75	100
2	16IT4201	Java Programming	3	0	0	3	25	75	100
3	16IT4202	Design and Analysis of Algorithm	3	0	0	3	25	75	100
4	16IT4203	Software Analysis and Design	3	0	0	3	25	75	100
5	16IT4204	Computer Architecture	3	0	0	3	25	75	100
6	16IT4205	Information Theory and Coding Techniques	3	0	0	3	25	75	100
PRACTICAL									
7	16IT4001	Java Programming Laboratory	0	0	4	2	50	50	100
8	16IT4002	Algorithms Lab	0	0	4	2	50	50	100
9	16IT4003	Case Tools Lab	0	0	4	2	50	50	100
Total Credits:			**18**	**1**	**12**	**25**	**300**	**600**	**900**

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For the students admitted during the academic year 2017-2018 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 Credits:	**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
9	16IT6801	Mini Project	0	0	6	3	50	50	100
		Total Credits:	**18**	**0**	**16**	**26**	**325**	**575**	**900**

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LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
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 2016-2017 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 Credits:			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

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
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

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3	16IT8303	Advanced Database Technology	3	0	0	3	25	75	100
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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Principal

PRINCIPAL
Hindusthan College of Engineering & Technology
COIMBATORE - 641 032

SYLLABUS

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.	19MA1101	CALCULUS (COMMON TO CSE & IT)	3	1	0	4

Course Objective

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

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
	SEQUENCE AND SERIES	
II	Definition and examples – Series – Test for Convergence – Comparison Test – D Alembert's Ratio Test – Alternative Series – Alembert's Leibnitz test.	12
	MULTIVARIATE CALCULUS (DIFFERENTIATION)	
III	Total derivatives - Jacobians – Maxima, Minima and Saddle points – Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
	DOUBLE INTEGRATION	
IV	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	
V	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
	TOTAL INSTRUCTIONAL HOURS	60

Course Outcome

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

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 - Bali N.P & Manish Goyal, —A Text book of Engineering Mathematicsl, 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
R3 - Grewal B.S, —Higher Engineering Mathematicsl, 42nd Edition, Khanna Publications, Delhi, 2012.

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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.

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
B.TECH.	19CY1151	CHEMISTRY FOR ENGINEERS (Common to all branches)	2	0	2	3

Course Objective

The student should be conversant with

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.	6
	Estimation of total, permanent and temporary hardness of water by EDTA.	3
II	**POLYMER & COMPOSITES** preparation, Polymerization – types 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.	6+9=15
	Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric titration (Mixture of strong acid and base). Conductometric precipitation titration using BaCl2 and Na2SO4.	

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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 H2 -O2 fuel cell applications.	6
V	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy– principles – 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.	6
	Determination of iron content of the water sample using spectrophotometer. (1,10 phenanthroline / thiocyanate method).	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 Chemistryl Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCE BOOKS:

R1 - B.Sivasankar —Enigneering Chemistryl Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara —A Text book of Engineering Chemistryl 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 a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.*	5 4
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.*	5 4
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.*	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	5

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	comprehension; *Illustrative programs: selection sort, insertion sort, merge sort, histogram.*	4

FILES, MODULES, PACKAGES

V	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

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 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.	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.	19HE2101	BUSINESS ENGLISH FOR ENGINEERS	2	1	0	3

(COMMON TO ALL BRANCHES)

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 – Hamilton Theorem (excluding proof) - Orthogonal matrices – 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 equations of 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.	19PH2151	MATERIAL SCIENCE (COMMON TO ALL BRANCHES)	2	0	2	3

The student should be able to

Course Objective

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 indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber (Qualitative). **Determination of band gap of a semiconductor** **Determination of acceptance angle and numerical aperture in an optical fiber**	6 3 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. **B – H curve by Magnetic hysteresis experiment**	6 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 crystal structures.	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. **Determination of velocity of sound and compressibility of liquid – Ultrasonic wave,** **Determination of Coefficient of viscosity of a liquid –Poiseuille's method**	6 3 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 —A Text 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 and tribal 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

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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

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.	19IT2151	PROGRAMMING IN C	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 – One dimensional 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, "Programming in C", Oxford University Press, Second Edition, 2016.ISBN 9780199456147

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 text book 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.	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.	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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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16MA3105	DISCRETE MATHEMATICS AND GRAPH THEORY (COMMON TO CSE & IT)	3	1	0	4

Course Objectives

1. Introduce logical theory and proportional calculus techniques that will create logical thinking.
2. Generalize counting problems using mathematical induction, inclusion and exclusion principles.
3. Study the Boolean algebra which is used in the Boolean logics and circuits.
4. Create the basic knowledge of graph theory which is applied in Computer networks.
5. Recognize the concepts of trees in computer engineering.

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

Course Outcome

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

TEXT BOOKS:

T1 - Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, Delhi, 2014.
T2- T.Veerarajan, "Discrete Mathematics with Graph Theory and Combinatorics", Tata. McGraw-Hill Education, 15th reprint, 2012.

REFERENCE BOOKS:

R1 - Jean Paul Trembley ,R Manohar, "Discrete Mathematical Structures with Application to Computer Science", McGraw Hill,Inc. New York, 30th reprint, 2008.
R2 - Kenneth H.Rosen, "Discrete Mathematics and its Applications", seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2013.
R3 - Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications,2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT3201	DIGITAL PRINCIPLES AND SYSTEM DESIGN (COMMON TO CSE & IT)	3	0	2	4

Course Objective

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

Unit	Description	Instructional Hours
I	**MINIMIZATION TECHNIQUES AND LOGIC GATES** 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-Tabulation method-Implementation of Boolean functions using logic gates.	9
II	**COMBINATIONAL CIRCUITS** Analysis and design of combinational circuits- Circuits for arithmetic operations: adder, subtractor, Serial adder/ Subtractor - Parallel adder/ Subtractor-Carry look ahead adder-BCD adder-Magnitude comparator-Encoders and Decoders-Multiplexers and Demultiplexers, Code converters-Memory and Programmable logic.	9
III	**SYNCHRONOUS SEQUENTIAL CIRCUITS** Flip flops - Design of synchronous sequential circuits: State diagram - State table – State minimization - State assignment. Shift registers-Counters.	9
IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS** Analysis and design of asynchronous sequential circuits-Reduction of state and flow tables–Race-free state assignment–Hazards.	9
V	**HARDWARE DESCRIPTION LANGUAGE** Introduction to Hardware Description Language (HDL)- HDL for combinational circuits- Half adder, Full adder, Multiplexer, De-multiplexer, HDL for Sequential Circuits-Flip flops, Synchronous and Asynchronous Counters, Registers.	9
	Total Instructional Hours	**45**

DIGITAL LABORATORY: LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates.
2. Design and implementation of Half/Full Adder & Half/Full Subtractor.
3. Design and implementation of Binary to Gray and Gray to Binary Conversion.
4. Design and implementation of Parity generator/checker.
5. Design and implementation of Multiplexers and Demultiplexers.
6. Design and implementation of Synchronous and Asynchronous Counters.
7. Coding Combinational/Sequential circuits using HDL.

Total Instructional Hours	**15**
Total(45+15)	**60**

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Course Outcome	Upon completion of this course, the students will be able to CO1: Simplify boolean functions using different methods. CO2: Design and implement combinational logic circuits. CO3: Design and implement various sequential logic circuits. CO4: Design using PLD. CO5: Write HDL code for digital circuits.

TEXT BOOKS:

T1 - Morris Mano M. and Michael D. Ciletti, "Digital Design", IV Edition, Pearson Education, 2008.
T2 - Charles H.Roth,Jr.,Lizy Kurian John, and Byeong Kil Lee,"Digital Systems Design using Verilog" First Edition,Cengage Learning,2014.

REFERENCE BOOKS:

R1-S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design",SecondEdition, Vikas Publishing House Pvt. Ltd, New Delhi, 2010.
R2-Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2013
R3-Donald D.Givone, "Digital Principles and Design", Tata Mc-Graw-Hill Publishing company limited, New Delhi, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT3202	DATA STRUCTURES (COMMON TO CSE & IT)	3	0	0	3

Course Objective

1. To study the design and applications of ADTs and Linked List
2. To understand the various non-linear data structures like binary tree, binary search tree, AVL, and Binary Heap Tree
3. To build an application using sorting and searching
4. To understand the graph ADT and its applications
5. To Understand various hashing techniques

Unit	Description	Instructional Hours
I	**Linear Structures** Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – applications of lists	9
II	**Stack and queues** Stack ADT – Queue ADT – circular queue implementation – Applications of stacks and queues.	7
III	**Non Linear Data Structures** Tree Tree ADT –Representation of trees–Binary Tree ADT – expression trees – applications of trees – BST ADT – tree traversals. AVL Trees –B-Tree – heaps – binary heaps – applications of binary heaps-Binomial heaps.	10
IV	**Non Linear Data Structures** Graphs Introduction to Graphs- Definitions – Breadth First Search -Depth First Search-Topological sort – Shortest-Path Algorithms – Dijkstra algorithm- MST- Prim's and Kruskal's algorithms – Floyd algorithm- Warshall's Algorithm - Biconnectivity – Euler circuits – applications of graphs.	10
V	**Sorting, Searching** Sorting algorithms: Insertion sort -Selection sort -Shell sort -Bubble sort -Quick sort -Merge sort - Radix sort –Searching: Linear search –Binary Search - Hashing – Separate chaining – open addressing – rehashing – extendible hashing	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Implement the linear data structures
CO2: Understand the implementation of Stack and Queue
CO3: Formulate the different non-linear data structures like binary trees
CO4:Design algorithms for various searching and sorting techniques
CO5: Work with various Graph algorithms

TEXT BOOKS:

T1 - Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Third Edition, Addison-Wesley,2007
T2 – A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, 2009.

REFERENCE BOOKS :

R1 – Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 7th Edition, Wiley. 2004.
R2 - Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", Galgotia Publications, 2007.
R3 - Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, "Data Structures using C and C++", 2nd ed, Prentice-Hall of India, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT3203	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Course Objective

1. Learn the basic file systems and database design.
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 - Views of data –Data models – Types of data models – Relational Algebra.	8
II	**RDBMS AND NORMALIZATION** Relational DBMS – ER model - Extended ER- Normalization – Functional Dependencies, Anomaly - 1NF to 5NF - Domain Key Normal Form	8
III	**SQL & QUERY OPTIMIZATION** SQL fundamentals -SQL Standards - Data types - DDL – DML – DCL – TCL - Integrity – Trigger- Cursors- Embedded SQL - Static Vs Dynamic SQL - Query Processing and Optimization	10
IV	**TRANSACTION PROCESSING AND CONCURRENCY CONTROL** Introduction - ACID Properties -Transaction Concepts - Transaction Recovery – System Recovery – Media Recovery — Locking Protocols – Two Phase Locking –SQL Facilities for Concurrency- Serializability - Concurrency – Need for Concurrency- Concurrency Control – Two Phase Commit Protocol - Dead lock.	9
V	**TRENDS IN DATABASE TECHNOLOGY** RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing – B and B+ tree Index Files – Database access Control – Types of Privileges - Introduction to Multidimensional and Parallel databases , Spatial and multimedia databases , Mobile databases, Object Oriented Databases and XMLDatabases.	10
	Total Instructional Hours	**45**

Course Outcome

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

TEXTBOOKS:

T1 - Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education,2016.
T2- Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.

REFERENCE BOOKS :

R1- C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
R2- Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT3204	OPERATING SYSTEMS (COMMON TO CSE & IT)	3	0	0	3

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 Files ystems.
5. Learn the Distributed operating systems

Unit	Description	Instructional hours
I	**OPERATING SYSTEMS OVERVIEW** Introduction –operating systems overview- Evolution of Operating System.- Computer System Organization-Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.	7
II	**PROCESS MANAGEMENT** Processes-Process Concept, Process Scheduling, Interprocess Communication; Threads-Overview, Multicore Programming, Multithreading Models. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks	11
III	**STORAGE MANAGEMENT** Main Memory-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory-Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory	9
IV	**FILE SYSTEM IMPLEMENTATION & MASS STORAGE STRUCTURE** Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management- I/O Systems	9
V	**TYPES OF OPERATING SYSTEMS** Single processor systems – Multiprocessor Systems – Clustered Systems – Real Time Systems – Open source operating system- Distributed Systems –Distributed operating systems –Distributed file systems –Distributed Synchronization. Case study: Linux Systems- Virtualization	9
	Total Instructional Hours	45

Course Outcome

Upon completion of this course, the students will be able to
CO1:Analyze various Scheduling algorithms.
CO2:Apply deadlock, prevention and avoidance algorithms.
CO3:Compare and contrast various memory management schemes.
CO4:Analyze and Implement a prototype file systems.
CO5:Study the distributed operating systems

TEXT BOOK:

T1:Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9thEdition, John Wiley and Sons Inc., 2012.
T2:TomAdelstein,BillLubanovic,"LinuxSystemAdministrationSolveReal-lifeLinuxProblems Quickly", O'ReillyMedia.

REFERENCES:

R1: Andrew S. Tanenbaum, "Modern Operating Systems", 4/E, Pearson Publications, 2014.
R2: Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
R3: D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, TataMcGraw-Hill Education,2007.
R4: Harvey M.Deitel-Operating systems,Third Edition,Pearson/Prentice Hall,2004.
R5:William Stallings, "Operating Systems –Internals and Design Principles", 8/E, Pearson Publications, 2014

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT3001	DATA STRUCTURES LABORATORY (COMMON TO CSE & IT)	0	0	4	2

Course Objective

The student should be made to:

1. To learn the methodical way of solving problem
2. To comprehend the different methods of organizing large amount of data
3. To efficiently implement the different data structures
4. To efficiently implement solutions for specific problems

Expt. No.	Description of the Experiments
1	Write a C++ program that uses functions to perform the following: a) Create a singly linked list of integers. b) Delete a given integer from the above linked list. c) Display the contents of the above list after deletion.
2	Write a C++ program that uses functions to perform the following: a) Create a doubly linked list of integers. b) Delete a given integer from the above doubly linked list. c) Display the contents of the above list after deletion.
3	Write a C++ program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.
4	Write C++ programs to implement a double ended queue ADT using i) array and ii) doubly linked list respectively.
5	Write a C++ program that uses functions to perform the following: a) Create a binary search tree of characters. b) Traverse the above Binary search tree recursively in Post order.
6	Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers. b) Traverse the above Binary search tree non recursively in order.
7	Write C++ programs for implementing the following sorting methods to arrange a list of integers in ascending order: a) Insertion sort b) Merge sort
8	Write C++ programs for implementing the following sorting methods to arrange a list of integers in ascending order: a) Quicksort b) Selection sort
9	Write C++ programs to perform the following searching i) Linear search ii) Binary Search
10	Write a C program for implementing Heap sort algorithm for sorting a given list of integers in ascending order.
11	Write a C++ program to implement all the functions of a dictionary (ADT) using hashing.
12	Write C++ programs for implementing the following graph traversal algorithms: a)Depth first traversal b)Breadth first traversal
	Total Practical Hours **45**

Course Outcome

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

CO1: Abstract data and entities from the problem domain, build object models and design software solutions using object-oriented principles and strategies.

CO2: Break a problem into logical pieces and develop algorithms for solving simple problems.

CO3: Discover, explore and apply tools and best practices in object-oriented programming.

CO4: Develop programs that appropriately utilize key object-oriented concepts.

CO5: Analyze various data structures such as list, stack, tree , graphs etc.,

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT3002	OPERATING SYSTEMS LABORATORY (COMMON TO CSE & IT)	0	0	4	2

Course Objective

1. Learn shell programming and the use of filters in the UNIX environment.
2. Be exposed to programming in C using system calls.
3. Learn to use the file system related system calls.
4. Be exposed to process creation and inter process communication.
5. Be familiar with implementation of CPU Scheduling Algorithms, page replacement algorithms and Deadlock avoidance

Expt. No.	Description of the Experiments
1	Basics of UNIX commands.
2	Shell Programming.
3	Implement the following CPU scheduling algorithms a. Round Robin b. SJF c. FCFS d. Priority
4	Implement all file allocation n strategies a. Sequential b. Indexed c. Linked
5	Implement Semaphores
6	Implement all File Organization Techniques a. Single level directory b.Twolevel c. Hierarchical d.DAG
7	Implement Bankers Algorithm for Dead Lock Avoidance
8	Implement an Algorithm for Dead Lock Detection
9	Implement all page replacement algorithms a. FIFO b.LRU c.LFU
10	Implement IPC using Shared memory.
11	Experiments on fork
12	Implement Paging Technique of memory management.
	Total Practical Hours 45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Implement deadlock avoidance, and Detection Algorithms
CO2: Compare the performance of various CPU Scheduling Algorithm
CO3: Critically analyze the performance of the various page replacement algorithms
CO4: Create processes and implement IPC
CO5: Implement paging and synchronization.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT3003	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	4	2

Course Objective

1. Learn to create and use a database with a query language
2. Have hands on experience on DDL, DML and DCL Commands
3. Familiarize advanced SQL queries.
4. Study PL/SQL
5. Be Exposed to different applications

Expt. No.

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Implementing SQL queries on Integrity constraints and Views
4. Implementing Join operation and Nested Queries
5. Study of PL/SQL block.
6. Apply the concepts of High level programming language extensions (Control structures and Exceptions).
7. Demonstrate Procedures and Function in PL/SQL block.
8. Creation of database Cursors.
9. Creation of database Triggers.
10. Creation of database Forms& Reports
11. Working with XML
12. Database Design and implementation (Mini Project)
    a) Inventory Control System.
    b) Material Requirement Processing.
    c) Hospital Management System.
    d) Railway Reservation System.
    e) Personal Information System.
    f) Web Based User Identification System.
    g) Timetable Management System.
    h) Hotel Management System

Total Practical Hours **45**

Course Outcome

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

CO1: The student should be able to Design and implement a database schema for a given problem-domain

CO2: The student should be able to Populate and query a database

CO3: The student should be able to Create and maintain tables using PL/SQL.

CO4: The student should be able to Prepare reports.

CO5: The student should be able to create different applications using sql commands

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16MA4108	PROBABILITY AND QUEUEING THEORY (COMMON TO CSE & IT)	3	1	0	4

Course Objectives

1. Construct a well-defined knowledge of probability and random variables.
2. Understand the concept of standard distributions which can describe the real life phenomenon.
3. Know the concept of two dimensional random variables and determine covariance.
4. Understand the concept of random processes and Marko chain.
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** Definition – Axioms of Probability – Conditional Probability – Total Probability – Bayes Theorem (with out proof) -Random variable –Discrete and continuous random variables – Moment generating functions.	12
II	**STANDARD DISTRIBUTIONS** Discrete Distributions - Binomial, Poisson, Geometric distributions - Continuous Distributions - Uniform, Exponential and Normal distributions.	12
III	**TWO DIMENSIONAL RANDOM VARIABLES** Joint distributions – discrete and continuous random variables – marginal and conditional probability distributions – covariance – correlation.	12
IV	**RANDOM PROCESSES** Classification - Stationary process - Markov process - Markov chains - Transition probabilities - Limiting distributions - Poisson process – Birth and death process.	12
V	**QUEUEING THEORY** Markovian models – Birth and death queueing models – Steady state results – Single and Multiple server queueing models – (M/M/1):(∞/FCFS), (M/M/1):(N/FCFS), (M/M/C):(∞/FCFS) and (M/M/C):(N/FCFS) – Little's formula. (Derivations excluded).	12
	Total Instructional Hours	**60**

Course Outcomes

CO1: Understand the concepts of probability and random variables.
CO2: Describe various discrete and continuous distribution functions.
CO3: Understand and characterize phenomenon of two dimensional random variables.
CO4: Obtain a fundamental knowledge of the random processes which evolves with respect to time in a probabilistic manner.
CO5: Identify the queuing models in the given system, find the performance measures and analyse the result.

TEXT BOOKS:

T1 - Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 2011.
T2 - Veerarajan, T., Probability, Statistics and Random Processes, Tata McGraw-Hill, 2nd Edition, New Delhi, 2010.

REFERENCE BOOKS:

R1- O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, First Indian Reprint, 2010.
R2 - A.O. Allen, "Probability, Statistics and Queueing Theory with Computer Applications", Elsevier, Second Edition, 2012.
R3 - K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, Second Edition, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4201	JAVA PROGRAMMING (COMMON TO CSE & IT)	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 input and output streams in java
4. Understand the event handling classes in java
5. Learn frames and windows in java and its applications

Unit	Description	Instructional Hours
I	**OVERVIEW OF JAVA PROGRAMMING** Review of Object oriented programming-Introduction to java programming-Features of Java Language, JVM -The Java Environment-Primitive Data types-variables-arrays-control statements-classes and objects-access specifier-methods-constructor-finalize method-strings-Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes.	9
II	**PACKAGES AND INTERFACES** Packages-defining package-access protection-importing packages- interfaces-Defining an interface-implementing an interface-applying interface-variables in interface-extended interface-Exception Handling-exception types-uncaught exception-multiple catch-nested try-throw and finally-built-in exceptions-multithreaded programming-java thread model-thread priorities-synchronization-thread class and runnable interface-creating multiple threads- inter thread communication-string-input and output	9
III	**INPUT AND OUTPUT STREAMS** I/O basics-reading console input-writing console output-reading and writing files-applet fundamentals-Applet Basics-An Applet Skeleton-Simple Applet Display Methods-The HTML APPLET Tag-Passing Parameters to Applets-using instanceof-native method.	9
IV	**EVENT HANDLING** The Delegation Event Model-Event Classes-The ActionEvent Class-The AdjustmentEvent Class-The ComponentEvent Class-The ContainerEvent Class-Event Listener Interfaces-The ActionListener Interface-The AdjustmentListener Interface-The ComponentListener Interface-The Container Listener Interface-Using the Delegation Event Model-adapter class-inner classes.	9
V	**FRAMES AND WINDOWS** Window Fundamentals-Working with Frame Windows-Creating a Frame Window in an Applet-Displaying Information Within a Window-Working with Graphics-Drawing Lines-Drawing Rectangles-Drawing Ellipses and Circles-Working with Color-Working with Fonts.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: To Understand the Basics of java Programming
CO2: Design program using user defined packages and interfaces
CO3: Develop applications using applet class in java
CO4: Apply event handling classes to create different events in java
CO5: Design real time applications using frames and windows

TEXT BOOKS:

T1 - Herbert Schildt, "The complete reference java 2",seventh edition, McGraw – Hill 2007.

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", Fifth edition, Prentice Hall of India private limited,2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4202	DESIGN AND ANALYSIS OF ALGORITHM	3	0	0	3

Course Objective

1. To learn general techniques for analyzing algorithms.
2. To understand the divide and conquer techniques.
3. To gain knowledge about greedy and dynamic programming
4. To learn Branch and Bound technique.
5. To study about NP complete problems.

Unit	Description	Instructional Hours
I	**ALGORITHM ANALYSIS** Importance - role of algorithms in computing - Algorithm efficiency - Mathematical analysis for Recursive and Non-recursive algorithms - Empirical analysis of algorithm	9
II	**DIVIDE AND CONQUER & BRUTE FORCE** Divide And Conquer Technique: Merge sort - Quick sort- Finding maximum and minimum Brute Force Approach: Selection Sort - Bubble Sort	9
III	**GREEDY & DYNAMIC PROGRAMMING** Greedy approach: Prims Algorithms - Kruskal's Algorithm - Dijkstra's Algorithm - Huffman Trees and Codes - Dynamic programming: Knapsack Problem and Memory functions - Optimal Binary Search Trees - Warshall's and Floyd's Algorithms.	9
IV	**BACKTRACKING & BRANCH-AND-BOUND** Backtracking: N - Queens Problem - Hamiltonian Circuit Problem - Subset Sum Problem Branch and bound: Assignment Problem - Knapsack Problem – Travelling Salesman Problem.	9
V	**NP PROBLEMS & ADVANCED ALGORITHMS** NP-completeness – Polynomial time verification – Theory of reducibility – Circuit satisfiability - NP-complete problems: Vertex cover - Hamiltonian cycle and traveling salesman problems – Introduction to approximation algorithms - Randomization algorithms and parallel algorithms - Parallel sorting.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Analyze the implications of iterative and recursive algorithms

CO2: Recognize general principles and good algorithm design techniques for developing efficient algorithms

CO3: Design and implement problem solving techniques such as Divide and conquer greedy method, dynamic programming, Backtracking, Branch and Bound

CO4: Apply mathematical preliminaries to the analysis and design stages of different types of algorithms

CO5: Analyze the efficiency of NP-complete problems

TEXT BOOKS:

T1 - Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2012.

T2 - Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009.

REFERENCE BOOKS :

R1-AnanyLevitin,"IntroductiontotheDesignand AnalysisofAlgorithms",PearsonPublications, 3rd Edition, 2012.

R2-Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall ofIndia Publications, 3rd Edition, 2009.

R3-Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms," 2nd Edition, Galgotia Publications, 2008

R4- Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis",Pearson Publications, 3rd Edition, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4203	SOFTWARE ANALYSIS AND DESIGN	3	0	0	3

Course Objective

1. Aware of a member of generic models to structure the software development process.
2. Understand fundamental concepts of requirements engineering and specification.
3. Capture, document and analyze requirements.
4. Study the concepts of modeling in object oriented contexts.
5. Understand Object Constraint Language.

Unit	Description	Instructional Hours
I	**SOFTWARE PROCESS MODELS** Software- Legacy Software-A layered technology-Categories of Software-A process frame work-CMMI-Product and Process-Process Models-The Waterfall Model-Incremental Process Models-Incremental Model-The RAD Model-Evolutionary Process Models-Prototyping-The Spiral Model-The Concurrent Development Model-Specialized Process Models.	9
II	**REQUIREMENT ENGINEERING** Requirement Engineering-Requirements Engineering Tasks-Initiating the Requirements Engineering Process- Eliciting Requirements-Developing Use cases-Building the Analysis Models-Elements of the Analysis Model- Analysis Pattern-Negotiating Requirements-Validating Requirements.	9
III	**ANALYSIS MODELING** Requirement Analysis-Analysis modeling approaches-Data modeling concepts-Object Oriented Analysis-Scenario based modeling-Flow oriented Modeling-Class based modeling-Creating a behavior model.	10
IV	**OBJECT-ORIENTED ANALYSIS BASICS** Introduction-Overview of object oriented system development-Object basics-The Unified Process-Modeling concepts- Modeling as a design technique-Analysis and Modeling-UML diagrams-Use case Modeling-Class Modeling-State Modeling-Interaction Modeling.	10
V	**REQUIREMENTS & MORE MODELING** Object Constraint Language- Inception- Evolutionary Requirements- Domain Models-System Sequence Diagrams-Operation Contracts.	7
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the qualifications of systems analysts and project managers to design better information systems.

CO2: Discuss the aims and objectives of information systems in the context of a human activity system for better systems development.

CO3: Understand analysis and design techniques and methods to meet the special needs of current information systems.

CO4: Analyze and design with Object-oriented method in UML.

CO5: Describe constraints and introduce OCL.

TEXT BOOKS:

T1-Roger S.Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill International edition, Seventh edition, 2009.

T2-Michael Blaha and James Rumbaugh, "Object-oriented modeling and design with UML", Prentice- Hall of IndiaIndia, 2005.

India,2005.

REFERENCE BOOKS :

R1- Stephan Schach, Software Engineering, Tata McGraw Hill, 2007.

R2-O'Docherty , Mike. Object-Oriented Analysis & Design.Wiley.2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4204	COMPUTER ARCHITECTURE	3	0	0	3

Course Objective

1. To make students understand the basic structure and operation of digital computer.
2. To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
3. To expose the students about the concept of pipelining.
4. To familiarize the students with hierarchical memory system including cache memories and virtual memory.
5. To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

Unit	Description	Instructional Hours
I	**OVERVIEW & INSTRUCTIONS** Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes- Basic I/O operations – Stacks and queues- Memory-Reference Instructions	9
II	**ARITHMETIC OPERATIONS** ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Sub word parallelism., Design of Accumulator Logic	7
III	**PROCESSOR AND CONTROL UNIT** Basic MIPS implementation – Building data path – Control Implementation scheme – Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards – Influence on Instruction sets – Data path and control consideration – Superscalar operation-Exceptions.	11
IV	**PARALLELISM** Introduction to Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Introduction to Multicore processors.	9
V	**MEMORY AND I/O SYSTEMS** Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory- Memory Management requirements – Secondary storage, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Apply the basic instructions and addressing modes.
CO2: Design arithmetic and logic unit.
CO3: Design and analyze pipelined control units
CO4: Compare the parallel processing architectures.
CO5: Evaluate performance of memory systems.

TEXT BOOKS:

T1 - David A. Patterson and John L. Hennessey, "Computer organization and design', Morgan Kauffman / Elsevier, Fifth edition, 2014.
T2- V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VI th edition, Mc Graw-Hill Inc, 2012.

REFERENCE BOOKS :

R1 - William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education, 2006.
R2- Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
R3-Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
R4- John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4205	INFORMATION THEORY AND CODING TECHNIQUES	3	0	0	3

Course Objective

1. To understand the information theory fundamental
2. To characterize the different compression techniques used for sending the text and images
3. To analyze the coding methods for audio and video coding
4. To get a clear view of different error detection methods
5. To get a clear view of different error control methods

Unit	Description	Instructional Hours
I	**INFORMATION THEORY** Uncertainty, Information and Entropy – Source coding Theorem – Data Compaction – Shannon Fano coding, Huffman coding – Discrete Memory less channels-Mutual Information – channel capacity – channel coding Theorem – Channel capacity Theorem.	9
II	**SOURCE CODING: TEXT, AUDIO AND SPEECH** Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 – Speech: Channel Vocoder, Linear Predictive Coding	9
III	**SOURCE CODING: IMAGE AND VIDEO** Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles–I, B, P frames, Motion estimation, Motion compensation, H.261, MPEG standard.	9
IV	**ERROR CONTROL CODING: BLOCK CODES** Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding – Single parity codes, Hamming codes, Repetition codes – Linear block codes, Cyclic codes – Syndrome calculation, Encoder and decoder – CRC	9
V	**ERROR CONTROL CODING: CONVOLUTIONAL CODES** Convolutional codes – code tree – trellis - state diagram - Encoding – Decoding - Maximum likelihood decoding, Sequential decoding and Viterbi algorithm – Principle of Turbo coding	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students will be able to
CO1: Apply the principles of Information theory
CO2: Implement the source coding methods for text and Audio and Speech CO3: Analyze the source coding methods for Image and Video
CO4: Detect and correct the errors using linear block codes
CO5: Detect and correct the errors using cyclic codes and Convolutional codes.

TEXT BOOKS:

T1 - R Bose, "Information Theory, Coding and Cryptography", 2nd Edition, TMH, 2008-
T2 - Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards",Pearson Education Asia, 2002.

REFERENCE BOOKS:

R1 - K Sayood, "Introduction to Data Compression", 3rd Edition, Elsevier, 2006.
R2 - S Gravano, "Introduction to Error Control Codes", Oxford University Press, 2007.
R3 - Amitabha Bhattacharya, "Digital Communication", TMH, 2006.
R4 - Simon Haykin, "Communication Systems", 4th Edition, Wiley India,
R5 -Watkinson J, "Compression in Video and Audio", Focal Press, London, 2001

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4001	JAVA PROGRAMMING LABORATORY (COMMON TO CSE & IT)	0	0	4	2

Course Objective

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

Expt. No.	Description of the Experiments
1.	Develop Rational number class in Java. Use JavaDoc comments for documentation. Your implementation should use efficient representation for a rational number, i.e. (500 / 1000) should be represented as (½).
2.	Develop Date class in Java similar to the one available in java.util package. Use JavaDoc comments.
3.	Implement Lisp-like list in Java. Write basic operations such as 'car', 'cdr', and 'cons'. If L is a list [3, 0, 2, 5], L.car() returns 3, while L.cdr() returns [0,2,5].
4.	Design a Java interface for ADT Stack. Develop two different classes that implement this interface, one using array and the other using linked-list. Provide necessary exception handling in both theimplementations.
5.	Design a Vehicle class hierarchy in Java. Write a test program to demonstrate polymorphism
6.	Design classes for Currency, Rupee, and Dollar. Write a program that randomly generates Rupee and Dollar objects and write them into a file using object serialization. Write another program to read that file, convert to Rupee if it reads a Dollar, and while leave the value as it is if it reads a Rupee.
7.	Design a scientific calculator using event-driven programming paradigm of Java.
8.	Write a multi-threaded Java program to print all numbers below 100,000 that are both prime and fibonacci number (some examples are 2, 3, 5, 13, etc.). Design a thread that generates prime numbers below 100,000 and writes them into a pipe. Design another thread that generates fibonacci numbers and writes them to another pipe. The main thread should read both the pipes to identify numbers common to both.
9.	Develop a simple OPAC system for library using even-driven and concurrent programming paradigms of Java. Use JDBC to connect to a back-end database
10.	Develop multi-threaded echo server and a corresponding GUI client in Java
11.	[Mini-Project] Develop a programmer's editor in Java that supports syntax highlighting, compilation support, debugging support, etc.
12.	Write a java program that prints the meta-data of a given table.

Total Practical Hours 45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Apply good programming design methods for program development.
CO2: Apply the different event driven programming for implementing solutions to practical problems.
CO3: Design and implement polymorphism, exception handling and multi-threading in java.
CO4: Ability to access data from a DB with Java programs.
CO5: Able to create client server communications for data sharing using java.

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE Java, Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server
HARDWARE Standalone desktops 30Nos

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4002	ALGORITHMS LAB	0	0	4	2

Course Objective

1. To understand variety of advanced abstract data type (ADT) and data structures and their implementations
2. To build a solid foundation in algorithms and their applications
3. Employ various design strategies for problem-solving.
4. Measure and compare the performance of different algorithms. .
5. Learn how to analyze and design solution to the problem.

Expt. No.	Description of the Experiments
1.	Write Program to perform Binary Search using Divide & Conquer.
2.	Use divide and conquer method to recursively implement and to find the maximum and minimum in a given list of n elements.
3.	Sort a given set of elements using the Merge sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
4.	Write a Program to implement Quick sort using divide and Conquer technique.
5.	Write program to find Topological ordering of nodes in a DAG.
6.	Write program to sort an array using Insertion Sort, Selection sort.
7.	a. Write program to find all nodes reachable from a given node using DFS b. Write Program to find all nodes reachable from a given node using BFS
8.	Write program to solve 0/1 Knapsack problem using dynamic programming.
9.	a. Write program to find transitive closure of a given directed graph using Warshall's algorithm. b. Write program to Implement All Pair Shortest paths problem using Floyd's algorithm.
10.	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
11.	Find Minimum Cost Spanning Tree of a given undirected graph using Prims algorithm.
12.	Implement N Queen's problem using Back Tracking.

Total Practical 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: To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.
CO3: To Identify and analyze criteria and specifications appropriate to new problems.
CO4: To develop the efficient algorithms for the new problem with suitable designing techniques.
CO5: To design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT4003	CASE TOOLS LAB	0	0	4	2

Course Objective

1. To Learn the basics of OO analysis and design skills.
2. To learn how to identify objects, relationships, services and attributes through UML.
3. To build a conceptual model during analysis and design.
4. To evaluate existing CASE Tools
5. Learn to map design to code

Expt. No.	Description Of The Experiments
1.	To develop a problem statement and Statement of Work.
2.	Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart).
3.	Identify Use Cases and develop the Use Case model.
4.	Identify the business activities and develop an UML Activity diagram.
5.	Identity the conceptual classes and develop a domain model with UML Class diagram.
6.	Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
7.	Draw the State Chart diagram
8.	Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation and patterns
9.	Draw Component and Deployment diagrams.
10.	Practice forward engineering and reverse engineering

Suggested List of Applications

1. Student Marks Analyzing System
2. Online Quiz System
3 Online Railway Ticket Reservation Systems
4. Payroll System
5. Course Registration System
6. Expert System for Medical Diagnosis System
7. ATM Systems
8. Stock Maintenance
9. Library Management System
10. Passport Automation System Design
11. 11.Foreign Trading system.
12. BPO Management System.

Total Practical Hours 45

Course Outcome

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

CO1: Develop a knowledge on the basics of object-oriented software development and its life cycle models.

CO2: Analyze and design software requirements in efficient manner

CO3: Construct various UML models (including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams, and implementation diagrams) using the appropriate notation using the Rational Software Suite.

CO4: Recognize the role and function of each UML model in developing object-oriented software.

CO5: Work with object oriented CASE tools

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT5201	COMPUTERNETWORKS (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	CourseCode	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	
I	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 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
	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.	9
	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.	9
	Total Instructional Hours	**44**

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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 event listeners.	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
	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	MICROCONTROLLER 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: Dataprocessing, 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 Processorarchitecture.
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**

Course Outcome

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" ,3 Rd 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 "Systems Programming", 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 preprocessing: 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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PROFESSIONAL ELECTIVES

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
	MULTIMEDIA BASICS	
I	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
	MULTIMEDIA COMPRESSION	
II	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
	PROTOCOLS	
IV	Traditional protocols: Problems with traditional protocols-protocols for multimedia- multicast protocols throughput of reliable protocols - Protocol implementation- scaling and efficiency issues.	9
	MULTIMEDIA AUTHORING AND APPLICATIONS	
V	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 applicationsbased 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	CourseCode	Name of the Course	L	T	P	C
B.TECH.	16IT7002	DISTRIBUTED AND CLOUD COMPUTING LABORATORY	0	0	4	2

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 CloudSim 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
	MULTIMEDIA SYSTEM DESIGN: AN INTRODUCTION	
I	Multimedia Elements, Multimedia Applications, Multimedia System Architecture, Evolving Technologies for Multimedia Systems, Multimedia Databases.	9
	COMPRESSION AND DECOMPRESSION TECHNIQUES	
II	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
	MULTIMEDIA INPUT AND OUTPUT TECHNOLOGIES	
III	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
	STORAGE AND RETRIEVAL TECHNOLOGIES	
IV	Magnetic Media Technology, RAID Level-0 To 5, Optical Media, WORM optical drives, Hierarchical Storage Management, Cache Management for storage systems.	9
	MULTIMEDIA APPLICATIONDESIGN	
V	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
	Security of Device, Network, and Server Levels	
II	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
	Application Level Security in Cellular Networks	
III	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
	Application Level Security in MANETs	
IV	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
	Security challenge	
V	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 - Sandeep Chatterjee 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 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, 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 realworld 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 SocialMedia 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-jn-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 documentsand 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) 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	16IT8310	PERVASIVE COMPUTING	3	0	0	3

Course Objective

The course should enable the students to:

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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OPEN ELECTIVE

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
6. 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.

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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

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	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

Chairman - BoS
IT - HiCET

Dean (Academics)
HiCET

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

SEMESTER – III – R2016

Course Code & Name: 16MA3105 Discrete Mathematics and Graph Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	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: 16IT3201 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	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: 16IT3202 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	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: 16IT3203 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	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: 16IT3204 Operating System

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: 16IT3001 Data Structures Laboratory

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

Course Code & Name: 16IT3002 Operating Systems Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 16IT3003 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	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**

Semester – IV

Course Code & Name: 16MA4108 Probability 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	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	2	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2	2	-	-	-	-	-	-	2	2	2

Course Code & Name: 16IT4201 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: 16IT4202 Design and Analysis of Algorithm

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	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: 16IT4203 Software Analysis and Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	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: 16IT4204 Computer Architecture

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: 16IT4205 Information Theory and Coding Techniques

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: 16IT4001 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	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: 16IT4002 Algorithms Lab

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: 16IT4003 Case Tools Lab

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

Semester – V

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**

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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:

Year	Sem	Course code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
II	III	**16MA3105**	Discrete Mathematics and Graph Theory	3	3	2	2	2	2	0	1	0	1	1	2	0	1
		16IT3201	Digital Principles And System Design	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		16IT3202	Data Structures	3	2	0	0	1	0	0	0	0	0	1	2	1	0
		16IT3203	Database Management Systems	2	2	1	0	0	0	0	0	0	0	1	2	1	2
		16IT3204	Operating System	3	3	2	2	2	2	0	1	0	1	1	2	0	1
		16IT3001	Data Structures Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		16IT3002	Operating Systems Laboratory	3	2	0	0	1	0	0	0	0	0	1	2	1	0
		16IT3003	Database Management Systems Laboratory	2	2	1	0	0	0	0	0	0	0	1	2	1	2
	IV	**16MA4108**	Probability And Queuing Theory	3	3	3	2	2	-	-	-	-	-	-	2	2	2
		16IT4201	Java Programming	3	2	2	0	2	0	0	0	0	0	1	2	1	1
		16IT4202	Design and Analysis of Algorithm	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		16IT4203	Software Analysis and Design	3	2	2	2	2	2	0	1	1	0	2	2	1	0

		16IT4204	Computer Architecture	3	2	2	0	2	0	0	1	0	1	1	2	1	0
		16IT4205	Information Theory and Coding Techniques	3	1	2	0	2	0	0	0	0	0	1	2	1	1
		16IT4001	Java Programming Laboratory	3	1	1	1	1	0	0	0	1	0	1	1	1	0
		16IT4002	Algorithms Lab	3	2	2	2	2	2	0	1	1	0	2	2	1	0
		16IT4003	Case Tools Lab	3	0	2	0	0	2	0	1	1	0	2	0	1	0
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