Curriculum and Syllabus [Regulation-23]
Incorporating Guidelines of NEP2020

B.Tech. in Information Technology

(Effective From 2023-2024 Admission Batch)

JIS College of Engineering

(NAAC 'A' Accredited an Autonomous Institute)

(Affiliated to Maulana Abul Kalam Azad University of Technology)

1st Year 1st Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT101	Programming for Problem Solving	3	0	0	3	3
2	ENGG	Minor	EE(IT)101	Basic Electrical and Electronics Engineering	3	0	0	3	3
3	SCI	Multidisciplinary	M(IT)101	Engineering Mathematics - I	3	0	0	3	3
4	SCI	Multidisciplinary	PH(IT)101	Engineering Physics - I	3	0	0	3	3
5	HUM	Value Added Course	HU104	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU105	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT191	Programming for Problem Solving Lab	0	0	3	3	1.5
2	ENGG	Minor	EE(IT)191	Basic Electrical and Electronics Engineering Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	PH(IT)191	Engineering Physics - I Lab	0	0	3	3	1.5
4	HUM	Ability Enhancement Course	HU(IT)191	Technical Seminar Presentation	0	0	2	2	1
5	ENGG	Skill Enhancement Course	ME(IT)191	Engineering Graphics and Design Lab	0	0	3	3	1.5
Total of Theory, Practical								29	22

HUM: Humanities; ENGG: Engineering; SCI: Science

1st Year 2nd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT201	Data Structure and Algorithm	3	0	0	3	3
2	SCI	Multidisciplinary	CH(IT)201	Engineering Chemistry	2	0	0	2	2
3	SCI	Multidisciplinary	M(IT)201	Engineering Mathematics - II	3	0	0	3	3
4	HUM	Ability Enhancement Course	HU201	Professional Communication	2	0	0	2	2
5	HUM	Value Added Course	HU202	Values and Ethics	2	0	0	2	2
6	HUM	Value Added Course	HU203	Constitution of India	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT291	Data Structure and Algorithm Lab	0	0	3	3	1.5
2	SCI	Skill Enhancement Course	CH(IT)291	Engineering Chemistry Lab	0	0	2	2	1
3	HUM	Ability Enhancement Course	HU291	Professional Communication Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME(IT)291	Workshop and Manufacturing Practices Lab	0	0	3	3	1.5
Total of Theory, Practical								23	18

2nd Year 3rd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Minor	IT302	Analog and Digital Electronics	3	0	0	3	3
3	ENGG	Major	IT303	Formal Language and Automata Theory	3	0	0	3	3
4	SCI	Minor	M(IT)301	Numerical Methods and Statistics	2	0	0	2	2
5	SCI	Minor	PH(IT)301	Engineering Physics - II	2	0	0	2	2
		B.PRACTICAL							
1	ENGG	Major	IT391	Computer Organization and Architecture Lab	0	0	3	3	1.5
2	ENGG	Minor	IT392	Analog and Digital Electronics Lab	0	0	3	3	1.5
3	ENGG	Minor	IT393	Python Programming Lab	0	0	3	3	1.5
4	HUM	Ability Enhancement Course	HU(IT)391	Soft Skill and Aptitude	0	0	2	2	1
5	SCI	Skill Enhancement Course	PH(IT)391	Engineering Physics - II Lab	0	0	3	3	1.5
Total of Theory, Practical								27	20

2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT401	Object Oriented Programming Using Java	3	0	0	3	3
2	ENGG	Major	IT402	Software Engineering	3	0	0	3	3
3	ENGG	Major	IT403	Operating System	3	0	0	3	3
4	SCI	Minor	M(IT)401	Discrete Mathematics	3	0	0	3	3
5	HUM	Minor	HU401	Economics for Engineers	2	0	0	2	2
B.PRACTICAL									
1	ENGG	Major	IT491	Object Oriented Programming Lab	0	0	3	3	1.5
2	ENGG	Major	IT492	Software Engineering Lab	0	0	2	2	1
3	ENGG	Major	IT493	Operating System Lab	0	0	3	3	1.5
4	ENGG	Minor	IT494	R-Programming Lab	0	0	2	2	1
5	HUM	Ability Enhancement Course	HU(IT)491	Seminar and Group Discussion	0	0	2	2	1
6	ENGG	Skill enhancement course	HU(IT)495	IT Workshop Lab (SciLab / MATLAB/ C++)	0	0	2	2	1
Total of Theory, Practical								28	21

3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT501	Database Management System	3	0	0	3	3
2	ENGG	Major	IT502	Computer Networking	3	0	0	3	3
3	ENGG	Major	IT503	Design and Analysis of Algorithm	3	0	0	3	3
4	ENGG	Major	IT504	Artificial Intelligence	3	0	0	3	3
5	ENGG	Minor	IT505	A. e-Commerce and ERP B. Mobile Application Development C. Microprocessor and Microcontroller	2	0	0	2	2
B.PRACTICAL									
1	ENGG	Major	IT591	Database Management System Lab	0	0	3	3	1.5
2	ENGG	Major	IT592	Computer Networking Lab	0	0	3	3	1.5
3	ENGG	Major	IT593	Design and Analysis of Algorithm Lab	0	0	2	2	1
4	ENGG	Major	IT594	Artificial Intelligence Lab	0	0	3	3	1.5
5	ENGG	Minor	IT595	A. E-Commerce and ERP Lab B. Mobile Application Development Lab C. Microprocessor and Microcontroller Lab	0	0	2	2	1
6	PRJ	Project	IT581	Minor Project-I	0	0	0	2	1
Total of Theory, Practical								29	21.5

3rd Year 6th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT601	Web Technology	2	0	0	2	2
2	ENGG	Major	IT602	Machine Learning	3	0	0	3	3
3	ENGG	Major	IT603	A. Computer Graphics and Multimedia B. Digital Image Processing C. Internet of Things	3	0	0	3	3
4	ENGG	Major	IT604	A. Data Mining and Knowledge Discovery B. Cryptography and Network Security C. Compiler Design	3	0	0	3	3
5	ENGG	Minor	IT605	A. Mobile Computing B. Virtual and Augmented Reality C. Social Network Analysis	2	0	0	2	2
B.PRACTICAL									
1	ENGG	Major	IT691	Web Technology Lab	0	0	3	3	1.5
2	ENGG	Major	IT692	Machine Learning Lab	0	0	3	3	1.5
3	ENGG	Major	IT693	A. Computer Graphics and Multimedia Lab B. Digital Image Processing Lab C. Internet of Things Lab	0	0	3	3	1.5
4		Internship	IT681	Internship	0	0	0	0	1
5	PRJ	Project	IT682	Minor Project - II	0	0	0	2	1
Total of Theory, Practical								24	19.5

4th Year 7th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT701	A. Cloud Computing B. Internet Technology C. Big Data Analytics D. Pattern Recognition	3	0	0	3	3
2	ENGG	Major	IT702	A. Soft Computing B. Cyber Security C. Wireless Ad hoc Network D. NoSQL Database with MongoDB	3	0	0	3	3
3	ENGG	Major	IT703	A. Advanced Database Management System B. Block Chain Technology C. Advanced Computer Architecture D. Quantum Computing	3	0	0	3	3
4	ENGG	Minor	IT704	A. Digital Forensics B. Modelling and Simulation C. Deep Learning & Neural Networks D. Real Time Systems	3	0	0	3	3
B.PRACTICAL									
1	ENGG	Major	IT791	A. Cloud Computing Lab B. Internet Technology Lab C. Big Data Analytics Lab D. Pattern Recognition Lab	0	0	3	3	1.5
2	ENGG	Major	IT792	A. Soft Computing Lab B. Cyber Security Lab C. Wireless Ad hoc Network Lab D. NoSQL Database with MongoDB Lab	0	0	3	3	1.5
3		Internship	IT781	Industrial Training / Internship	0	0	0	0	2
4	PRJ	Project	IT782	Major Project-I	0	0	0	8	4
Total of Theory, Practical								26	21

4th Year 8th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT801	A. Data Sciences B. Business Analytics C. Cluster and Grid Computing D. Distributed Database	3	0	0	3	3
2	ENGG	Major	IT802	A. Human Computer Interaction B. Natural Language Processing C. Distributed Computing D. Information and Coding Theory	3	0	0	3	3
3	ENGG	Minor	IT803	A. Bio-Informatics B. Embedded System C. Human Resource Management D. Computer Vision	3	0	0	3	3
4	HUM	Ability Enhancement Course	HU(IT)801	Principles of Management	2	0	0	2	2
B.PRACTICAL									
1			IT881	Grand Viva	0	0	0	0	2
2	PRJ	Project	IT882	Major Project-II	0	0	0	12	6
Total of Theory, Practical								23	19

Total Credit = 162

Detailed Syllabus
of
1st Semester

		1st Year 1st Semester							
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT101	Programming for Problem Solving	3	0	0	3	3
2	ENGG	Minor	EE(IT)101	Basic Electrical and Electronics Engineering	3	0	0	3	3
3	SCI	Multidisciplinary	M(IT)101	Engineering Mathematics - I	3	0	0	3	3
4	SCI	Multidisciplinary	PH(IT)101	Engineering Physics - I	3	0	0	3	3
5	HUM	Value Added Course	HU104	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU105	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT191	Programming for Problem Solving Lab	0	0	3	3	1.5
2	ENGG	Minor	EE(IT)191	Basic Electrical and Electronics Engineering Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	PH(IT)191	Engineering Physics - I Lab	0	0	3	3	1.5
4	HUM	Ability Enhancement Course	HU(IT)191	Technical Seminar Presentation	0	0	2	2	1
5	ENGG	Skill Enhancement Course	ME(IT)191	Engineering Graphics and Design Lab	0	0	3	3	1.5
Total of Theory, Practical								29	22

PAPER NAME: PROGRAMMING FOR PROBLEM SOLVING
PAPER CODE: IT101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Number system, Boolean Algebra

Course Outcome:

After completion of the course students will be able to

CO1	Understand and differentiate among different programming languages for problem solving.
CO2	Describe the way of execution and debug programs in C language.
CO3	Define, select, and compare data types, loops, functions to solve mathematical and scientific problem.
CO4	Understand the dynamic behaviour of memory by the use of pointers.
CO5	Design and develop modular programs using control structure, selection structure and file.

CO–PO Mapping:

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

Course Content:

Module-1: Fundamentals of Computer: [9L]
History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system. Arithmetic– Addition and Subtraction (using1'scomplementand2'scomplement). Representation of Characters-ASCII Code Basics of Compiler, Interpreter and Assembler Problem solving – Basic concept of Algorithm. Representation of algorithm using flow chart and pseudo code. Some basic examples.

Module-2: Introduction to C Programming: [5L]

Overview of Procedural vs Structural language; History of C Programming Language. Variable and Data Types: The C characterize identifiers. And keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions: Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators-type conversion, C expressions, precedence and associativity. Input and Output: Standard input and output, formatted output–print f, formatted input scan f.

Module-3: Branch and Loop: [5L]

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder. Switch Case: break and continue; switch-case, concept of go to and labels. Loops - while, for, do while

Module-4: Program Structures [4L]

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function. Storage Class in C: Storage Class-auto, external, static and register storage class, scope rules and life time of variables C pre-processor:

Pre-processing directive and macro, parameterized macro.

Module-5: Array and Pointer [7L]

Arrays: One dimensional arrays, Two-dimensional arrays, Passing an array to a function Pointers: Pointers, Pointer and Array, Pointer and functions. Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String. Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module-6: Structures, Unions and Enum [3L]

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference between structure and union.

Module-7: File in C [3L]

Files handling- opening and closing a file in different mode, formatted and unformatted files, Command line arguments, f open, f close, f get c, f put c, f print f, f scan f function.

Textbook:

- **Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill**
- **KanetkarY.-LetusC,BPBPublication,15thEdition**

Reference Books:

- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
- **K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition**

PAPER NAME: BASICS ELECTRICAL AND ELECTRONICS ENGINEERING
PAPER CODE: EE(IT)101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Basic 12th standard Physics and Mathematics, Concept of components of electric circuit.

Course Outcome:

After completion of the course students will be able to

CO1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO2	To solve simple ac circuits in steady state
CO3	Impart the knowledge of Basic Electronics Devices and ICs.
CO4	Analyze the simple electronics circuits

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	2	2
CO2	3	3	2	1	-	-	-	-	-	-	2	2
CO3	3	2	2	1	-	-	-	-	-	-	1	2
CO4	2	3	2	1	-	-	-	-	-	-	2	1

Course Content:

MODULE 1: Elementary Concepts of Electric Circuits [6L]
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

MODULE 2: Electrical Machine [8L]
Transformer: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. DC Machines: Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

MODULE 3: Fundamentals of Semiconductor Devices [6L]
Introduction to Semiconductor: Concept of energy band diagram; Comparison among metal, insulator, semiconductor; Semiconductors-classifications and Fermi energy level; Charge neutrality and Mass-Action law in semiconductor; Current flow in semiconductor due to drift & diffusion process; Einstein relation.

MODULE 4: PN Junction Diode [4L]
Principle of operation; V-I characteristics; principle of avalanche & Zener breakdown; Junction resistances and capacitances; V-I characteristics of Zener diode.

MODULE 5: Bipolar Junction Transistors [4L]
PNP and NPN structures; Principle of operation; Current gains in CE, CB and CC mode; input and output characteristics; Biasing & Stability Analysis-Concept of Fixed Bias, Collector to base Bias & voltage divider bias.

MODULE 6: Introduction to IC [8L]
Integrated circuit-Basic idea, classifications, advantages, disadvantages; OPAMP(IC741)- Pin configuration and equivalent circuit; Characteristics of OPAMP(IC741); Inverting & Non-Inverting Amplifier; Adder, Subtractor, Differentiator & Integrator Circuit.

Textbooks:

- A Textbook of Electrical Technology - Volume I (Basic Electrical Engineering) & Volume II (Ac & DC Machines)-B. L Theraja & A.K. Teraja, S. Chad,23rd Edition, 1959

- D. Chattopadhyay, P.C Rakshit, "Electronics Fundamentals and Applications", New Age International (P) Limited Publishers, Senenth Edition,2006
- Basic Electrical & Electronics Engineering by J.B. Gupta , S.K. Kataria & Sons,2013
- Basic Electrical and Electronics Engineering-I by Abhijit Chakrabarti and Sudip Debnath, McGraw Hill, 2015
- M. S. Sukhija and T. K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press,2012.
- DP Kothari and IJ Nagrath, "Basic Electrical & Electronics Engineering", Tata McGraw Hill,2020.

Reference Books

- DC Kulshreshtha, "Basic Electrical Engineering",TataMcGrawHill,2010.
- T.K. Nagsarkar, M.S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
- Hughes, "Electrical and Electronic Technology", Pearson Education".
- Parker and Smith, "Problems in Electrical Engineering", CBS Publishers and Distributors.
- Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
- Bernard Grob, Basic Electronics, McGraw Hill.
- Chinmoy Saha, Arindham Halder and Debarati Ganguly, Basic Electronics- Principles and Applications, Cambridge University Press, 2018.

PAPER NAME: ENGINEERING MATHEMATICS- I
PAPER CODE: M(IT)101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Basic 12th standard Mathematics

Course Outcome:

After completion of the course students will be able to

CO1	Recall the properties related to matrix algebra and calculus.
CO2	Determine the solutions of the problems related to matrix algebra and calculus.
CO3	Apply the appropriate mathematical tools of matrix algebra and calculus for the solutions of the problems.
CO4	Analyze different engineering problems linked with matrix algebra and calculus.

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1

Course Content:

Module I: Liner Algebra [11L]
Echelon form and normal (canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrix, Cayley-Hamilton theorem.

Module II: Single Variable Calculus [5L]
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Power series; Taylor's series.

Module III: Multivariable Calculus (Differentiation) [13L]
Function of several variables; Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function; Jacobian; Maxima and minima of functions of two variables.

Module IV: Multivariable Calculus (Integration) [7L]
Double Integral, Triple Integral; Change of order in multiple integrals; Line Integral, Surface Integral, Volume Integral. Change of variables in multiple integrals.

Text Books:

- Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
- Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

- Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
- Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
- Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
- Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
- Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

- Bronson, R., Schaum's Outline of Matrix Operations. 1988.
- Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.

PAPER NAME: ENGINEERING PHYSICS- I
PAPER CODE: PH(IT)101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Basic 12th standard Mathematics and Physics

Course Outcome:

After completion of the course students will be able to

CO1	Explain basic principles of laser, optical fiber and holography.
CO2	Understand the properties of Nano material and semiconductor.
CO3	Analyze different crystallographic structures according to their co-ordination number and packing factors.
CO4	Analyze the structure, function and characteristics of different storage devices.
CO5	Justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics.

CO–PO Mapping:

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

Course Content:

Module 1: Modern Optics [12L]
Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. Fibre optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems.
Holography-Theory of holography, viewing of holography, applications

Module 2: Solid State Physics [6L]
Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction.

Module 3: Quantum Mechanics [8L]
Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems. Quantum Mechanics: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions-Qualitative discussion; uncertainty principle, relevant numerical problems, Introduction of Schrödinger wave equation (only statement).

Module 4: Physics of Nanomaterials [4L]
Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Module 5: Storage and display devices [6L]
Different storage and display devices-Magnetic storage materials, Hard disc (examples related to computers compared with semiconductor storage viz. Pendrive), Operation and application of CRT, CRO, Liquid crystal display (LCD), LED, OLED, Plasma display, Thin film transistor display).

Text Books:
- Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers).
- Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila (S. Chand Publishers).
- Perspective & Concept of Modern Physics -Arthur Baiser (Publisher: MaGrawhill)
- Principles of engineering physics – Md. N Khan and S Panigrahi (Cambridge University Press).
- Concepts of Modern Engineering Physics-A. S. Vasudeva. (S. Chand Publishers)
- Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila (S. Chand Publishers).
- Physics Volume 1&2 - Haliday, Resnick & Krane, Publisher: Wiley India).
- Engineering Physics-B. K. Pandey And S. Chaturvedi (Publisher: Cengage Learning, New Delhi).

Reference Books
Modern Optics:
- A text book of Light-Brijlal & Subhramanium, (S. Chand publishers).
- Optics-Ajay Ghatak (TMH)

Solid State Physics:
- Solid state physics- S. O. Pillai.
- Introduction to solid state physics-Kittel (TMH).

Quantum Mechanics:
- Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House).
- Quantum mechanics -A.K. Ghatak and S Lokenathan

Physics of Nanomaterials
- Introduction to Nanotechnology, B.K. Parthasarathy.
- Introduction to Nanoscience and Nanotechnology, An Indian Adaptation-Charles P. Poole, Jr., Frank J. Owens.

Storage and display devices
- Optics-B.D. Gupta (Books and Allied Pvt. Ltd.).
- Solid state physics, solid state devices and electronics by C. M. Kachhava.

PAPER NAME: ENVIRONMENTAL SCIENCE
PAPER CODE: HU104
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDIT: 2

Pre-requisite: Basic 12th standard Science Knowledge.

Course Outcome:

After completion of the course students will be able to

CO1	Able to understand the natural environment and its relationships with human activities.
CO2	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CO3	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
CO4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	-	2	3	3	-	-	1	2
CO2	3	3	3	1	1	2	3	3	-	-	1	2
CO3	3	3	3	2	1	2	3	3	-	-	1	2
CO4	1	1	1	1	2	2	3	3	-	-	1	2

Course Content:

Module 1: Resources and Ecosystem [6L]
Resources: Types of resources, resistance to resources, Human resource, Population Growth models: Exponential Growth, logistic growth.
Ecosystem: Components of ecosystem, types of ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Food chain, Food web.
Energy and Environment: Conventional energy sources, coal and petroleum, Green energy sources, solar energy, tidal energy, geothermal energy, biomass

Module 2: Environmental Degradation [9L]
Air Pollution and its impact on Environment: Air Pollutants, primary & secondary pollutants, Criteria pollutants, Smog, Photochemical smog and London smog, Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.
Water Pollution and its impact on Environment: Water Pollutants, Oxygen demanding wastes, heavy metals, BOD, COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal poisoning and toxicity.
Land Pollution and its impact on Environment: Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio- medical wastes, E-wastes.
Noise Pollution and its impact on Environment: Types of noise, Noise frequency, Noise pressure, Noise intensity, Noise Threshold limit, Effect of noise pollution on human health.

Module 3: Environmental Management [6L]
Environmental Impact Assessment: Objectives of Environmental management, Components of Environmental Management, Environmental Auditing, Environmental laws and Protection Acts of India
Pollution Control and Treatment: Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator, etc., Waste Water Treatment, Noise pollution control.
Waste Management: Solid waste management, Open dumping, Land filling, incineration, composting, E-waste management, Biomedical Waste management.

Module 4: Disaster Management [3L]
Study of some important disasters: Natural and Man-made disasters, earthquakes, floods drought, landside, cyclones, volcanic eruptions, tsunami, Global climate change. Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

Disaster management Techniques: Basic principles of disasters management, Disaster Management cycle, Disaster management policy, Awareness generation program

Text Books:

- Basic Environmental Engineering and Elementary Biology, Gourkrishna Dasmohapatra, Vikas Publishing.
- Basic Environmental Engineering and Elementary Biology, Dr. Monindra Nath Patra & Rahul Kumar Singha, Aryan Publishing House.
- Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha for UGC, Universities Press

Reference Books:

- A Text Book of Environmental Studies, Dr. D.K. Asthana & Dr. Meera Asthana, S.Chand Publications.
- Environmental Science (As per NEP 2020), Subrat Roy, Khanna Publisher

PAPER NAME: INDIAN KNOWLEDGE SYSTEM
PAPER CODE: HU105
CONTACT: 1:0:0
TOTAL CONTACT HOURS: 12
CREDIT: 1

Pre-requisite: Basic 12th standard Science Knowledge.

Course Outcome:

After completion of the course students will be able to

CO1	To recall & state thought process of social setting in ancient India to identify the roots anddetails of some contemporary issues faced by Indians.
CO2	The students are able to identify & inspect the importance of our surroundings& culture todesign & formulate sustainable developmental solutions.
CO3	To develop the ability to understanding the issues related to 'Indian' culture, tradition andits composite character to apply the same in the socio-technological developments in present scenario.
CO4	The students are able to relate & assess Indian Knowledge System in the health care,architecture, agriculture & other systems.

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	3	-	3	-	2	3	1	-	2
CO2	-	-	2	-	-	3	3	2	3	3	-	
CO3	-	-	2	-	-	3	3	1	3	1	-	2
CO4			2			3	3	2	3			

Course Content:

Module-1: [3L]
An overview of Indian Knowledge System (IKS): Importance of Ancient Knowledge - Definition of IKS - Classification framework of IKS - Unique aspects of IKS. The Vedic corpus: Vedas and Vedangas - Distinctive features of Vedic life. Indian philosophical systems: Different schools of philosophy.

Module-2: [3L]
Salient features of the Indian numeral system: Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers.
Highlights of Indian Astronomy: Historical development of astronomy in India.

Module-3: [3L]
Indian science and technology heritage : Metals and metalworking - Mining and ore extraction –Physical structures in India - Irrigation and water management - Dyes and painting technology - Surgical Techniques - Shipbuilding

Module-4: [3L]
Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, Traditional Knowledge in agriculture, Traditional societies depend on it for their food and healthcare needs.

Text Book:

- Introduction to Indian knowledge system: concepts and applications-Mahadevan B.Bhat, Vinayak Rajat, Nagendra Pavana R.N.,PHI

Reference Books:

- Traditional Knowledge system in India, Amit Jha, Atlantic Publishers
- S. N. Sen and K. S. Shukla, History of Astronomy in India, Indian National Science Academy, 2nd edition, New Delhi, 2000

PAPER NAME: PROGRAMMING FOR PROBLEM SOLVING LAB
PAPER CODE: IT191
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisites: Number system, Boolean Algebra

Course Outcome:

After completion of the course students will be able to

CO1	Apply the conception of data type, variable declaration to solve the problem.
CO2	Analyze the conception of data handling to solving problem and identify and correct syntax errors / logical errors as reported during compilation time and run time.
CO3	Create program using Arrays, Pointers, Structures, Union and Files. for solving different problem both recursive and non-recursive method

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	--	--	--	--	--	--	--	--	--	--	3
CO2	3	3	3	--	--	--	--	--	--	--	--	3
CO3	2	2	2	2	2	--	--	--	--	--	--	3

Module-1: Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE, compilation and execution of C program. Introduction to Code block.

Module-2: Problem based on

a) Basic data types
b) Different arithmetic operators.
c) Print f( ) and scan f( ) functions.

Module-3: Problem based on conditional statements using

a) if-else statements
b) different relational operators
c) different logical operators

Module-4: Problem based on

a) **for** loop
b) **while** loop
c) **do-while** loop

Module-5: Problem based on

a) How to write a menu driven program using **switch-case** statement
b) How to write a function and passing values to a function
c) How to write a **recursive function.**

Module-6: Problem based on

a) How to use **array (both I-Dand2-D).**
b) How to pass an **array** to a **function.**

Module-7: Problem based on manipulation of strings in different way.
Module-8: Problem based on

a) How to handle compound variables in C
b) How to handle file in C
c) How to use command line argument in C

Textbook:

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- KanetkarY.-LetusC,BPBPublication,15thEdition

Reference Books:

- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
- K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

PAPER NAME: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB
PAPER CODE: EE(IT)191
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisites: Number system, Boolean Algebra

Course Outcome:

After completion of the course students will be able to

CO1	To Analyze a given network by applying KVL and KCL.
CO2	To Examine the Operation of DC Motor.
CO3	To Examine the Operation of Basic Electronics Devices and ICs.
CO4	To design simple electronics circuits.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	-	2	-	-	2	-	2	3
CO2	3	3	2	3	-	2	-	-	3	-	2	2
CO3	3	2	2	3	-	2	-	-	2	-	3	3
CO4	3	3	2	2	-	2	-	-	3	-	2	3

List of Experiments: -

1. Familiarization with different passive and active electrical & electronic components.
2. Familiarization with different Electrical & Electronics Instruments.
3. Verification of KVL and KCL.
4. Forward and reversal of DC shunt motor.
5. Speed control of DC shunt motor.
6. Study of the P-N junction diode V-I characteristics (Forward & Reverse Bias).
7. Study of the Characteristics of Zener diode (Forward & Reverse Bias).
8. Study of the Input and Output characteristics of BJT in CE mode.
9. Determination of offset voltage, offset current & bias current of OPAMP(IC741).
10. Determination of CMRR and slew rate of OPAMP(IC741).
11. Determination of inverting and non-inverting gain of OPAMP(IC741).
12. Extramural Experiment.

Textbooks:

- Handbook of Laboratory Experiments in Electronics Engineering Vol. 1, Author Name: A.M. Zungeru, J.M. Chuma, H.U. Ezea, and M. Mangwala, Publisher -Notion Press Electronic Devices and Circuit Theory by Robert Boylestad Louis Nashelsky,7th Edition, Prentice Hall Experiments Manual for use with Grob's Basic Electronics 12th Edition by Wes Ponick, Publisher-McGraw Hill, 2015.
- Laboratory Manual for 'Fundamentals of Electrical & Electronics Engineering': A handbook for Electrical & Electronics Engineering Students by Manoj Patil (Author), Jyoti Kharade (Author), 2020.
- The Art of Electronics, Paul Horowitz, Winfield Hill,Cambridge University Press, 2015.
- A Handbook of Circuit Math for Technical Engineers, Robert L. Libbey CRC Press, 05-Jun- 1991.

Reference Books:

- Basic Electrical and Electronics Engineering, Author:S. K. Bhattacharya, Publisher: Pearson Education India,2011
- Practical Electrical Engineering
- By Sergey N. Makarov, Reinhold Ludwig, Stephen J. Bitar, Publisher: Springer International Publishing, 2016

PAPER NAME: TECHNICAL SEMINAR PRESENTATION
PAPER CODE: HU(IT)191
CONTACT: 0:0:2
CREDIT: 1

Prerequisites: Number system, Boolean Algebra

Course Outcome:

After completion of the course students will be able to

CO1	Able to develop advanced verbal and nonverbal communication skills through Power Point presentation.
CO2	Able demonstrate interpersonal skills through Group Discussion both for organizational communication and campus recruitment drive.
CO3	Able to recognize and apply the knowledge of public speaking.
CO4	Able to be industry ready professionals by various personality development programs.
CO5	Understand and write a detailed technical report as per organizational needs.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	3	-	3	2	-	-	3	3	1	3
CO2	3	3	-	-	-	3	-	-	3	3	-	3
CO3	2	2	2	-	-	2	1	-	3	3	1	3
CO4	2	-	-	-	1	3	-	-	3	3	1	3
CO5	1	2	-	-	2	2	-	2	3	3	1	3

Module 1: Presentation

- Teaching Presentation as a Skill
- Speaking Strategies and Skills
- Media and Means of Presentation
- Extended Practice and Feedback

Module 2: Effective Presentation

- Rules of making micro presentation.
- Assignment on micro presentation.
- Need for expertise in oral presentation.
- Assignment on Oral presentation.
- Macro Presentation in Groups.

Module 3: Writing a Technical Report

- Organizational Needs for Reports and types
- Report Formats
- Report Writing Practice Sessions and Workshops

Module 4: Speaking Skills

- The Need for Speaking: Content and Situation-based speaking
- Public Speaking Activities: [Just a Minute, Paired Role Play, Situational Speaking Exercises]
- The Pragmatics of Speaking—Pronunciation practice and learner feedback.

Text / Reference Books:

- Technical communication By Meeenakshi Raman and Sangeeta Sharma; Oxford Publication.

PAPER NAME: ENGINEERING GRAPHICS AND DESIGN LAB
PAPER CODE: ME(IT)191
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisites: Basic Knowledge of Geometry

Course Outcome:

After completion of the course students will be able to

CO1	Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings
CO2	Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements
CO3	Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts
CO4	Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	--	1	2	--	1	--	--	1	--	--	1
CO2	3	--	2	2	--	1	--	--	1	1	--	1
CO3	2	2	2	1	--	2	--	--	1	--	--	1
CO4	1	--	2	2	2	2	--	--	1	1	--	1

Basic Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Introduction to Engineering Drawing:
Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Orthographic & Isometric Projections:
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice- versa.

Sections and Sectional Views of Right Angular Solids:
Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Overview of Computer Graphics:
Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

CAD Drawing, Customization, Annotations, layering:
Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Demonstration of a simple team design project:
Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

- Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House
- K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:

- Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House.
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
- Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

PAPER NAME: ENGINEERING PHYSICS -I LAB
PAPER CODE: PH(IT)191
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Outcome:

After completion of the course students will be able to

CO1	Demonstrate experiments allied to their theoretical concepts.
CO2	Conduct experiments using LASER, Optical fiber.
CO3	Participate as an individual, and as a member or leader in groups in laboratory sessions actively.
CO4	Analyse experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiment.
CO5	Design solutions for real life challenges.

CO-PO Mapping:

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

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
Experiments on Classical Physics (Any 4 to be performed from the following experiments):

- Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
- Determination of Young's moduli of different materials.
- Determination of Rigidity moduli of different materials.
- Determination of wavelength of light by Newton's ring method.
- Determination of wavelength of light by Laser diffraction method.
- Optical Fibre-numerical aperture, power loss.

Experiments on Quantum Physics (Any 2 to be performed from the following experiments):

- Determination of Planck's constant using photoelectric cell.
- Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
- Determination of Stefan's Constant.
- 10.Study of characteristics of solar cell.

Perform atleast one of the following experiments:

- Determination of Q factor using LCR Circuit. 12.Study of I-V characteristics of a LED/LDR

**In addition it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

- Study of dispersive power of material of a prism.
- Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
- Determination of thermal conductivity of a bad/good conductor using Lees-Charlton / Searle apparatus.
- Determination of the angle of optical rotation of a polar solution using polarimeter.
- Any other experiment related to the theory.

Text Books

- Vibration, Waves and Acoustics- Chattopadhyay and Rakshit Classical & Modern
- A text book of Light- K.G. Mazumder & B.Ghosh (Book & Allied Publisher)
- Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
- Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
- Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
- Practical Physics by K.G. Mazumder (New Central Publishing)
- Practical Physics by R. K. Kar (Book & Allied Publisher)

Detailed Syllabus
of
2nd Semester

1st Year 2nd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT201	Data Structure and Algorithm	3	0	0	3	3
2	SCI	Multidisciplinary	CH(IT)201	Engineering Chemistry	2	0	0	2	2
3	SCI	Multidisciplinary	M(IT)201	Engineering Mathematics-II	3	0	0	3	3
4	HUM	Ability Enhancement Course	HU201	Professional Communication	2	0	0	2	2
5	HUM	Value Added Course	HU202	Values and Ethics	2	0	0	2	2
6	HUM	Value Added Course	HU203	Constitution of India	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT291	Data Structure and Algorithm Lab	0	0	3	3	1.5
2	SCI	Skill Enhancement Course	CH(IT)291	Engineering Chemistry Lab	0	0	2	2	1
3	HUM	Ability Enhancement Course	HU291	Professional Communication Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME(IT)291	Workshop and Manufacturing Practices Lab	0	0	3	3	1.5
Total of Theory, Practical								23	18

PAPER NAME: DATA STRUCTURE AND ALGORITHM
PAPER CODE: IT201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Basic Mathematics, Programming language

Course Outcome:

After completion of the course students will be able to

CO1	Understand the concept of large amounts of data efficiently, such as large databases and indexing services.
CO2	Use some formal design methods and programming languages which emphasize on data structures, as the key organizing factor in software design
CO3	Analyze different kinds of data structures which are suited to different kinds of applications, and some are highly specialized to specific tasks
CO4	Create efficient data structures which are a key to designing efficient algorithms

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	--	3	--	--	--	--	--	--	--	--	2
CO2	3	--	--	--	--	--	--	--	--	--	--	1
CO3	3	3	3	2	--	--	--	--	--	--	--	1
CO4	3	--	3	2	--	--	--	--	--	--	--	3

Course Contents:

Module I: Concepts of data structures [7L]

a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – order notations. Array: Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked list: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module II: Stack and Queue [7L]

Stack and its implementations (using array, using linked list), applications. Queue, circular queue, Dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications. Recursion: Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications- The Tower of Hanoi, Eight Queens Puzzle

Module III: Trees [12L]

Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees –operations (insertion, deletion with examples only). Huffman tree.

Graphs: Graph definitions and Graph representations/storage implementations–adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity–Depth-first search(DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, Forward-edge),applications. Minimal spanning tree– Prim‘s algorithm

Module IV: Sorting Algorithm [10L]

Internal sorting and external sorting Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap), and radix sort. Tree Sort technique. Searching: Sequential search, binary search, interpolation search. Hashing: Hashing functions, collision resolution techniques

Textbooks:

- Data Structures ,by Reema Thereja, OXFORD Publications
- Data Structures and Algorithms Using C by Amitava Nag and Joyti Prakash Singh, VIKASH Publication
- Data Structures by S. Lipschutz.

Reference books:

- Data Structure using C ,by E. Balagurusamy .Mcgraw Hill)
- Data Structures Using Cand C++,by Moshe J.Augenstein, ,Aaron, M. Tenenbaum

PAPER NAME: ENGINEERING CHEMISTRY
PAPER CODE: CH(IT)201
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDIT: 2

Pre-requisite: Basic 12th standard Chemistry.

Course Outcome:

After completion of the course students will be able to

CO1	Able to understand the basic principles of elements, organic reactions drug synthesis and computational chemistry.
CO2	Able to apply the knowledge of different engineering materials, advanced polymers, and nanomaterials tosolve complex engineering problems.
CO3	Able to analyse and evaluate water quality parameters and its treatment.
CO4	Able to the knowledge of free energy, energy storage device, fuels and corrosion to design environmentfriendly & sustainable devices.
CO5	Able to apply the knowledge of different instrumental techniques to analyse unknown engineering materials.

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2	-	-	-	-	-	2	2
CO2	3	3	3	3	-	-	2	-	-	-	2	2
CO3	3	3	-	-	-	-	3	-	-	-	3	2
CO4	3	3	3	2	-	-	3	-	-	-	3	2
CO5	3	3	3	3	2	-	-	-	-	-	2	2

Module 1: Elements and their properties [6L]
Elements and their properties: Bohr's theory for one electron system, Hydrogen spectrum, Quantum numbers, Atomic orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle, Electronic configuration and Magnetic properties. Periodic Table for Engineers: Modern Periodic table, Periodic properties, study of advanced functional materials like Silicones, Silicates, Zeolite and alloys like steel, mischmetal, Neodymium alloy and their applications.

Module 2: Energy devices and Semiconductors [6L]
Use of free energy in chemical equilibria: Laws of Thermodynamics, Enthalpy, Entropy, Spontaneity, Electrochemical Cell, Dry Cell, Mercury Cell, Lead Storage batteries, Fuel Cells, Solar Cells, Nernst equation and applications, Electrochemical sensors. Crystals and Semiconductors: Crystals and their defects, Stoichiometric and Non-stoichiometric defects, Band theory and Doping, n-type and p-type semiconductors, Superconductors

Module 3: Industrial Applications of Chemistry [7L]
Advanced Polymeric materials: Classification, Engineering Plastics, conducting polymers, bio polymers, polymer composites. Industrial corrosion: Classification, Effects of corrosion, Preventive measures
Analysis of Water Quality: Water quality parameters. Fuels and their applications: Classification of Fuels, Calorific Values, Solid fuels; coal qualifications, Liquid Fuels; Knocking, Cetane and Octane number, composition and uses of gaseous fuels; water gas, BioGas, CNG, LPG

Module 4: Organic Reaction Products and their spectroscopic analysis [4L]
Organic Reactions: Substitution, Elimination and Addition reactions. Drug designing and synthesis: Paracetamol, Aspirin.

Spectroscopic Analysis: [1L]
UV – Visible Spectra, IR spectra

Text Books

- Fundamentals of Engineering Chemistry, By Dr. Sudip Bandopadhyay & Dr. Nirmal Kumar Hazra
- A Text Book of Engineering Chemistry by Dr. Rajshree Khare
- Engineering Chemistry 1, Gourkrishna Dasmohapatra

Reference Books

- Engineering Chemistry, 16th Edition, P.C. Jain & Dr. Monica Jain
- A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co.
- Fundamentals of Molecular Spectroscopy, by C. N. Banwell
- Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan

PAPER NAME: ENGINEERING MATHEMATICS- II
PAPER CODE: M(IT)201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Basic 12th standard Mathematics

Course Outcome:

After completion of the course students will be able to

CO1	Recall the properties related to ordinary differential equations, Laplace transform andnumerical techniques.
CO2	Determine the solutions of the problems related to ordinary differential equations, Laplacetransform and numerical techniques.
CO3	Apply appropriate mathematical tools of ordinary differential equations, Laplace transform and numerical techniques for the solutions of the problems.
CO4	Analyze engineering problems by using ordinary differential equation, Laplace transform and numerical Methods.

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1

Course Content:

Module I: First Order Ordinary Differential Equations (ODE) [9L]
Solution of first order and first-degree ODE: Exact ODE, Rules for finding Integrating factors, Solution of first order and first-degree ODE: Exact ODE, Rules for finding Integratingfactors, Linear ODE, Bernoulli's equation. Solution of first order and higher degree ODE: solvable for p, solvable for y and solvable for x and Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE) [8L]
Solution of second order ODE with constant coefficients: C.F. &P.I., Method of variation of parameters, Cauchy-Euler equations.

Module III: Laplace Transform (LT) [12L]
Concept of improper integrals; Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of tf(t) , LT of f(t)/t , LT of derivatives of f(t), LT of integral of f(t), Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods: [7L]
Introduction to error analysis, Calculus of finite difference. Interpolation: Newton forward and backward interpolation, Lagrange's interpolation. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule. Numerical solution of ordinary differential equation: Euler method, Fourth order Runge-Kutta method.

Text Books:

- Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
- Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

- Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
- Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

- Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
- Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
- Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
- Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- Bronson, R., Schaum's Outline of Matrix Operations. 1988.
- Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.

PAPER NAME: PROFESSIONAL COMMUNICATION
PAPER CODE: HU201
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDIT: 2

Pre-requisite: Basic (10+2) level of knowledge of English grammar, vocabulary reading and writing skills.

Course Outcome:

After completion of the course students will be able to

CO1	Define, describe and classify the modalities and nuances of communication in a workplace context.
CO2	Review, appraise and understand the modes, contexts and appropriacy of communicating across cultures and societies.
CO3	Identify, interpret and demonstrate the basic formats, templates of business and official communication.
CO4	Identify, compare and illustrate reading strategies and basic writing strategies.
CO5	Interpret, analyze and evaluate semantic-structural, interpersonal andmulticultural dynamics in business communication.

CO–PO Mapping:

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

Course Content:

Module 1: Verbal and Non verbal Communication: [4L]
Definition, Relevance and Effective Usage. Components of Verbal Communication: Written and Oral Communication. Components of Non-verbal Communication: Kinesics, Proxemics, Chronemics, Haptics Paralanguage. Barriers to Effective Communication

Module 2: Workplace Communication Essentials and Cross Cultural Communication: [4L]
Communication at the Workplace—Formal and Informal Situations. Language in Use—Jargon, Speech Acts/Language Functions, Syntactical and Grammatical Appropriacy. Cultural Contexts in Global Business: High Context and Low Context Cultures. Understanding Cultural Nuances and Stereotyping
Achieving Culturally Neutral Communication in Speech and Writing.

Module 3: Reading Strategies and Basic Writing Skills: [4L]
Reading: Purposes and Nature of Reading
Reading Sub-Skills—Skimming, Scanning, Intensive Reading
Reading General and Business Texts(Reading for Comprehension and Detailed Understanding) Basic Writing Skills—Paragraph and Essay writing, writing technical documents
Writing Technicalities—Paragraphing, Sentence Structure and Punctuation

Module 4: Report Writing: [4L]
Nature and Function of Reports Types of Reports
Researching for a Business Report Format, Language and Style Report Documentation

Module 5: Employment Communication: [8L]
Writing Business Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application, Offer)
Creating an Employee Profile-- Preparing a CV or Résumé
Creating a Digital/Online Profile – LinkedIn (Résumé/Video Profile)

Writing Other Interoffice Correspondence--E-mails: types, convention, and etiquette, Memo, Notices and Circulars

Preparing Meeting Documentation—Drafting Notice and Agenda of Meetings, Preparing Minutes of Meetings.

References:

- Meenakshi Raman and Sangeetha Sharma. Technical Communication. 3rd edition. New Delhi:Oxford University Press, 2015.
- Mark Ibbotson. Cambridge English for Engineering. Cambridge: Cambridge University Press,2008.
- Mark Ibbotson. Professional English in Use: Engineering. Cambridge: Cambridge UP, 2009.
- Lesikar et al. Business Communication: Connecting in a Digital World. New Delhi: TataMcGraw-Hill, 2014.
- John Seeley. Writing Reports. Oxford: Oxford University Press, 2002.
- Judith Leigh. CVs and Job Applications. Oxford: Oxford University Press, 2002.
- Judith Leigh. Organizing and Participating in Meetings. Oxford: Oxford University Press,2002.
- Michael Swan. Practical English Usage. Oxford: OUP, 1980.
- Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking.
- 8th ed. London: Longman, 2001.
- Diana Booher. E-writing: 21st Century Tools for Effective Communication.

Links:-

- Purdue University’s Online Writing Lab (OWL)- https://owl.purdue.edu/
- Business English Pod- https://www.businessenglishpod.com/

PAPER NAME: VALUES AND ETHICS
PAPER CODE: HU202
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDIT: 2

Pre-requisite: Basic 12th standard Science Knowledge.

Course Outcome:

After completion of the course students will be able to

CO1	Understand the core values that shape the ethical behaviour of an engineer and Exposedawareness on professional ethics and human values.
CO2	Understand the basic perception of profession, professional ethics, various moral issues &uses of ethical theories
CO3	Understand various social issues, industrial standards, code of ethics and role ofprofessional ethics in engineering field
CO4	Aware of responsibilities of an engineer for safety and risk benefit analysis, professionalrights and responsibilities of an engineer.
CO5	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

CO–PO Mapping:

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

Course Content:

Module 1: [4L]
Value: Definition- Importance and application of Value in life- Formation of Value- Process of Socialization- self and integrated personality. Types of values-Social, Psychological, Aesthetic, Spiritual, and Organizational-Value crisis in contemporary society: individual, societal cultural and management level.

Module-2: [4L]
Effects of Technological Growth- Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Problems of Technology transfer- Technology assessment impact analysis. Human Operator in Engineering projects and industries- Problems of man, machine- interaction- Impact of assembly line and automation-Human centered Technology.

Module-3: [4L]
Impact of Ethics on Business Policies and Strategies – Utilitarianism – Principles of Utilitarianism - Criticism of Utilitarianism - Impact on Business Culture - Role of CEO in shaping Business Culture– Ethical Leadership – Characteristics.

Module-4: [2L]
Types of Ethical issues - Internal Ethics of Business – Hiring Employees – Promotion - Wages – Job discrimination - its nature and extent- Exploitation of Employees – Discipline and Whistle Blowing.

Module-5: [4L]
Markets and consumer Protection – Consumer rights – Unethical Practices in Marketing – Ethics of Competition and Fair Prices – Ethics in Advertising and False Claims - Environmental Protection and Ethics –Pollution Control – Ecological ethics.

Module-6: [6L]

Social Responsibilities of Business – Definition and case study of Corporate Compliance; Responsibilities towards Customers, shareholders, employees – Social Audit – Objectives and Need for Social Audit – Methods of Social Audit – Benefits – Obstacles –Social Audit in India.

Text Books:

- A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996
- S. K. Chakraborty: Values and Ethics in Organization, OUP

Reference Books:

- U.C.Mathur, Corporate Governance & Business Ethics, Macmillan, 2005
- Fernando. A. C., Business Ethics – An Indian Perspective, Pearson Publication, 2009.
- Prem Vir Kapoor, Professional Ethics & Human Values, Khanna Publishing House, New Delhi

PAPER NAME: CONSTITUTION OF INDIA
PAPER CODE: HU203
CONTACT: 1:0:0
TOTAL CONTACT HOURS: 12
CREDIT: 1

Pre-requisite: Basic 12th standard Science Knowledge.

Course Outcome:

After completion of the course students will be able to

CO1	To Identify and explore the basic features and modalities of Indian constitution.
CO2	To Differentiate and relate the functioning of Indian parliamentary system at the centre and state level.
CO3	To Differentiate the various aspects of Indian Legal System and its related bodies.

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	3	-	1	-	-
CO2	-	-	-	-	-	1	-	2	-	3	-	-
CO3	-	-	-	-	-	3	-	2	-	1	-	-

Course Content:

Module 1: History of Making of the Indian Constitution: [3L]
History. Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble Salient Features

Module 2: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy: [6L]
The Right to Equality
The Right to Freedom: I (Article 19)
The Right to Freedom: II (Articles 20, 21 and 22) The Right against Exploitation
The Right to freedom of Religion Cultural and Educational rights The Right to Property
The Right to Constitutional Remedies Fundamental Duties

Module-3: Organs of Governance: [3L]
Parliament - Composition - Qualifications and Disqualifications -Powers and Functions – Executive- President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

Text Books:

- Indian Constitution by D.D.Basu, The Publisher, LexisNexis
- PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

Reference Books:

- Constitution of India by Subhas C Kasyap, Vitasta Publishing
- The Constitution of India, P.M Bakshi, Universal Law Publishing Co.Ltd, New Delhi, 2003.
- Indian Constitution Text Book - Avasthi, Avasthi, Publisher: LAKSHMI NARAIN AGARWAL
- Introduction to the Constitution of India, Brij Kishore Sharma, PHI

PAPER NAME: DATA STRUCTURE AND ALGORITHM LAB
PAPER CODE: IT291
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisite:
Basic Mathematics, Programming language

Course Outcome:
After completion of this course students will be able to

CO1	Apply the concept of dynamic memory management, data types, basic data structures, and complexity analysis.
CO2	Analyze the complexity of the different data structure and algorithm
CO3	Design and implement the appropriate linear and non-linear data structure and algorithm design method for a specified application design

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	--	--	--	--	--	--	--	--	2
CO2	3	2	--	--	--	--	--	--	--	--	--	2
CO3	2	2	3	--	--	--	--	--	--	--	--	2

List of Experiments:

- Implementing Non-Restricted Linear Data Structure
- Problem based on Implementation of Non-Restricted Linear Data Structure like- Implementation of list as data structure using array.
- Implementation of list as data structure using linked list of different types. Implementation of polynomial as data structure using array and linked list. Implementation of sparse matrix as data stricture using array.
- Implementing Restricted Linear Data Structure
- Problem based on Implementation of Restricted Linear Data Structure like- Implementation of stack as data structure using array.
- Implementation of stack as data structure using linked list.
- Implementation of queue as data structure using array (physical, linear and circular model). Implementation of queue as data structure using linked list.
- Converting infix to post-fix and evaluating post-fix expression using stack. Implementing Tower-of-Hanoi problem.
- Implementing Non-Linear Data Structure
- Problem based on Implementation of Non-Linear Data Structure like Implementation of Binary Tree as data structure using array and linked list.
- Implementation of Binary Search Tree (BST) as data structure using linked list. Implementation of Heap as data structure using array.
- Implementation of Priority Queue as data structure using Heap.
- Implementing Sorting and Searching algorithm
- Problem based on Implementation of Sorting and Searching algorithm Implementation of Bubble sort using appropriate data structure.
- Implementation of Selection sort using appropriate data structure.
- Implementation of Insertion sort using appropriate data structure. Implementation of Quick sort using appropriate data structure.
- Implementation of Merge sort using appropriate data structure. Implementation of Heap sort using appropriate data structure. Implementation of Radix sort using appropriate data structure. Implementation of Sequential Search using appropriate data structure. Implementation of Binary Search using appropriate data structure.
- Implementation of hashing with collision resolution using linear and quadratic probing.

Textbooks:

- Data Structures Using C, by Reema Thereja, OXFORD Publications
- Data Structures and Algorithms Using C by Amitava Nag and Joyti Prakash Singh, VIKASH Publication
- Data Structures by S. Lipschutz.

Reference Books:

- Data Structures Using C, by E. Balagurusamy E. Mc graw Hill)
- Data Structures Using C and C++, by Moshe J. Augenstein, Aaron M. Tenenbaum

PAPER NAME: ENGINEERING CHEMISTRY LAB
PAPER CODE: CH(IT)291
CONTACT: 0:0:2
CREDIT: 1

Prerequisites: Number system, Boolean Algebra

Course Outcome:

After completion of the course students will be able to

CO1	Able to operate different types of instruments for estimation of small quantitieschemicals used in industries and scientific and technical fields.
CO2	Able to analyse and determine the composition and physical property of liquid and solidsamples when working as an individual and also as a team member.
CO3	Able to analyse different parameters of water considering environmental issues.
CO4	Able to synthesize drug and sustainable polymer materials.
CO5	Capable to design innovative experiments applying the fundamentals of modernchemistry

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	3	1	-	2	3	-	-	-	-	1
CO2	2	2	1	1	-	1	-	-	-	1	-	1
CO3	-	-	-	-	-	-	-	-	3	3	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	2	1	2	2	-	-	1	-	-	-	-	2

List of Experiments: -

- Determination of the concentration of the electrolyte through conductance measurement.
- Determination of water quality measurement techniques.
- Determination of the concentration of the electrolyte through pH measurement.
- Estimation of Cu in brass
- Estimation of Fe_2O_3 in Cement
- Isolation of graphene from dead dry batteries and their use for temporary soldering.
- Synthesis of Silver Nanoparticles doped organic thin film for organic transistors.
- Estimation of corrosion in a given sample metal.
- Preparation of Si-nano crystals for future memory devices.
- Green Synthesis of ZnO based Polymer Nano composites.
- Synthesis of polymers for electrical devices and PCBs.
- Determination of Partition Coefficient of acetic acid between two immiscible liquids.
- Drug design and synthesis
- Rheological properties of the Newtonian fluids
- Innovative Experiments

PAPER NAME: PROFESSIONAL COMMUNICATION LAB
PAPER CODE: HU291
CONTACT: 0:0:2
CREDIT: 1

Prerequisites: Basic knowledge of LSRW skills.

Course Outcome:

After completion of the course students will be able to

CO1	Recognize, identify and express advanced skills of Technical Communication in English through Language Laboratory.
CO2	Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.
CO3	Articulate and present the skills necessary to be a competent Interpersonal communicator.
CO4	Deconstruct, appraise and critique communication behaviors.
CO5	Adapt, negotiate and facilitate with multifarious socio-economical and professional arenas with effective communication and interpersonal skills.

CO-PO Mapping:

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

Module 1: Introduction to the Language Lab
The Need for a Language Laboratory
Tasks in the Lab
Writing a Laboratory Note Book

Module 2: Active Listening
What is Active Listening?
Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
Listening in Business Telephony

Module 3: Speaking
Speaking—Accuracy and Fluency Parameters
Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs.
Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
Group Discussion: Principles and Practice
Giving a Presentation—Learning Presentation Basics and Giving Micro Presentations

Module 4: Lab Project Work
Writing a Book Review
Writing a Film Review
Scripting a Short Presentation (2 minutes)
Making a short video CV (1-2 minutes)

References:

- IT Mumbai, Preparatory Course in English syllabus
- IIT Mumbai, Introduction to Linguistics syllabus

PAPER NAME: WORKSHOP AND MANUFACTURING PRACTICES LAB
PAPER CODE: ME(IT)291
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisites: 10+2 with Mathematics, Physics and Chemistry.

Course Outcome:

After completion of the course students will be able to

CO1	Gain basic knowledge of Workshop Practice and Safety useful for our daily living.
CO2	**Understand the use of Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc.**
CO3	Apply and performing operations like such as Marking, Cutting etc used in manufacturingprocesses.
CO4	Analyse the various operations in the Fitting Shop using Hack Saw, various files, Scriber,etc to understand the concept of tolerances applicable in all kind of manufacturing.
CO5	Get hands on practice of in Welding and apply various machining processes which give alot of confidence to manufacture physical prototypes in project works.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	2	-	2	2	-	-
CO2	3	-	-	-	-	-	2	-	2	2	-	-
CO3	3	-	-	-	-	-	2	-	2	2	-	-
CO4	3	-	-	-	-	-	2	-	2	2	-	-
CO5	3	2	2	-	-	-	2	-	2	2	-	-

(i) Theoretical discussions:
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting

(ii) Workshop Practice:

Module 1 - Machine shop
Typical jobs that may be made in this practice module:
i. To make a pin from a mild steel rod in a lathe.
ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop
Typical jobs that may be made in this practice module:
i. To make a Gauge from MS plate.

Module 3 - Carpentry
Typical jobs that may be made in this practice module:
i. To make wooden joints and/or a pattern or like.

Module 4 - Welding & Soldering shop
Typical jobs that may be made in this practice module:
i. Arc Welding: To join two thick (approx 5mm) MS plates by manual metal arc welding.
ii.Gas Welding: To join two thin mild steel plates or sheets by gas welding.
iii.House wiring, soft Soldering

Module 5 – Smithy & Casting
Typical jobs that may be made in this practice module:
i.A simple job of making a square rod from a round bar or similar.
ii.One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 6 – CNC Machining & Laser Cutting
Typical jobs that may be made in this practice module:
i.At least one sample shape on mild steel plate should be made using CNC Milling / CNC Lathe Machine
ii.At least one sample shape on glass should be made using laser cutting machine.

Module 7 – 3D Printing
i)Exposure to a 3D printing machine,
ii)3D printing of at least one sample model using available materials.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

- Hajra Choudhury S.K., Hajra Choudhury A.K. and NirjharRoy S.K., ―Elements of Workshop Technology‖, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
- Rao P.N., ―Manufacturing Technology‖, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:

- Gowri P., Hariharan and A. Suresh Babu, ManufacturingTechnology – I, Pearson Education, 2008.
- Roy A. Lindberg, ―Processes and Materials of Manufacture‖, 4th edition, Prentice Hall India, 1998.
- Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
- Manufacturing Science by A. Ghosh and A.K. Mallick,Wiley Eastern.
- Principles of Metal Cutting/Principles of Machine Tools by G.C. Sen and A. Bhattacharya, New Central Book Agency, Kolkata.

Detailed Syllabus
of
3rd Semester

2nd Year 3rd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Minor	IT302	Analog and Digital Electronics	3	0	0	3	3
3	ENGG	Major	IT303	Formal Language and Automata Theory	3	0	0	3	3
4	SCI	Minor	M(IT)301	Numerical Methods and Statistics	2	0	0	2	2
5	SCI	Minor	PH(IT)301	Engineering Physics - II	2	0	0	2	2
		B.PRACTICAL							
1	ENGG	Major	IT391	Computer Organization and Architecture Lab	0	0	3	3	1.5
2	ENGG	Minor	IT392	Analog and Digital Electronics Lab	0	0	3	3	1.5
3	ENGG	Minor	IT393	Python Programming Lab	0	0	3	3	1.5
4	HUM	Ability Enhancement Course	HU(IT)391	Soft Skill and Aptitude	0	0	2	2	1
5	SCI	Skill Enhancement Course	PH(IT)391	Engineering Physics - II Lab	0	0	3	3	1.5
Total of Theory, Practical								27	20

PAPER NAME: COMPUTER ORGANIZATION AND ARCHITECTURE
PAPER CODE: IT301
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS:3

Pre-requisite: Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures.

COURSE OUTCOME:
At the end of the course the student will be able to:
CO1: Apply the operational concepts for instruction execution, arithmetic operations, control signals, memory operations and data transfer methods on various problems.
CO2: Analyze types of addressing modes, .interrupts, arithmetic and logic circuits, memory, pipeline performance and bus architectures and its timing diagrams.
CO3: Develop technological aspects on computer organization and architecture to solve complex problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											1
CO2		3										1
CO3			3	3								2

Module – 1: [**6L]**
Basic organization of the stored program computer and operation sequence for execution of a program.
Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes.

Module – 2: [6L]
Overflow and underflow. Design of adders - ripple carry and carry look ahead principles.
Design of ALU.
Fixed point multiplication -Booth's algorithm.
Fixed point division - Restoring and non-restoring algorithms.
Floating point - IEEE 754 standard.

Module – 3: **[6L]**
Memory unit design with special emphasis on implementation of CPU-memory interfacing.
Memory organization, static and dynamic memory, memory hierarchy, associative memory.
Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses;
Virtual memory organization, mapping and management techniques, memory replacement policies.

Module – 4: [8L]
Design of control unit - hardwired and micro programmed control.
Introduction to RISC architectures. RISC vs CISC architectures.
I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA.
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques;

Module – 5: [5L]
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures. Array and vector processors.

Module – 6: [5L]
Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

Text Books:

- Mano, M.M., “Computer System Architecture”, PHI.
- Kai Hwang”Advance Computer Architecture” McGraw Hill
- Behrooz Parhami “ Computer Architecture”, Oxford University Press
- Nicholas P Carter”Computer Architecture & Organization” McGraw Hill,

Reference Book:

- Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,
- Hamacher, “Computer Organisation”, McGraw Hill,
- N. senthil Kumar, M. Saravanan, S. Jeevananthan, “Microprocessors and Microcontrollers”
- Chaudhuri P. Pal, “Computer Organisation & Design”, PHI,
- P N Basu- “Computer Organization & Architecture” , Vikas Pub

PAPER NAME: ANALOG AND DIGITAL ELECTRONICS
PAPER CODE: IT302
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisite:
Mathematics, Physics, Basic Electronics.

Course Objectives
The objective of the course is to prepare students to perform the analysis and design of various digital and analog electronic circuits.

Course Outcomes:
After completion of this course students will be able to

CO1	Apply the basic concept of analog and digital electronics, combinational and sequential logic and analog-to-digital digital-to-analog conversion techniques.
CO2	Analyze the characteristics of analog and digital circuits.
CO3	Judge working principles of basic Analog and Digital electronics circuits for different applications.
CO4	Design different analog circuits, combinational logic devices and sequential logic devices like counters and registers.

CO -. PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**											**2**
CO2		**3**										**1**
CO3		**2**		**3**								
CO4			**3**	**3**								

Course Content

MODULE I [10L]:

Analog Electronics: Analog Electronics: Diodes, Transistors, Feedback and Op-amp, Power Amplifiers – Class A, B, AB and C - basic concepts, power, efficiency calculation; Phase Shift, Wein Bridge oscillators; 555 Timer and Multivibrators; Schimtt Trigger circuit.

MODULE II [10L]:

Introduction to Number Systems: Introduction to Number Systems: Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic; Boolean algebra; Various logic gates; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-MAP method and Quin Mc-Clusky Method.

MODULE III [6L]:

Combinational Circuits: Combinational Circuits: Adder and Subtractor; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and Checker.

MODULE IV [6L]:

Sequential Circuits: Sequential Circuits: Basic Flip-flop & Latch; SR, JK, D, T and JK Master-slave Flip Flops Registers (SISO, SIPO, PIPO, PISO); Ring counter, Johnson counter; Basic concept of Synchronous and Asynchronous counters; Design of synchronous and asynchronous Mod N Counter.

MODULE V [2L]:

A/D and D/A conversion techniques: A/D and D/A conversion techniques: Basic concepts of R-2R, A/D and D/A; successive approximation ADC.

MODULE VI [2]:

Logic families: Logic families: TTL, ECL, MOS and CMOS - basic concept

Text Books:

- 'Digital Circuits and Design', Salivahanan, S. Arivazhagan, Vikas Publishers
- 'Electronics Fundamentals and Applications', D. Chattopadhyay, P. C. Rakshit, New Age International Publishers

Reference Books:

- 'Digital Design', M. Morris Mano, Pearson Education

PAPER NAME: FORMAL LANGUAGE AND AUTOMATA THEORY
PAPER CODE: IT303
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Elementary discrete mathematics including the notion of set, function, relation, product, partial order, equivalence relation, graph & tree.

Course Objective:
Being familiar with a broad overview of the theoretical foundations of computer science.

Course Outcome:
After completion of this course students will be able to

CO1	Understand situations in related areas of theory in computer science.
CO2	Model, compare and analyze different computational models using combinatorial methods and Identify limitations of some computational models and possible methods of proving them.
CO3	Analyze rigorously formal mathematical methods to prove properties of languages, grammars and Automata.
CO4	Construct algorithms for different problems and argue formally about correctness on different restricted Machine models of computation.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	--	--	--	--	--	--	--	2
CO2	2	3	3	3	2	--	--	--	--	--	--	1
CO3	3	3	3	2	--	--	--	--	--	--	--	2
CO4	3	3	2	3	--	--	--	--	--	--	--	2

Course Contents:

MODULE I: [10L]
Fundamentals: Definition of Automata, Use of Automata. Definition of sequential circuit, block diagram, mathematical representation, and concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state model Finite state machine: Definitions, capability & state equivalent, Finite memory definiteness, testing table & testing graph. Minimization of FSM-completely specified and incompletely specified (Merger graph, Merger table, Compatibility graph). Limitations of FSM Application of finite automata, Finite Automata with Output-Moore & Mealy machine.

MODULE II: [10L]
Deterministic finite automaton and non-deterministic finite automaton. Transition diagrams and Language recognizers. Chomsky Hierarchy. Finite Automata: NFA with Î transitions - Significance, acceptance of languages. NFA to DFA conversion. DFA minimization. Myhill-Nerode theorem Regular Languages: Regular sets. Regular expressions, identity rules. Arden ‘s theorem state and prove Constructing Finite Automata for a given regular expression, Regular string accepted by NFA/DFA. Pumping lemma of regular sets. Grammar Formalism: Regular grammars-right linear and left linear grammars. Equivalence between regular linear grammar and FA.

MODULE III: [10L]
Introduction to Context free grammars, Derivation trees, sentential forms. Right most and leftmost derivation of strings. Basic applications of the concept of CFG, Ambiguity in context free grammars. Minimization of Context Free Grammars: Removal of useless, null and unit productions. Chomsky normal form and Greibach normal form. Pumping Lemma for Context Free Languages. Enumeration of properties of CFL. Closure property of CFL. Push down Automata: Push down automata, definition. Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA,

MODULE IV: [6L]

Turing Machine: Turing Machine, definition, model, Design of TM, TM as language accepter, TM as transducers. Recursively enumerable and recursive languages. Computable functions. Church's hypothesis, counter machine, Types of Turing machines Universal Turing Machine, Decidability, Undesirability, Halting problem.

Textbooks:

- "Theory of Computer Science-Automata Languages and Computation", Mishra andChandrashekaran,2nd edition,PHI
- "Switching&FiniteAutomata",ZVIKohavi,2ndEdn.,TataMcGrawHill
- "An Introduction to Computing", Peter Linz, Narosa.

Reference books:

- Introduction to Automata Theory Language and Computation", Hopcroft H.E.and Ullman J.D

PAPER NAME: NUMERICAL METHODS AND STATISTICS
PAPER CODE: M(IT)301
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDITS: 2

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard algebra and calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques of numerical approximations and statistical approaches.

Course Outcome(s):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1:	Apply numerical approaches to obtain approximate solutions to intractable mathematical problems.
CO2:	Apply the statistical approaches to determine distinctive measures dealing with real-world data.
CO3:	Analyze the accuracy of the results gained through the numerical techniques.
CO4:	Analyze the findings of mathematical models using the underlying principles of statistical approaches.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Course Content

Module-I: Numerical Solution of Polynomial and Transcendental Equations [6L]
Bisection method, Regula-Falsi, Secant method, Fixed Point Iteration method, Newton-Raphson method.

Module-II: Numerical Solution of a System of Linear Equations [8L]
Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method.

Module- III: Statistics [10L]
Measures of Central Tendency: Mean, Median, Mode.
Measures of Dispersion: Range, Mean deviation, Variance, Standard deviation.
Correlation: Bivariate Data, Scatter Diagram, Methods of studying correlation – Karl-Pearson's coefficient of correlation.
Regression: Regression lines, Regression equations, Regression coefficients.

Text Books:

- Gupta, S. and Dey, S., Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
- Das, N. G., Statistical Methods, TMH.

Reference Books:

- Scarborough, J. B., Numerical Mathematical Analysis. Oxford and IBH Publishing

- Jain, M. K., Iyengar, S. R. K. and Jain, R. K. Numerical Methods (Problems and Solution). New age International Publisher.
- Sancheti, D. S. and Kapoor, V. K., Statistics Theory, Method & Application, Sultan Chand & sons, New Delhi.
- Balagurusamy, E. Numerical Methods, Scitech. TMH.
- Shastri, S. S. Numerical Analysis, PHI.

PAPER NAME: ENGINEERING PHYSICS-II
PAPER CODE: PH(IT)301
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDITS: 2

Prerequisite: Knowledge of Basics Physics.

Course Outcome
After completion of this course student will be able to

CO1:	Explain atomic level problems using quantum mechanics, action of quantum gates and semiconductor and optoelectronic devices.
CO2:	Apply quantum mechanics in explaining quantum bits, formation of energy bands.
CO3:	Compare differences between classical and quantum computation, quantum circuits, differences between electronic materials and analyze the importance of statistical mechanics in classifying action of different types of semiconductors.
CO4:	Design quantum logic gates of various types used in performing operations in digital systems.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	1	2	2	-	-	-	-	-	2
CO2	2	-	-	1	0	0	-	-	-	-	-	2
CO3	2	2	-	0	2	0	-	-	-	-	-	1
CO4	2	2	-	2	2	2	-	-	-	-	-	1

Course Content

Module 1: Quantum Mechanics-II, Quantum Computation and Communication[12L]
1.01: Quantum Mechanics-II
Formulation of quantum mechanics and Basic postulates; Operator Correspondence-Measurements in Quantum Mechanics-Eigen value, Eigen function, superposition principle, orthogonality of wave function, expectation value, Commutator. Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Schrödinger's equation as energy eigen value equation, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels).

1.02: Quantum Computation and Communication
The idea of n-dimensional vector space, use of 'bra-ket' notation, matrix representation of bra &kets; basis, Hilbert space; Pauli matrices Idea of qubit and examples of single qubit logic gates- Classical bits, qubit as a two level system; Bloch vector, Pauli gate, Hadamard gate, Phase shift gate.

Module 2: Statistical Mechanics [4L]
Concept of energy levels and energy states, phasespace, microstates, macrostates and thermodynamic probability, MB, BE, FD statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level, Occupation probability.

Module 3: Electronic materials [5L]
Classical free electron theory- Inadequacy, Band theory of solids: Bloch Theorem-statement only, Kronig-Penny model (qualitative treatment) - Energy-band (E-k) diagram, allowed and forbidden energy bands, Energy band diagrams, Types of electronic materials: metals, semiconductors, and insulators, Direct and indirect bandgaps (with example), Effective mass, Density of states (Bulk materials).

Module 4: Semiconductors and Photon-Semiconductor interaction [3L]
Semiconductor materials of interest for optoelectronic devices (III-V, II-IV semiconductors; examples and specialty), Optical transitions in semiconductors: LED.

Text Books:

- Integrated Engineering Physics by Amal Kumar Chakraborty, Publisher: Chaya Prakasani
- Engineering Physics by and Panigrahi, Publisher: Oxford.
- Advanced Engineering Physics (Volume II) by Prof. (Dr.) S. P. Kuila, Publisher: New Central Book Agency

Reference Books

- Advanced Quantum Mechanics-J. J. Sakurai (Tata Mc Graw Hill).
- Quantum Computation and Quantum Information(10th Anniversary Edition)-Nielsen & Chuang
- Statistical Mechanics by B.B. Laud (New Age International Pvt Ltd Publishers)
- Statistical Mechanics by Satyaprakash (Visionias)
- Introduction to solid State physics-Kittel (Tata Mc Graw Hill)
- Solid State Physics- Ali Omar (Pearson Eduction)
- Solid state physics- S. O. Pillai (New Age International (P) Limited)
- Solid State Physics-A. J. Dekker (Prentice-Hall India).

PAPER NAME: COMPUTER ORGANIZATION AND COMPUTER ARCHITECTURE LAB
PAPER CODE: IT391
CONTACTS: 0:0:3
CREDITS: 1.5

Prerequisite: Basic concept of Digital Electronics. Course Objective: Implementation of digital logic using XLINX tool. Simulate digital circuit design using XLINX tool

Course Outcome:
After completion of this course students will be able to

CO1:	Apply the knowledge of mathematics, science, and engineering in simulation.
CO2:	Apply quantum mechanics in explaining quantum bits, formation of energy bands.
CO3:	Use Hardware Description Language (HDL) in order to implement skills in designing Architectural solutions and describing designs using VHDL

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**											**1**
CO2		**3**			**2**							**1**
CO3			**3**	**3**								**2**

1. Implementation of simple 8-to-1 line and 4-to-1 line Multiplexer
2. Realization of the basic gates (AND, OR, NOR, NOT, NAND).
3. Implementation of HALF ADDER circuit using basic gates and verify its output.
4. Implementation of FULL ADDER circuit using basic gates and verify its output.
5. Implementation of HALF SUBTRACTER circuit using basic gates and verify its output.
6. Implementation of FULL SUBTRACTER circuit using basic gates and verify its output.
7. Implementation of 1:4 De-Multiplexer and 1:8 De-Multiplexer
8. Implementation of 2:4 decoder and 3:8 Decoder using logic gates.
9. Implementation of 4:2 Encoder and 8:3 En coder using logic gates.
10. Implementation of Binary to its corresponding Gray conversion and vice versa.
11. Implementation of 4-bit Comparator.
12. Implementation of D-Flip-Flop and SR- Flip-Flop,JK Flip-Flop and T Flip-Flop.
13. Implementation of Circuit for 8-bit adder.
14. Implementation of ALU Design.
15. Implementation of CPU Design.

Text Books:

- Mano, M.M., “Computer System Architecture”, PHI.
- Kai Hwang”Advance Computer Architecture” McGraw Hill
- Behrooz Parhami “ Computer Architecture”, Oxford University Press
- Nicholas P Carter”Computer Architecture & Organization” McGraw Hill,

Reference Book:

- Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,
- Hamacher, “Computer Organisation”, McGraw Hill,
- N. senthil Kumar, M. Saravanan, S. Jeevananthan, “Microprocessors and Microcontrollers”

PAPER NAME: ANALOG AND DIGITAL ELECTRONICS LAB
PAPER CODE: IT392
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite:
Mathematics, Basic Electronics, Concepts of Basic Electrical components.

Course Objectives:
The objective of the course is to illustrate the students different electronic circuit and their application in practice.

Course Outcomes:
After completion of this course students will be able to

CO1	Make use of analog and digital electronic circuit devices.
CO2	Examine the characteristics of different analog and digital circuits.
CO3	Construct different combinational and sequential circuits using basic logic gates.

CO vs. PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**											**2**
CO2		**3**		**3**								
CO3			**3**		**2**				**3**	**1**		

List of Experiments:
1. Design of a Class A amplifier.
2. Design of a Phase-Shift Oscillator.
3. Design of a Schmitt Trigger using Op-amp.
4. Realization of basic logic gates.
5. Design of Half and Full adder and Half and Full Subtractor
6. Construction of simple Multiplexer & Demultiplexer circuits using logic gates.
7. Construction of simple Decoder & Encoder circuits using logic gates.
8. Realization of SR / JK / D/ T flip flops using logic gates.
9. Design of Shift Register using J-K / D Flip Flop.
10. Realization of Synchronous Up/Down counters.
11. Design of MOD- N Counter (Synchronous and Asynchronous).
12. Study of DAC and ADC.

Text Books:
- 'Digital Circuits and Design', Salivahanan, S. Arivazhagan, Vikas Publishers
- 'Electronics Fundamentals and Applications', D. Chattopadhyay, P. C. Rakshit, New Age International Publishers

Reference Books:
- 'Digital Design', M. Morris Mano, Pearson Education

PAPER NAME: PYTHON PROGRAMMING Lab
PAPER CODE: IT393
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisite:
Basic knowledge of computers, basic knowledge of programming .

Course Objective:
Use basic concept of python programming language for developing solutions, Develop small projects.

Course Outcome:
After completion of this course students will be able to

CO1	Apply different Programming Concept for application development
CO2	Analyze the application of different features of Python in application development
CO3	Evaluate the performance of different solutions using python to find an optimal solution
CO4	Develop different application using Python

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	2	-	-	-	-	-	-	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2
CO3	3	2	1	3	3	-	-	-	-	-	-	2
CO4	3	3	3	3	3	2	2	3	2	-	-	2

Course Contents:

MODULE 1: Introduction to Python
Installation of Python, Understanding the environment setup of python, Different phases for execution of python program, Basic features of Python, Major Application areas, Advantages and disadvantages.

MODULE 2: Variable and Functions
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

MODULE 3: Control Structure
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;

MODULE 4: List Tuple String
Packages Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Strings, Concepts of packages

MODULE 5: Object Oriented Concepts
Defining class, creation of objects, Built in class, garbage collection, operator overloading, Inheritance.

MODULE 6: Exception Handling
Exception Handling, Assertion, except clause, try-finally, exception with arguments, raising exception, and user defined exception

MODULE 7:. GUI Programming
Turtle Graphics, Writing GUI Programs

MODULE 8: File Operations
File related modules in Python, File modes and permissions, Reading & Writing data from a file, Redirecting output streams to files, Working with directories, CSV files and Data Files

MODULE 9:
ODBC and Python, Working with Databases in MySQL, Working with Tables in MySQL, Working with SQLite Database

MODULE 10: Innovative Idea Development:
Applying Python features for developing innovative projects

Textbooks:
- Core Python Programming by R. Nageswara Rao

Reference books:
- 'Python for Education', Ajith Kumar B. P., Inter University Accelerator Center, New Delhi, 2010.
- 'Python Cookbook: Recipes for Mastering Python 3', 3rd Edition - David Beazley & Brian K. Jones, O'Reilly Media, Inc., 2013.

PAPER NAME: SOFT SKILL AND APTITUDE
PAPER CODE: HU(IT)391
CONTACT: 0:0:2
CREDIT: 1

Prerequisite: Basic ability of soft skills.

Course Outcome
After completion of this course students will be able to:

CO1	Identify, define, apply workplace interpersonal communication modalities in an effective manner.
CO2	Employ, infer, relate group behavioural and personal interview skills.
CO3	Organize, differentiate, employ reading proficiency skills.
CO4	Identify, classify, organize and relate question types and aptitude test patterns in placement tests.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	2	2	1	3	2	3	-	3
CO2	3	2	2	-	2	1	-	3	3	3	-	3
CO3	3	-	-	-	2	-	-	-	-	3	2	3
CO4	3	3	1	1	3	-	-	-	3	3	3	3

Module 1: – Introduction to Soft Skills
The Skills of Interpersonal Communication. 2. Team Behavior. 3. Time Management Skills

Module 2- Verbal Ability: Reading
Enhancing reading speed and vocabulary enhancement through intensive practice of placement test-based reading passages.

Module 3 – Verbal Ability Test Patterns
Introducing Verbal Ability tests—Test Question Types: Synonyms and Antonyms, Error Spotting/Sentence Improvement, Analogies and Para Jumbles.

Module 4 – Group Discussion and Personal Interview.
Basics of Group Discussion—Intensive practice on answering interview-based questions
common in placement interviews.

List of recommended Books:

- Meenakshi Raman and Sangeetha Sharma. Technical Communication. 3rd edition. New Delhi: Oxford University Press, 2015.
- Mark Ibbotson. Cambridge English for Engineering. Cambridge: Cambridge University Press,2008.
- Mark Ibbotson. Professional English in Use: Engineering. Cambridge: ,2009.
- John Seeley. Writing Reports. Oxford: Oxford UniversityPress,2002.
- DianaBooher.E-writing:21stCenturyTools forEffectiveCommunication.Macmillan,2007.
- Michael Swan. Practical English Usage. Oxford: OUP, 1980.

PAPER NAME: ENGINEERING PHYSICS-II LAB
PAPER CODE: PH(IT)391
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite: Knowledge of Physics up B. Tech 1st year Engineering Physics-I Lab course

Course Outcome
At the end of the course students' will be able to

CO1	Demonstrate experiments allied to their theoretical concepts.
CO2	Conduct experiments using semiconductors, dielectric and ferroelectrics.
CO3	Classify various types of magnetic materials.
CO4	Participate as an individual, and as a member or leader in groups in laboratory sessions actively.
CO5	Analyze experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiments.

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2											1
CO2	2	1		3								
CO3			2									1
CO4									3			
CO5										1		2

Experiments
1. Measurement of specific charge of electron using CRT.
2. Determination of band gap of a semiconductor.
3. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given Semiconductor.
4. Study of I-V characteristics of a LED.
5. Study of I-V characteristics of a LDR.
6. To study current-voltage characteristics and load response of Solar Cell.
7. To study areal characteristics and spectral response characteristics of photo voltaic solar cells & measurement of maximum workable power.
8. Study of I-V characteristics of a pn junction diode.
9. Study of I-V characteristics of a Schottky diode.

In addition to regular 7 experiments it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:
1. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.
2. Measurement of Curie temperature of the given sample
3. Study of dipolar magnetic field behavior using deflection magnetometer.
4. Determination of dielectric constant of given sample (frequency dependent)
5. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup

Detailed Syllabus
of
4th Semester

2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT401	Object Oriented Programming Using Java	3	0	0	3	3
2	ENGG	Major	IT402	Software Engineering	3	0	0	3	3
3	ENGG	Major	IT403	Operating System	3	0	0	3	3
4	SCI	Minor	M(IT)401	Discrete Mathematics	3	0	0	3	3
5	HUM	Minor	HU401	Economics for Engineers	2	0	0	2	2
B.PRACTICAL									
1	ENGG	Major	IT491	Object Oriented Programming Lab	0	0	3	3	1.5
2	ENGG	Major	IT492	Software Engineering Lab	0	0	2	2	1
3	ENGG	Major	IT493	Operating System Lab	0	0	3	3	1.5
4	ENGG	Minor	IT494	R-Programming Lab	0	0	2	2	1
5	HUM	Ability Enhancement Course	HU(IT)491	Seminar and Group Discussion	0	0	2	2	1
6	ENGG	Skill enhancement course	HU(IT)495	IT Workshop Lab (SciLab / MATLAB/ C++)	0	0	2	2	1
Total of Theory, Practical								28	21

COURSE NAME: OBJECT ORIENTED PROGRAMMING USING JAVA
COURSE CODE: IT401
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisite:
Basic Programming, Computer Fundamentals

Course Objective:

Understand basic of Object Oriented Programming. Understanding the features of Java. Enable students to write Java program and develop projects

Course Outcome:

After completion of this course students will be able to

CO1	Apply the con concept of Java programming language to find solution of a given problem
CO2	Analyze Java application for correctness
CO3	Evaluate different solution based on object oriented concepts.
CO4	Develop different java application for a given requirement

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	2

Course Contents:
MODULE I: **History and Evolution of Java: [6L]**
The Byte code, Features of Java An overview of Java: Object-Oriented Programming, Structure of a Java program, Data Types and Variables, Type conversion and casting, Arrays ,Class Fundamentals, Declaring Objects, Command-Line Arguments Module II

MODULE II: Class and Object: [10L]
Defining class and object, Class Members-Local variable, instance variable, class variable, Primitive and Reference variable, Constructor, this keyword, finalize and garbage collection, Understanding method- method returning object, passing objects, method passing and returning arrays, use of method overloading. Static-Static block and non-static block, static variable, static method. Nested& inner classes. Lambda expression.

MODULE III: Reusability Property: [6L]
Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super () method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages. Annotation, Introduction to the concept of Module

MODULE IV: String Handling: [2L]
String Constructor, String length, Special string Operations, Character Extraction, String comparison, Modifying a string, String Buffer.

MODULE V: Exception Handling & Multithreading: [6L]
Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes, exception with arguments. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads. Assertion

MODULE VI : Basic IO Operation And File Handling :[2L]
Understanding unformatted and formatted IO. Reading and writing files. Serialization and deserialization.

MODULE-VII: Collection and Generics: [2L]
About Generics, A simple Generic Example, General class with Two Type Parameters, General form of generic class
.

MODULE-VIII: Unit Testing: [2L]
Concept of unit testing, introduction to JUnit test, Assertions, Different test methods, Test suits

Textbooks:

- Herbert Schildt Java Complete Reference TMH
- Reference books:
- Mr Kotiyana JAVA The Complete Core Reference ORACLE
- First Java , Kathie Siera, O'really.

COURSE NAME: SOFTWARE ENGINEERING
COURSE CODE: IT402
CONTACT: 3:0:0
CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Mathematics, Data Structure and Basic Computations.

Course Objective:
In this course, students will gain a broad understanding of the discipline of software engineering and its application to the development of and management of software systems. Knowledge of basic software engineering methods and practices and their appropriate application.

Course Outcome:
After completion of this course students will be able to

CO1	Identify the need for engineering approach to software development and various processes of requirements analysis for software engineering problems.
CO2	Apply software engineering principles, techniques to develop and maintain, large scale software systems
CO3	Analyze and design of complex systems and meet ethical standards, legal responsibilities
CO4	Produce efficient, reliable, robust and cost-effective software solutions and perform independent research and analysis as an effective member or leader of software development team to achieve personal and team goals

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	--	2	--	1	1	--	--	--	--	1
CO2	1	2	2	1	--	2	2	--	1	--	1	1
CO3	1	3	3	2	--	--	--	--	2	2	1	1
CO4	1	2	3	2	--	3	2	--	3	2	2	2

Course Contents:

Module I: Introduction : [2L]
Definition of Software Engineering, Software crisis, Evolution of technology- Hype curve, Exploratory style of Software development vs. Software Engineering, Human cognition mechanism, Software Engineering principle- abstraction and decomposition

Module II: Software Development Life Cycle (SDLC) models : [4L]
Water fall model, V-shape Model, Prototyping Model, Spiral Model, RAD Agile Model,
Verification and Validation.

Module III: Software Project Management [7L]
Responsibility of a project manager, Project planning, Metrics for project size estimation, Project estimation techniques, COCOMO model, Halstead's Software Science, Scheduling- CPM, PERT, Gantt chart, Risk management, Software configuration management, Staffing and team leader project and planning.

Module IV: Requirement analysis and specification [3L]
SRS, Requirement gathering and specification, Functional requirement, Traceability

Module V: Software Design [8L]
Characteristics of a good software, Cohesion and coupling, Function oriented design- DFD, Structure chart. Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design

and the requirements. Object oriented design- class and relationship, UML diagrams.

Module VI: Coding and Testing [7L]
Coding Standard, software documentation, Testing- unit testing, black box testing- equivalence class partitioning, boundary value analysis, white box testing- McCabe's Cyclometric complexity, Mutation Testing, Debugging, Program analysis tool, Integration Testing, Grey box testing, System testing- Smoke and performance testing.

Module VII: Software Reliability and Quality Management [2L]
Reliability, Hazard, MTTF, Repair and Availability, Software quality, Software reliability and fault-tolerance, six-sigma.

Module VIII: Computer-aided software engineering [3L]
Computer-aided software engineering (CASE)-environment and benefit. Function point methods (FSM, ISO,OMG) & Metrics. Standards: Capability Maturity Model Integration, ISO 9001.

Textbooks:

- Rajib Mall: Software Engineering, PHI
- Roger S. Pressman, "Software Engineering – A Practitioner's Approach",
- Seventh Edition, Mc Graw-Hill International Edition

Reference books:

- Ian Somerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
- Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
- Software Engineering: Iyan Somerville, 7th Edition

COURSE NAME: OPERATING SYSTEM
COURSE CODE: IT403
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Basic knowledge of computers, Basic knowledge of programming

Course Outcome:

After completion of the course students will be able to

CO1	Apply various concepts of CPU scheduling, memory management, synchronization and file management.
CO2	Analyze different algorithms of process scheduling, disk scheduling, OS structures and services.
CO3	Evaluate different operating system approaches.
CO4	Design solutions for complex problems related to Process and Memory Management.

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	--	--	--	--	--	--	--	--	--	--	1
CO2	--	3	--	--	--	--	--	--	--	--	--	1
CO3	--	--	3	2	--	--	--	--	--	--	--	1
CO4	--	--	2	3	--	--	--	--	--	--	--	2

Content:

Module-1: Introduction: [6L]
Operating System structure, Operating System operations, Process management, Memory management, Storage management, Protection and security, Kernel data structures, computing environments. Operating System Services, User Operating System interface.

Module-2: Process: [15L]
Processes: Process Concept, Process Scheduling, Interprocess communication.
Process Synchronization: The critical section problem, Peterson's solution, Mutex locks, Semaphores, Classical problems of synchronization.
Multithreaded Programming: Multithreading models.
CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms.
Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.

Module-3: Memory: [10]
Main Memory: Background, swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table.
Virtual Memory: Background, Demand paging, Copy on write, Page replacement algorithms, Allocation of frames, Thrashing.

Module-4: Disk Performance [3L]

Introduction, Why disk scheduling is necessary, Disk scheduling strategies, rotational optimization.
Module-5: File and Database Systems [2L]

Free space management, File access control.

Textbook:
- Operating System Concepts, by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9th Edition, Wiley India, 2012.

Reference Book:
- Operating Systems, A Concept-Based Approach, by DM Dhamdhere, 3rd Edition, Tata Mcgraw-Hill, 2012.

- Modern Operating Systems, by Andrew S. Tanenbaum and Herbert Bos, 4th Edition, Pearson, 2014.
- UNIX complete reference by Herbert Schildt, 2nd edition McgrawHill2.
- Sumitabha Das: UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.

COURSE NAME: DISCRETE MATHEMATICS

COURSE CODE: M(IT)401

CONTACT: 3:0:0

TOTAL CONTACT HOURS: 36

CREDITS: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard set theory, calculus, basic probability.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques of Probability Distribution Abstract Algebra and Graph Theory. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their

Course Outcome(s):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Apply the appropriate mathematical tools for the solutions of the problems in probability and graph theory.

CO2: Identify the distinctive algebraic structures.

CO3: Analyze the real-world uncertain phenomena by identify probability distribution.

CO4: Analyze the real-life problems using the algorithms of graph theory.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
M(IT)401	3	2.5	-	-	-	-	-	-	-	-	-	-

Course Content:

Module-I: Probability Distributions [12L]

Random Variable: Discrete and Continuous, Probability Distribution, Probability Mass Function and Probability Density Function for single variable only, Distribution Function, Expectation and Variance, Special Types of Distributions: Binomial, Poisson and Normal, Binomial Approximation to Poisson distribution and Normal Distribution

Module-II: Algebraic Structures [12L]

Group, Commutative Group, Order of a Group, Order of an element of a Group, Properties of Group, Subgroup, Cyclic group, Coset, Lagrange‘s theorem, Normal subgroup, Permutation group, Symmetric group(S3). Ring, Properties of Ring, Sub ring, Integral Domain, Field.

Module -III: Graph Theory [12L]

Graph: Properties and Theorems, Digraphs, Weighted Graph, Connected and Disconnected Graph, Bipartite Graph,

complement of a Graph, Regular Graph, Complete Graph, Walk, Path, Circuit, Euler Graph, Hamiltonian Circuit, Adjacency and Incidence Matrices of a Graph, Tree: Properties and Theorems, Binary Tree, Spanning Tree, Minimal Spanning Tree, Dijkstra's algorithm, Kruskal's Algorithm, Prim's Algorithm

Text Books:

- Das, N.G., Probability and Statistics, The McGraw Hill Companies.
- Chakraborty, S. K. and Sarkar, B. K., Discrete Mathematics, Oxford University Press.
- Deo, N., Graph Theory with Applications to Engineering and Computer Science, Prentice Hall.

Reference Books:

- Gupta, S. C. and Kapoor, V. K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- Sharma, J. K., Discrete Mathematics, Macmillan.
- Wilson: Introduction to Graph Theory, Pearson Education.
- Mapa, S. K., Higher algebra: Abstract and Linear, Levant , 2011.
- Grewal, B. S., Higher Engineering Mathematics, Khanna Pub.
- Kreyzig, E. Advanced Engineering Mathematics, John Wiley and Sons.
- Spiegel, M. R., Schiller, J. J. and Srinivasan, R. A., Probability and Statistics (Schaum's Outline Series), TMH.

COURSE NAME: ECONOMICS FOR ENGINEERS
COURSE CODE: HU 401
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDIT: 2

Course Objective:
The objective of this course is to acquaint the students with the basic principles of economics and develop decision making skills using basic economic Principles, to educate the students in evaluating various Business Projects.

Course Outcome:
After completion of this course students will be able to

CO1	Apply the appropriate engineering economics analysis method for problem solving
CO2	Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.
CO3	Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and systems.
CO4	Evaluate the profit of a firm, carry out the break even analysis and employ the tool to make production decision.
CO5	Discuss and solve advanced economic engineering analysis problems including taxation and inflation.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	2	-	-	-	1	-	-	1	-	3	1
CO2	-	2	-	-	-	1	-	-	1	-	3	1
CO3	-	2	-	-	-	1	-	-	1	-	3	1
CO4	-	2	-	-	-	1	-	-	1	-	3	1
CO5	-	2	-	-	-	1	-	-	1	-	3	1

Course Contents:
MODULE I: [2L]
Introduction to Economics:
Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and Scope of Economics, Managerial Decision Analysis.

Module II : [4L]
Demand-Supply Framework & Equilibrium:
Demand and Supply: Determinants of demand, movements vs. shift in demand curve, Determinants of Supply, Movement along a supply curve vs. shift in supply curve; Market equilibrium and price determination.
Elasticity of demand and supply, Application of demand and supply.
Consumer Theory: Ordinal Utility theory: (Indifference curve approach): Consumer's preferences; Indifference curves; Budget line; Consumer's equilibrium.

Module III: [6L]
Theory of Production and Costs:
concept of Production function, types of Production function, Laws of return to scale and variable Proportion, Cost Function, Types of Cost Function, Different Cost curves, Relation between Average and marginal cost, Relationship between Short Run costs and Long Run costs, Cost volume profit analysis and it's application

Module IV: [4L]
Selected Macroeconomic Principles:
Introduction to Macroeconomic Variables – Circular Flow of Income – Closed and Open Economy Models - Saving-Investment Identity.
National income and different technique to measure of national income
inflation: Inflation – Causes, Measurement, Effect, Measures to Control Inflation.

Module V: [5L]

Financial Accounting and Financial management:

Accounting Basic concept of Journal, Trading A/C, Profit& Loss A/C, Balance Sheet and the concept of time value of money(application of all factors of time value of money) & Capital budgeting technique.

Module VI: [3L]

Market Structure:

Classification of Different Markets (Concepts only) – Perfect Competition, Monopoly, Monopolistic Competition, Monopsony and Oligopoly.

Perfect Competition: Assumption; Theory of a firm under perfect competition; Demand and Revenue; Equilibrium of the firm in the short run and long run.

Monopoly: Short-run and long-run equilibrium of monopoly firm; Price discrimination.

Text books:

1. Economics, by Lipsey and Chrystal, Oxford university Press
2. Modern Accountancy, Vol.-I-, by Hanif &Mukherjee, Tata Mgrow Hill

Reference books:

1. Modern Economic Theory, by K.K. Dewett, S.Chand Principles of Economics, by H.L. Ahuja, S. Chand
2. Engineering Economics, by R. Paneer Seelvan, PHI
3. Economics for Engineers, by Dr. Shantanu Chakraborty & Dr. Niranjana Singha Roy, Law Point Publication

COURSE NAME: OBJECT ORIENTED PROGRAMMING LAB
COURSE CODE:IT491
CONTACT:0:0:3
CREDITS:1.5

Prerequisite:
Basic knowledge of computers, basic knowledge of programming

Course Objective:
Enable students to use basic object oriented features in coding. Enable students to develop small projects

Course Outcome
After completion of this course students will be able to
CO1: Apply object oriented programming concepts in designing programs. CO2: Analyze different dimensions of a problem and provide optimal solutions. CO3: Evaluate and analyze different solution based on object oriented concepts.
CO4: Implement solutions of real-life problems in the field of Information Technology.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-
CO3	-	-	3	2	-	-	-	-	-	-	-	-
CO4	-	-	3	-	3	-	-	-	-	-	-	2

Course Contents:

Module 1: Basic Program introduction
Writing simple java program, compiling and running. Understanding the main () method.

Module 2: Basic Java Concepts
Using basic java token, control structures. Illustrating class objects, constructor, final, finalize.
Understanding Arrays and hands on application using array. Understanding and writing methods.
Static and non static concepts.

Module 3: Reusable properties
Class Relationship. Using inheritance
Creating abstract classes, interfaces.

Module 4: String
String handling, Basic string handling concepts

Module 5: Exception and Threading:
Illustrating exception handling Illustrating multi threading applications

Module 6: IO:
Basic IO and File IO operation

Module 7: Generics and Collection

Test application using generics and collection classes

Module 8: Unit Test
JUnit Test

Module 9: Innovative Idea Development:
Applying Java new features for developing innovative projects

Textbooks:
Herbert Schildt Java Complete Reference TMH

Reference books:
Mr Kotiyana JAVA The Complete Core Reference ORACLE
Kathie Seira Head Forst Java Orielley

COURSE NAME: **SOFTWARE ENGINEERING LAB**
COURSE CODE: **IT492**
CONTACT: **0:0:2**
CREDIT: **1**

Prerequisite:
Familiar with MS Office Package and Basic Computations

Course Objective:
Demonstrate the UML diagrams with ATM system descriptions; demonstrate the working of software testing tools with c language, Understanding Project Planning Tools.

Course Outcome:
After completion of this course students will be able to

CO1	Make use of efficient models for development of software for various projects.
CO2	Analyze a specification and examine the corresponding design for developing software.
CO3	Produce efficient, reliable, robust and cost-effective software solutions Designing valid test cases.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	--	2	1	1	--	--	1	1	--	1
CO2	1	3	--	3	3	2	--	--	2	2	--	1
CO3	1	3	3	3	3	3	2	3	3	3	3	1

Course Contents:
List of Experiments:

1. Identifying the Requirements from Problem Statements
2. Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
3. Estimation of Project Metrics
4. Project Estimation Techniques -COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
5. Modelling UML Use Case Diagrams and Capturing Use Case Scenarios
6. Use case diagrams, Actor, Use Case, Subject, Graphical Representation, Association between Actors and Use Cases, Use Case Relationships, Include Relationship, Extend Relationship, Generalization Relationship, Identifying Actors, Identifying Use cases, Guidelines for drawing Use Case diagrams
7. Identifying Domain Classes from the Problem Statements
8. Introduction to selenium tool for software testing.
9. JUnit, Static analysis, Junit Framework
10. Prepare a SRS document in line with the IEEE recommended standards
11. Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case.
12. Draw the sequence diagram for any two scenarios.
13. Draw the collaboration diagram.
14. Draw the state chart diagram & component diagram.
15. Draw the deployment diagram.

Textbooks:

1. Rajib Mall: Software Engineering, PHI
2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition

Reference books:

1. Ian Somerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2011.
2. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
3. Software Engineering: Iyan Somerville, 7th Edition

PAPER NAME: OPERATING SYSTEM LAB
PAPER CODE: IT493
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisites: Basic knowledge of computers, Basic knowledge of programming

Course Objective:
Th The objective of the course is to have students understand and appreciate the principles in the design and implementation of operating systems software.

Course Outcome:
After completion of this course students will be able to

CO1	Experiment with Unix commands and shell programming
CO2	Analyze the best CPU scheduling algorithm, memory management algorithm, synchronization techniques for a given problem instance
CO3	Develop algorithm for deadlock avoidance, detection and file allocation strategies

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3				3				2			2
CO2		3			3				2			2
CO3			3	3	3				2			3

Course Contents:
Module 1: Basic Commands of UNIX:
File and Directory Related commands, Process and status information commands, Text related commands, File Permission commands, Pipes and filters, Managing Local Users and Groups

Module 2: Shell programming
Variables, Control Structure, Loop, Array, Function

Module 3: System Calls
I/O and Unix System Calls

Module 4: Process Synchronization
Implementation of Classical Synchronization problems using Semaphore

Module 5: CPU Scheduling Algorithm

Module 6: Memory Management Schemes

Module 7:.Page Replacement Algorithm

Textbooks:

- Russ Cox, Frans Kaashoek, Robert Morris, xv6: a simple, Unix-like teaching operating system", Revision8.
- Sumitabha Das , UNIX Concepts and Applications, Tata McGraw-Hill

COURSE NAME: R PROGRAMMING LAB
COURSE CODE: IT494
CONTACT: 0:0:2
CREDITS: 1

Prerequisite:
Basic knowledge of computers, basic knowledge of programming

Course Objective:
Enable students to use basic object oriented features in coding. Enable students to develop small projects

Course Outcome
After completion of this course students will be able to
CO1: Apply R programming concepts in designing programs.
CO2: Analyze different dimensions of a problem and provide optimal solutions. CO3: Evaluate and analyze different solution based for data analysis.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-
CO3	-	-	3	2	-	-	-	-	-	-	-	-

Course

Contents:
1.Download and install R-Programming environment and install basic packages using install.packages() command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)
3. Write a program to find list of even numbers from 1 to n using R-Loops.
4. Create a function to print squares of numbers in sequence.
5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write a program to read a csv file and analyze the data in the file in R.
9.Create pie chart and bar chart using R.
10. Create a data set and do statistical analysis on the data using R.

Textbooks:
Norman Matloff, The Art of R Programming, UC Davis 2009.

WEB REFERENCE:
https://www.r-project.org/

COURSE NAME: SEMINAR AND GROUP DISCUSSION
COURSE CODE: HU(IT)491
CONTACTS: 0:0:2
CREDIT: 1

Prerequisite: Basic spoken English skills and presentation skills.

Course Outcome
The Graduates of the IT program will be able to:
CO1: identify, define, apply workplace interpersonal communication modalities in an effective manner.
CO2: employ, infer, relate group behavioral and personal interview skills.
CO3: organize, differentiate, employ reading proficiency skills.
CO4: identify, classify, organize and relate question types and aptitude test patterns in placement tests.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	2	2	1	3	2	3	-	3
CO2	3	2	2	-	2	1	-	3	3	3	-	3
CO3	3	-	-	-	2	-	-	-	-	3	2	3
CO4	3	3	1	1	3	-	-	-	3	3	3	3

Course Content

Module 1: – Fundamentals of Technical Communication
1.The Skills of Technical Communication, 2. Team Behavior. 3. Time Management Skills**3L**

Module 2: - Verbal ability .**3L**
1.Reading skill Development, Enhancing reading speed and vocabulary enhancement through intensive practice of placement test-based reading passages.

Module 3: Presentation Strategy
Presentation: Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Module 4: – Group Discussion and Personal Interview**2L**
Basics of Group Discussion—Intensive practice on answering interview-based questions
common in placement interviews.

List of recommended Books:

- Meenakshi Raman and Sangeetha Sharma. Technical Communication. 3rd edition.New Delhi: Oxford University Press, 2015.
- Mark Ibbotson. Cambridge English for Engineering. Cambridge: CambridgeUniversity Press, 2008.
- MarkIbbotson. Professional English in Use: Engineering. Cambridge:CambridgeUP,2009.

Reference Books:

- Lesikar. Business Communication: Connectingin a Digital World. New Delhi:TataMcGraw- Hill,2014.
- John Seeley. Writing Reports. Oxford: Oxford UniversityPress,2002.
- DianaBooher.E-writing:21stCenturyTools forEffectiveCommunication.Macmillan,2007.
- Michael Swan. Practical English Usage. Oxford: OUP, 1980.

COURSE NAME: IT WORKSHOP LAB
COURSE CODE: HU(IT)495
CONTACT: 0:0:2
CREDITS: 1

Prerequisite:
Basic knowledge of computers, basic knowledge of programming

Course Objective:
Enable students to use basic object oriented features in coding. Enable students to develop small projects

Course Outcome
After completion of this course students will be able to
CO1: Apply MATLAB tools in designing programs.
CO2: Analyze different dimensions of a problem and provide optimal solutions.
CO3: Evaluate and analyze different solution in the domain of image processing and machine learning.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-
CO3	-	-	3	2	-	-	-	-	-	-	-	-

Course

Contents:
Module 1: Introduction to MATLAB
The MATLAB Environment , MATLAB Basics – Variables, Numbers, Operators, Expressions, Input and output. Vectors, Arrays – Matrices

Module 2: MATLAB Functions
Built-in Functions , User defined Functions

Module 3: Graphics with MATLAB
Files and File Management – Import/Export , Basic 2D, 3D plots , Graphic handling

Module 4: Programming with MATLAB
Conditional Statements, Loops • MATLAB Programs – Programming and Debugging. • Applications of MATLAB Programming.

Module 5: Mathematical Computing with MATLAB
Algebraic equations , Basic Symbolic Calculus and Differential equations , Numerical Techniques and Transforms

Textbooks:
- Guide to MATLAB - for Beginners and Experienced Users", 2nd Ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press, (2006).

Reference books:
- "Essentials of MATLAB Programming", 2nd Ed., Stephen J. Chapman, Cengage Learning, (2009).
- "MATLAB Demystified", David McMahon, The McGraw-Hill Companies, (2007).

Detailed Syllabus
of
5th Semester

3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT501	Database Management System	3	0	0	3	3
2	ENGG	Major	IT502	Computer Networking	3	0	0	3	3
3	ENGG	Major	IT503	Design and Analysis of Algorithm	3	0	0	3	3
4	ENGG	Major	IT504	Artificial Intelligence	3	0	0	3	3
5	ENGG	Minor	IT505	A. e-Commerce and ERP B. Mobile Application Development C. Microprocessor and Microcontroller	2	0	0	2	2
B.PRACTICAL									
1	ENGG	Major	IT591	Database Management System Lab	0	0	3	3	1.5
2	ENGG	Major	IT592	Computer Networking Lab	0	0	3	3	1.5
3	ENGG	Major	IT593	Design and Analysis of Algorithm Lab	0	0	2	2	1
4	ENGG	Major	IT594	Artificial Intelligence Lab	0	0	3	3	1.5
5	ENGG	Minor	IT595	A. E-Commerce and ERP Lab B. Mobile Application Development Lab C. Microprocessor and Microcontroller Lab	0	0	2	2	1
6	PRJ	Project	IT581	Minor Project-I	0	0	0	2	1
Total of Theory, Practical								29	21.5

COURSE NAME: DATABASE MANAGEMENT SYSTEM
COURSE CODE: IT501
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite: Logic of programming language, Basic concepts of data structure and algorithms

Course Objective: To develop conceptual understanding of database management system for solving different industry level problems & to learn its applications.

Course Outcome: After completion of this course students will be able to

CO1: Understand Database Management System, explain fundamental elements of a database management system.
CO2: Compare the basic concepts of relational data model, entity-relationship model, file organization and use appropriate index structure.
CO3: Apply efficient query optimization techniques, suitable transaction management, concurrency control mechanism and recovery management techniques.
CO4: Analyze the database design techniques and improve the design by normalization.
CO5: Design entity-relationship diagrams to represent simple database application scenarios, translate entity-relationship diagrams into relational tables, populate a relational database and formulate SQL queries on the data.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	2	-	-	-	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-
CO3	3	3	3	3	3	2	1	-	-	-	-	-
CO4	3	3	3	2	3	2	2	-	-	-	-	-
CO5	3	2	3	2	3	2	2	-	-	-	1	1

Course Contents:
Module I: [2L]
Introduction: Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module II :[9L]
Entity-Relationship and Relational Database Model
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module III: [6L]
SQL and Integrity Constraints
Concept of DDL, DML, DCL. Basic Structure, set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module IV: [8L]
Relational Database Design
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study.

Module V: [7L]
Internals of RDBMS
Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.

Module VI: [6L]
File Organization & Index Structures
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes.

Text books:
1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.

Reference books:
1. Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing.
2. Ramakrishnan: Database Management System, McGraw-Hill

COURSE NAME: COMPUTER NETWORKING
COURSE CODE: IT 502
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Basic Digital Communication, Computer Architecture and Operating System.

Course Objective:
Understanding the basic concept of different network models, explaining the network architecture, analyzing and evaluating different network protocols.

Course Outcome:
After completion of this course students will be able to

CO1	Illustrate the network topologies, model and architecture.
CO2	Apply different networking device, protocol for problem solving
CO3	Analyse different networking functions in different layer of OSI and TCP/IP Model.
CO4	Evaluate the optimal route for communication and idea about routing algorithms for data transmission.
CO5	Design network architecture and implement in practical field of work.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	2	1	--	--	--	--	--	--	2
CO2	3	3	2	2	3	--	3	--	--	--	--	3
CO3	3	3	2	3	2	3	--	--	--	--	--	2
CO4	3	3	2	3	3	--	--	--	--	--	--	2
CO5	3	3	3	1	3	3	3	3	2	--	--	3

Course Contents:

Module I: [4L]
Overview of Data Communication and Networking: Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI and TCP/IP.

Module II: [5L]
Physical Layer: Overview of data, signal, transmission & transmission media; Circuit switching: time division & space division switch, TDM bus; Telephone Network.

Module III: [8L]
Data link Layer: Types of errors, framing, error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go Back- N ARQ, Selective repeat ARQ, HDLC; Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet.

Module IV: [7L]
Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: IP addressing, subnetting; Routing: techniques, Routing Protocols, ARP, IP, ICMP, IPV6.

Module V: [6L]
Transport layer: Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm.

Module VI: [6L]
Application Layer: DNS, SMTP, SNMP, FTP, HTTPS, Firewalls, IP Filtering.

Text books:
1. B. A. Forouzan – "Data Communications and Networking (5th Ed.) "– TMH.
2. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education.

Reference books:
1. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI.
2. Black, Data & Computer Communication, PHI.
3. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP.

COURSE NAME: DESIGN AND ANALYSIS OF ALGORITHM
COURSE CODE: IT503
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite: Discrete Mathematics Data Structure and Basic Programming Knowledge

Course Objective: The objective of the course is to study paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice, use different computational models, order notation and various complexity measures to analyze the complexity/performance of different algorithms.

Course Outcome: After completion of this course students will be able to

CO1: Understanding the time complexity of the basic algorithms for the classic problems in various domains.
CO2: Apply the classic algorithms to solve different problems.
CO3: Evaluate existing algorithms by calculating the time complexity.
CO4: Design algorithm to solve various problems in different domains.
CO5: Design efficient algorithms for common engineering problems

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

Course Contents:
Module I: [2L]
Introduction: Time and Space Complexity, Different Asymptotic notations and their mathematical significance

Module II : [8L]
Divide and Conquer: Basic method, use, Merge Sort, Quick Sort and their complexity, Heap Sort and its complexity Dynamic Programming: Basic method, use, Matrix Chain multiplication, All pair shortest paths, single source shortest path, Strassen's matrix multiplication algorithm.

Module III: [8L]
Backtracking: Basic method, use, 8 queens problem, Graph coloring problem. Greedy Method: Basic method, use, Knapsack problem, traveling sales man, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm.

Module IV: [3L]
Branch and bound technique: integer programming, 0/1 knapsack problem

Module V: [4L]
Disjoint set manipulation: Set manipulation algorithm like UNION-FIND, union by rank. R18 B.Tech. IT Page 106 of 228 String matching problem: Different techniques – Naive algorithm, Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Module VI: [6L]
Amortized Analysis: Aggregate, Accounting, and Potential Method. Network Flow: Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

Module VII: [5L]
Notion of NP-completeness: P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability problem, Cook's theorem (Statement only). Approximation Algorithms: Necessity of

approximation scheme, performance guarantee, polynomial time approximation schemes.

Text books:

1. A. Aho, J. Hopcroft and J. Ullman “The Design and Analysis of Algorithms”
2. D. E. Knuth “The Art of Computer Programming”, Vol. 3
3. E. Horowitz and Shani “Fundamentals of Computer Algorithms” Reference books:
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms

Reference books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms

COURSE NAME: ARTIFICIAL INTELLIGENCE
COURSE CODE: IT504
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisite:
Data Structure, Design and Analysis of Algorithms, Statistics

Course Objective:
Comprehend the fundamental concepts of Knowledge Representation and Inference in Artificial Intelligence and its utilitarian importance in current technological context

Course Outcome
After completion of this course students will be able to
CO1: Understand and explain the fundamental concepts of Knowledge Representation
CO2: Apply difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
CO3: Explore relevant literature and apply the concept of Heuristic Techniques of Artificial Intelligence to solve problems.
CO4: Develop Inference Models for proposing solutions to the problems of Artificial Intelligence.
CO5: O5 Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.

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

Course Contents:
Module I: [3L]
Introduction to Artificial Intelligence:
Basic Concepts, History of Artificial Intelligence, Architecture of an Artificial Intelligent Agent, structure of agents, goal based agents, utility based agents, learning agents. Applications of Artificial Intelligence

Module II : [5L]
Artificial Intelligence Problem Formulation as State-Space Exploration Problem for Goal Searching: Basic Concepts, State-Space Exploration Formulation for Water Jug Problem, Missionaries and Cannibals Problems, 8-Puzzle Problem, Constraint Satisfaction Problem and Production System for Goal Searching. Blind Search Techniques for Goal Searching: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bi-directional Search.

Module III: [7L]
Heuristic Techniques for Goal Searching
Basic Concepts of Heuristic Techniques and Properties of Heuristic Functions, Hill Climbing Search. Best First Search, A* Search, Memory-bounded heuristic search: Iterative-deepening A* Search, Recursive Best First Search, Simplified Memory Bounded A* Search. Simulated Annealing Based Stochastic Search, Genetic Algorithm Based Evolutionary Search, Ant Colony Optimization

Module IV: [2**L]**
Adversarial Search for Game Playing:
Basic Concepts, Minimax Search, Alpha-Beta Pruning.

Module V: [5L]
Knowledge Representation and Inference using Propositional Logic and Predicate Logic:
Propositional Logic: Knowledge Representation and Inference using Propositional Logic Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic

Module VI: [4L]
Knowledge Representation :
Semantic Nets and Frames. Strong Slot-and-Filler Structure for Knowledge Representation: Conceptual Dependency and Script. Expert System: Introduction to expert system, Phases of expert system, characteristics of expert system and a case study; Introduction of Executive Support System and Decision Support System

Module VII: [8L]
Reasoning under Uncertainty:
Bayesian Inferencing and Bayesian Belief Network, Dempster-Shafer Theory, Overview of Fuzzy Logic and Inferencing, Overview of Hidden Markov Model.
Introduction to Natural Language Processing: Basic Concepts, Steps of Natural Language Processing, Morphological, Syntactic and Semantic Analysis, Discourse Integration and Pragmatic Analysis, Applications of Natural Language Processing.

Module VII: [2L]
Introduction to Machine Learning;
Basic concepts of Machine Learning Model, Supervised Learning, Unsupervised Learning, and Reinforced Learning, Overview of Artificial Neural Network

Text books:
1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
2. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGrawHill.

Reference books:
1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill.

COURSE NAME: E-COMMERCE AND ERP
COURSE CODE: IT 505A
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 35
CREDITS: 2

Prerequisite:
Concepts of Computer Networking, Operating System, Database Management System

Course Objective:
The objective of the course is to explain the characteristics and functions of electronic commerce including mobile commerce, fundamental characteristics of electronic markets, common business models used in B2C and B2B electronic commerce. To acquire an overview to ERP and the knowledge on related technologies. Skill to ERP Manufacturing Perspective and ERP modules and to examine ERP tools and understand the benefits of ERP.

Course Outcome
After completion of this course students will be able to

CO1: Understand the policy issues related to privacy, intellectual property rights, and establishing identity those are germane to electronic commerce along with the Internet and related technologies.
CO2: Comprehend the underlying economic mechanisms and driving forces of E-Commerce.
CO3: Analyse the impact that electronic commerce is facing and outlines the different digital transaction process and basic concepts of e-commerce.
CO4: Identify different technologies and IT support used in ERP.
CO5: Apply different tools used in ERP.

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

Course Contents:
Module I: [5L]
Introduction to E-Commerce:
Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, l Interchange and Internet Commerce.

Module II: [6L]
Business to Business E-Commerce:
Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E-commerce. Business models for E-commerce, Business Process Re-Engineering.

Module III: [5L]
Legal issues:
Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.

Module IV: [7L]
Security Issues:
Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security, Search engines, Intelligent agents in E-Commerce Electronic payment systems, E-security

Module V: [7L]

Business to Consumer E-Commerce and E-Business:

Consumer trade transaction, Web metrics, Elements of E-Commerce, Industry impacts of E-business. Integrating Intranet and internet web applications across multiple networks. Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Module VI: [5L]

Mobile Commerce:

Overview, Infrastructure, Applications, Mobile Payment, Limitations, Security in M-Commerce, ERP and Data warehousing, ERP and E-business.

Text books:

- E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH
- Handbook on Electronic Commerce, Shaw et al., Springer publication.
- Enterprise Resource Planning –Alexis Leon, Tata McGraw Hill

Reference books:

- E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH.
- Applied E-Commerce, Langer, John Wiley Publication.
- E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH.
- Enterprise Resource Planning, 2nd Edition by Alexis Leon, Tata McGraw Hill Education, 2008.
- Guide to Planning ERP Application, Annetta Clewwto and Dane Franklin, McGraw Hill, 1997.

COURSE NAME: MOBILE APPLICATION DEVELOPMENT
COURSE CODE: IT505B
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDITS: 2

Prerequisite:
Knowledge in basic programming languages

Course Objective
This course introduces students to programming technologies, design and development related to mobile applications. Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using an OS Software Development Kit (SDK). Upon completion, students should be able to create basic applications for mobile devices.

Course Outcome
After completion of this course students will be able to
CO1: Identify various concepts of mobile programming that make it unique from programming for other platforms,
CO2: Critique mobile applications on their design pros and cons
CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
CO4: Program mobile applications for the Android operating system that use basic and advanced phone features
CO5: Deploy applications to the Android marketplace for distribution.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	2	-	-	-	-	-	-	1
CO2	1	3	-	-	2	-	-	-	-	-	-	1
CO3	1	3	1	-	2	-	-	-	-	-	-	1
CO4	1	-	3	-	2	-	-	-	-	-	-	1

Course Contents:

Module I: [7L]
Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

Module II: [8L]
Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

Module III:[7L]
Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Module IV:[7L]
Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

Module V:[7L]
Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Text books:

1. T1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed.

Reference books:

1. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd
2. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

COURSE NAME: MICROPROCESSOR & MICROCONTROLLER
COURSE CODE: IT505C
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDITS: 2

Prerequisite:
Digital Electronics, Computer Programming, Computer Organization and Architecture

Course Objective:
To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques

Course Outcome
After completion of this course students will be able to
CO1: Describe the general architecture of a microcomputer system and architecture & organization of 8085 & 8086 Microprocessor
CO2: Understand the difference between 8085 and advanced microprocessor.
CO3: Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.
CO4: Recognize 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts
CO5: Understand and realize the Interfacing of memory & various I/O devices with 8085 microprocessors.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	3	-	3	-	2	-	-	3	2	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	1
CO3	2	3	-	-	3	-	-	-	2	-	-	1
CO4	2	-	-	3	3	-	-	-	2	2	-	1
CO5	2	-	-	3	3	-	-	-	2	2	-	1

Course Contents:
Module I: [10L]
Introduction to Microcomputer based system: History of evolution of Microprocessor and Microcontrollers and their advantages and disadvantages. Architecture of 8085 Microprocessor, Pin description of 8085. Address/data bus De multiplexing, Status Signals and the control signals. Instruction set of 8085 microprocessors, Addressing modes Timing diagram of the instructions (a few examples).

Module II: [**10L]**
Assembly language: programming with examples, counter and Time Delays, Stack and Subroutine Interrupts of 8085 processor (software and hardware), I/O Device Interfacing I/O Mapped I/O and Memory Mapped I/O, Serial (using SID and SOD pins and RIM, SIM Instructions) and transfer

Module III: [8L]
The 8086 microprocessors: Architecture, Addressing modes, interrupts. Introduction to 8051 Microcontroller – Architecture, Pin Details Addressing modes, Instruction set, Examples of Simple Assembly Language.

Module IV: [8**L]**
Memory interfacing with 8085, 8086 Support IC chips- 8255, 8251, 8237/8257, 8259, Support IC chips- 8255, 8251, 8237/8257, 8259, Interfacing of 8255 PPI with 8085 and Microcontroller 8051. Brief introduction to PIC microcontroller (16F877)

Text books:
1. Microprocessor architecture, programming and application with 8085 – R.
Gaonkar, Penram International

2. Fundamentals of microprocessor and microcontroller- B.Ram
3. An Introduction to Microprocessor and Applications –Krishna Kant, Macmillan

Reference books:

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford university press
2. 8086 Microprocessor –K Ayala, Cengage learning
3. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
4. The 8051 microcontrollers – Uma Rao and Andhe Pallavi, Pearson
5. The 8051 Microcontroller and Embedded System- Mazidi
6. The 8051 microcontroller - K. Ayala, Thomson

COURSE NAME: DATABASE MANAGEMENT SYSTEM LAB
COURSE CODE: IT591
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisite: Knowledge about the basics of electronics and basic concepts in logic design, basic knowledge of data structure and programming concept.

Course Objective: To develop conceptual understanding of database management system for solving different industry level problems & to learn its applications

Course Outcome: After completion of this course students will be able to
CO1 Applying SQL and PL/SQL for processing database.
CO2 Analyze the database using queries to retrieve records.
CO3 Develop solutions using database concepts for real time requirements.
CO4 Students get practical knowledge on designing and creating relational database systems.
CO5 Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.

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

Course Contents:
1. Study of Backend Tool – Oracle.
2. Data Definition Language (DDL) commands in RDBMS.
3. Data Manipulation Language (DML) and Data Control Language (DCL) commands in RDBMS.
4. High-level language extension with Cursors.
5. High level language extension with Triggers
6. Procedures and Functions.
7. Embedded SQL.
8. Database design using E-R model and Normalization.
9. Mini project (Application Development using Oracle and Visual Basic)
i. Inventory Control System.
ii. Material Requirement Processing
iii. Hospital Management System
iv. Railway Reservation System
v. Personal Information System
vi. Web Based User Identification System
vii. Time-table Management System

Text books:
1. ORACLE PL/SQL by example. Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rd Edition
Reference books:
1. ORACLE DATA BASE LOG PL/SQL Programming SCOTT URMAN, Tata Mc- Graw Hill.
2. SQL & PL/SQL for Oracle 10g, Black Book, Dr.P.S. Deshpande.

COURSE NAME: COMPUTER NETWORKING LAB
COURSE CODE: IT 592
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisite:
Basic Operating System.

Course Objective:
Understanding the basic concept of different network models, explaining the network architecture, apply different computer routing algorithms in real life problems.

Course Outcome:
After completion of this course students will be able to

- **CO1** Analyse different network topologies and devices.
- **CO2** Apply the concept of different type of networking for implementation.
- **CO3** Implement and discuss the various services offered by transport layer such as TCP and UDP.
- **CO4** Apply channel allocation, framing, error and flow control techniques.
- **CO5** Apply the basics of networking protocols for solving real life networking problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**2**	**3**	--	--	--	--	--	--	**2**
CO2	3	2	3	2	2	--	--	--	--	--	--	2
CO3	3	3	2	2	3	--	--	--	--	--	--	2
CO4	3	3	2	3	3	1	1	2	2	--	--	3
CO5	3	3	3	2	2	1	1	1	1	2	3	3

Course Contents:
1. Familiarization with: Different networking cables, Different connectors, Hubs, Switches, Routers.
2. NIC Installation & Configuration (Windows/Linux).
3. Understanding IP address, subnet etc, Connect the computers in Local Area Network.
4. Study of basic Network Configuration commands.
5. Configure a Network topology using packet tracer software.
6. Link Layer Error Detection Mechanism (Cyclic Redundancy Check), Data Link Layer Error Control mechanism (Selective Repeat, Go Back N).
7. Implementation of Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window), Data 8. Server Setup/Configuration: FTP, TELNET, NFS, DNS, Firewall.
9. TCP/UDP Socket Programming: Simple, TCP based, UDP based Multicast & Broadcast Sockets.
10. CISCO Packet Tracer Example.

Text books:
1. A. Forouzan – "Data Communications and Networking (5th Ed.) "– TMH.
2. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education.

Reference books:
1. A.S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI.
2. Black, Data & Computer Communication, PHI.
3. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP.

COURSE NAME: DESIGN ANALYSIS OF ALGORITHM LAB
COURSE CODE: IT593
CONTACT: 0:0:2
CREDIT: 1

Prerequisite: Discrete Mathematics, Data Structure, Basic Programming Knowledge

Course Objective: The objective of the course is to analyze and design algorithms, use different computational models, order notation and various complexity measures to analyze the performance of different algorithms.

Course Outcome: After completion of this course students will be able to
CO1 : Analyze algorithm to solve problems by iterative approach.
CO2: Analyze algorithm to solve problems by divide and conquer approach.
CO3: Implement algorithm to solve problems by Greedy algorithm approach.
CO4: Apply algorithm to solve problems by Dynamic programming, backtracking, branch, and bound approach..
CO5: Implement algorithm to solve problems by branch and bound approach.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	3	2	2	1	-	-	-	-	-	3	1
CO2	1	3	2	3	2	-	-	-	-	-	2	1
CO3	3	2	2	1	2	-	-	-	-	-	2	1
CO4	2	2	2	1	2	-	-	-	-	-	2	2
CO5	2	2	2	2	1	-	-	-	-	-	2	2

Course Contents:
1. Implement Merge Sort using Divide and Conquer approach
2. Implement Quick Sort using Divide and Conquer approach
3. Find the minimum number of scalar multiplication needed for chain of matrix using dynamic programming
4. Implement all pair of shortest path for a graph (Floyd-Warshall Algorithm) using dynamic programming
5. Implement Traveling Salesman Problem using dynamic programming
6. Implement Single Source shortest Path for a graph using Bellman Ford Algorithm
7. Implement 15 Puzzle Problem using Branch and Bound technique.
8. Implement 8 Queen Problem using Backtracking.
9. Implement any one of the following problems using Backtracking: Graph Coloring Problem, Hamiltonian Problem
10. Implement any one of the following problem using Greedy method: Knapsack Problem, Job sequencing with deadlines
11. Implement KMP algorithm for string matching.
12. Implement Ford Fulkerson algorithm.

Text books:
1. Hopcroft and J. Ullman “The Design and Analysis of Algorithms”
2. D. E. Knuth “The Art of Computer Programming”, Vol. 3
3. E. Horowitz and Shani “Fundamentals of Computer Algorithms”

COURSE NAME: ARTIFICIAL INTELLIGENCE LAB
COURSE CODE: IT594
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite:
Data Structure, Design and Analysis of Algorithms, Statistics.

Course Objective:
Gain foundational knowledge of PROLOG to implementing Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing

Course Outcome
After completion of this course students will be able to

CO1	Acquire foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing and understand the working principle of the agent and assess its utilitarian importance in current technological context leading towards lifelong learning.
CO2	Identify and formulate an engineering problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Agent Formulation Framework Artificial Intelligence.
CO3	Explore relevant literature and apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
CO4	Develop ideas and propose expert systems offering solutions to the challenging problems of Artificial Intelligence.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	3	2	--	--	--	--	--	--	2	2
CO2	2	1	3	3	--	--	--	--	--	--	3	2
CO3	2	1	1	2	--	--	--	--	--	--	2	2
CO4	2	1	1	3	--	1	2	2	--	--	3	2

Course Contents:

Introduction to PROLOG Programming along with the IDE and its Basic Components

Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy.

Arithmetic, Boolean Expression, Decision Making Strategies

Assignments for understanding implementation of Arithmetic Expression, Boolean Expression, and Decision-Making Strategies.

Recursion and Looping through Recursion

Assignments for understanding implementation of Recursion and Looping through Recursion.

List of Data Items in PROLOG

Assignments for understanding the utility of List in solving various problems.

Blind Search Techniques – BFS, DFS

Implementation of BFS and DFS Algorithms for Goal Searching to solve Puzzles (8-Puzzle, Water Jug Puzzle)

Heuristic Search Techniques – A* Search

Implementation of A* Search Algorithm for Goal Searching to solve Puzzles (8-Puzzle, Route Finding Puzzle)

Constraint Satisfaction Problem Solving

Implementation of Backtracking Strategies to solve Constraint Satisfaction Problems (Graph Coloring Problem, 8-Queens Problem)

Game Playing

Implementation of Adversarial Search Algorithm with alpha-beta pruning strategy for Game Playing (Tic-Tac-Toe)

Discussion on Project Problems and Allocation (Problem Description Report Submission)

Designing Solution Model and Proposal Report Submission

Project Implementation, Verification and Documentation

Project Demonstration and Project Report Review

Text books:

1. Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition, Addison-Wesley
2. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
3. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGrawHill.

Reference books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill.

COURSE NAME: E-COMMERCE AND ERP LAB
COURSE CODE: IT 595A
CONTACT: 0:0:2
CREDITS: 1

Prerequisite:
Object Oriented Programming, Computer Networking, Web Application Development, Database Management System

Course Objective:
Understanding basic concept of object-oriented programming and PHP framework, Explaining the client-side components, Appling the PHP web application development concept in web application development.

Course Outcome
After completion of this course students will be able to
CO1: Understand the concept of PHP framework.
CO2: Analyzing different client and server-side components for developing application.
CO3: Apply different concept for developing MVC application.
CO4: Implement the solution to real life problem using PHP concepts.
CO5: Apply different tools used in ERP.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	--	--	--	--	--	--	--
CO2	2	3	3	3	3	--	--	--	--	--	--	--
CO3	2	3	3	3	3	--	--	--	--	--	--	--
CO4	2	3	3	3	3	--	--	--	3	--	3	3
CO5	2	3	3	3	3	--	--	--	3	--	3	3

Course Contents:

Introduction to PHP:
Evaluation of PHP, Basic syntax, Variable constant, Data Types, control structure, function, array, string.

Web Designing:
Introduction to HTML HTML Tags Creating Forms Creating Tables Managing home page,
Java Script, CSS.

Database Connectivity with MySQL:
Introduction to RDBMS Connection with MySql Database Performing basic database operation (DML) (Insert, l
Select) Setting query parameter Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.)

E-Commerce/M-Commerce Applications:
Online Store, Online Banking, Credit Card Transaction Processing. Comparison Shopping in B2C, Exchanges Handling in B2B, Interaction Examples: Virtual Shopping Carts.

Introduction to PHP:
Evaluation of PHP, Basic syntax, Variable constant, Data Types, control structure, function,
array, string.

Web Designing:
Introduction to HTML HTML Tags Creating Forms Creating tables Managing home page, Java Script, CSS.

Database Connectivity with MySQL:
Introduction to RDBMS Connection with MySql Database Performing basic database operation (DML)
(Insert, Delete, Update, Select) Setting query parameter Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.)

Text book:
PhP Complete Reference Steven Holzner

Reference book:
Programming PHP Kevin Tatroe

COURSE NAME: MOBILE APPLICATION DEVELOPMENT LAB
COURSE CODE: IT595B
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite:
Basic knowledge on programming and database concepts.

Course Objective:
This is a practical course on Mobile Application Development and student will learn how to program in Android Platform and develop applications using SQLite that run on Andriod Operating System.

Course Outcome
After the completion of the course the student will be able to

CO1: Design and develop user interfaces for mobile apps using basicbuilding blocks, UI components and application structure using Emulator

CO2: Write simple programs and develop small applications usingthe concepts of UI design, layouts and preferences

CO3: Develop applications with multiple activities using intents,array adapter, exceptions and options menu.

CO4: Implement activities with dialogs, spinner, fragments andnavigation drawer by applying themes

CO5: Develop mobile applications using SQLite.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	1	3	2	3		2			
CO 2	3	3	3	2	3	2	3		2			
CO 3	3	3	3	2	3	2	3		2			
CO 4	3	3	3	2	3	2	3		2			
CO 5	3	3	3	2	3	3	3		2			

Course contents:

Fundamentals: Basic Building blocks – Activities, Services, Broadcast Receivers and Content providers, UI Components – Views and notifications Components for communication -Intents and Intent Filters

Application Structure: AndroidManifest.xml, user-permission – sdk, Resources and R.java, Assets, Layouts and Drawable Resources, Activities and Activity lifecycle.

Emulator-Android Virtual Device: Launching emulator, Editing emulator settings, Emulator shortcuts, Logcat usage, Introduction to DDMS

Basic UI design: Form widgets, Text Fields, Validation of EditText, Layouts, [dip, dp, sip, sp] versus px

Preferences: Shared Preferences, Preferences from xml

Menu: Option menu, Context menu, menu from xml, menu via code

Intents: Explicit Intents, Implicit intents

UI design: Time and Date, Images and media, Android Adapter and ListView, Composite, Alert Dialogs and Toast, Popup, Fragments, Navigation drawer

Tabs, Tab Activity Styles & Themes: styles.xml, drawable resources for shapes, gradients (selectors), style attribute in layout file, Applying themes via code and manifest file

Content Providers: SQLite Programming, SQLite Open Helper, SQLite Database, Cursor, Reading and updating Contacts, Reading bookmarks

References:

1.Joseph Annuzzi Jr, Lauren Darcey, Shane Condor, "Advanced Android Application Development, Developers Library", Pearson Education, 4th Edition (2015)
2.Lauren Darcey, Shane Condor, "Android, Wireless Application Development",
Pearson Education, 3rd Edition.
3.Paul Deitel, Harvey Deitel, Alexander Wald, "Android 6 for programmers, An AppDriven Approach", Pearson Education

COURSE NAME: MICROPROCESSOR AND MICROCONTROLLER LAB
COURSE CODE: IT595C
CONTACT: 0:0:2
CREDITS: 1

Prerequisite:
Basic Knowledge of Digital Electronics.

Course Objective:
To apply Assembly Level Programming for arithmetic-logical solutions and also to interpret the interfacing programming by conducting experiments

Course Outcome
After completion of this course students will be able to
CO1: Solve small assignments using the 8085 basic instruction sets and memory mapping through trainer kit and simulator.
CO2: Write 8085 assembly language programs like Addition, Subtraction, Multiplication, Square, Complement, look up table, Copying a block of memory, Shifting, Packing and unpacking of BCD numbers, Ascending order, Descending order etc. using trainer kit.
CO3: Validate the interfacing technique using 8255 trainer kit through subroutine calls
CO4: IN/OUT instructions like glowing LEDs accordingly, stepper motor rotation etc
CO5: Test fundamental of 8051 programs using the trainer kit.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	--	--	1	--	--	--	2	--	--	2
CO2	3	3	2	--	2	2	--	--	--	--	--	--
CO3	3	--	--	--	3	--	2	--	--	--	--	2
CO4	3	2	--	--	3	--	2	--	--	--	--	2

Course Contents:
1. Familiarization with 8085 register level architecture, the basic instruction sets (data transfer, arithmetic, logical, branching) and the trainer kit components including the memory map.
2. Familiarization with the process of storing, executing and viewing the contents of memory as well as registers in the trainer kit 8085 and simulator through small assignments.
3. Programming using 8085 kit and simulator for: Addition, Subtraction, Multiplication by repeated addition method, Square, Complement, Look up table, Copying a block of memory, Shifting, Packing and unpacking of BCD
numbers, Addition of BCD numbers, Binary to ASCII conversion, Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method.
4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, glowing of seven segment display.

Program for serial communication between two trainer kits.
1. Interfacing of 8255: Keyboard, Stepper motor rotation.
2. Study of 8051 Micro controller kit and writing programs

Text books:
1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar, Penram International
2. Fundamentals of microprocessor and microcontroller- B.Ram
Reference books:
1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford university press
2. 8086 Microprocessor –K Ayala, Cengage learning
3. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
4. The 8051 Microcontroller and Embedded System- Mazidi

Detailed Syllabus
of
6th Semester

3rd Year 6th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT601	Web Technology	2	0	0	2	2
2	ENGG	Major	IT602	Machine Learning	3	0	0	3	3
3	ENGG	Major	IT603	A. Computer Graphics and Multimedia B. Digital Image Processing C. Internet of Things	3	0	0	3	3
4	ENGG	Major	IT604	A. Data Mining and Knowledge Discovery B. Cryptography and Network Security C. Compiler Design	3	0	0	3	3
5	ENGG	Minor	IT605	A. Mobile Computing B. Virtual and Augmented Reality C. Social Network Analysis	2	0	0	2	2
B.PRACTICAL									
1	ENGG	Major	IT691	Web Technology Lab	0	0	3	3	1.5
2	ENGG	Major	IT692	Machine Learning Lab	0	0	3	3	1.5
3	ENGG	Major	IT693	A. Computer Graphics and Multimedia Lab B. Digital Image Processing Lab C. Internet of Things Lab	0	0	3	3	1.5
4		Internship	IT681	Internship	0	0	0	0	1
5	PRJ	Project	IT682	Minor Project - II	0	0	0	2	1
Total of Theory, Practical								24	19.5

COURSE NAME: WEB TECHNOLOGY
COURSE CODE: IT601
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDITS: 2

Prerequisite: Computer Networking, Database Management System, JAVA Programming Language.

Course Objective: Describing the web application architecture and protocols, illustrating different technologies those are used to develop web applications, describing different frameworks those used to develop web applications.

Course Outcome: After completion of this course students will be able to
CO1: Understand web application architecture, technologies, and frameworks
CO2: Apply the concept of different front end and back-end components in problem solving
CO3: Analyze different architecture and web components.
CO4: Evaluate different solutions in field of web application development.
CO5: Design web application architecture to provide solution in web application development fields.

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

Course Contents:
Module I: [2L] Introduction to World Wide Web: Web Architecture, Web Applications, Web servers, Web Browsers and Agents, Internet standards, DNS, SMTP, Pull and Push mechanism: Pros and Cons. HTTP, HTTPS, XMPP

Module II: [2L]
Mark-up: HTML: Elements, Attributes, Tags, Forms, Input, Frames, Tables

Module III: [2L]
Cascading Style Sheets:
Advantages, Rules, CSS, inline and external, using template Layouts

Module IV: [5L]
Java Script and Node JS: Basic java Script concepts, Use of Java Script, Variable, Object, function, Event Handling. Evaluation of Java Scrip. Create, Publish, Extend & Manage, Node.js HTTPs: Create Server and Get Data, Node.js Express, Node JS Mongo DB. Node.js Promise, Node.js Generators & Compare with Callbacks, Node js Streams: File stream, Pipes, Node.js Testing with Jasmine

Module V: [7L]
Server-side Programming: Servlets: HTTP Tunneling, Programmatically issuing HTTP GET, POST etc. and retrieval of content Concept of Dynamic Web pages, Web server versus Application server, Role of threading in a Server, Servlet-2.x API conforming to Web 2.0: Role of web.xml as deployment descriptor, request and response, Basic request handling, parameter retrieval, multiple parameter retrieval, inter-Servlet collaboration: Dispatching the request, Concept of state of web: Sessions , tracking session, Using Cookies and session Id, Parameter passing to and from session, Servlet Filters and common uses of Filters and Cookies. Migration to Servlet 3.x plus and omission of web.xml and concept of Web Socket.

Module VI: [6L]
Persistence: JDBC 3.x framework: Need and different approaches of persistence of data, Connecting to databases using c, ODBC bridge and Type-4 drivers, Executing basic CRUD using JDBC: Statement, Prepared Statement, Result Set.

Execution of batch SQL, Stored Procedures using Callable Statement, Transaction Failure management: Save Point and roll back concepts, Prevention of SQL injection, Concept of connection URL in details: Connecting to a remote database host (server). Concept of roles of Drivers: Java reflection in Action.

Module VII: [6L]
Java Server Pages: Benefits of JSP over Servlets, JSP scriptlets, page directives, declarations, action tags: <jsp:useBeabn/>, <jsp:include/><jsp:forward/> , introduction to MVC and Spring MVC.

Module VIII: [2L]
XML Technologies: XML, Namespace, DTD, W3C XML Schema.

Module IX: [2L]
Ajax: Introduction to Asynchronous pattern and Using XML to communicate over XML Http Request object. Handling 5 states and finding response state. Migration of Ajax to AJAJ.

Module X: [2L]
Web Service Introduction to web service architecture. Simple object access protocol, Web service description language, RESTful web service.

Text books:
1. Professional Java Server Programming Allamaraju, Apress

Reference books:
1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
2. Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Kogent Learning Solutions INC.

COURSE NAME: MACHINE LEARNING
COURSE CODE: IT602
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite: Probability, Linear Algebra, Multivariable Calculus, Programming

Course Objective: This introductory course gives an overview of many concepts, techniques, and algorithms in machine learning related to classification and regression problems. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work.

Course Outcome: After completion of this course students will be able to
CO1 : Understand the basics of machine learning techniques that make it useful to real-world problems.
CO2: Apply machine learning algorithms such as supervised, semi-supervised, and unsupervised.
CO3: Analyze various machine learning techniques to investigate real world applications.
CO4: Evaluate and create model for finding the solution of real world industry issues and problems.
CO5: Model the solution of real-life problems using Deep Learning techniques, Genetic Algorithms and Reinforcement Learning.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	1	3	-	-	-	-	-	-	-
CO2	3	1	1	1	3	-	-	-	**3**	-	-	-
CO3	3	3	2	2	3	-	-	-	**3**	-	-	-
CO4	3	3	2	3	3	-	-	-	**3**	-	-	-
CO5	3	3	3	3	3	-	-	-	**3**	**3**	1	1

Course Contents:
Module I: [8L]
Basics of Linear Algebra Introduction to Machine Learning, linear classification, perceptron update rule, Perceptron convergence, generalization, Maximum margin classification, Classification errors, regularization

Module II : [9L]
Logistic regression Linear regression, estimator bias and variance, active learning, Active learning, non-linear predictions, Regression/Classification Basic methods: Distance-based methods, Nearest Neighbors, Decision Trees, Kernel regression, kernel optimization, Model selection criteria, Description length, feature selection, expectation maximization.

Module III: [10L]
Classification Classification problems; decision boundaries; nearest neighbor methods, Probability and classification, Naive Bayes, Bayes' Rule and Naive Bayes Model, Hidden Markov models (HMMs), Bayesian networks, Learning Bayesian networks, Logistic regression, online gradient descent, neural network, support vector machine (SVM), kernel ridge regression.

Module IV: [9L]
Ensemble methods Bagging, random forests, boosting, Unsupervised learning: clustering, k-means, hierarchical agglomeration, Advanced discussion on clustering, Latent space methods; PCA, Text representations; multinomial models; clustering and latent space models.

Text books:
1. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill.
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Reference books:
1. Simon Haykin, Neural Networks and Learning Machines Third Edition, Pearson Publisher.

2. Christopher M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics), Springer, 2006.
3. Pattern Classification. Richard Duda, Peter Hart and David Stock. Second Edition, Wiley Interscience.

COURSE NAME: COMPUTER GRAPHICS AND MULTIMEDIA
COURSE CODE: IT603A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Computer Programming, Mathematics

Course Objectives:
The objective of the course is to provide comprehensive introduction about computer graphics system, design algorithms and two-dimensional transformations; to make the students familiar with techniques of clipping, three-dimensional graphics and three-dimensional transformations and become familiar with various software programs used in the creation and implementation of multimedia and to gain knowledge about hardware devices and software used.

Course Outcome:
At the end of the course students will be able to:
CO1 Understand the basic computer graphics and Identify different media representations of different multimedia data and data formats, windows, clipping and view-ports object representation.
CO2 Analyze geometric, mathematical and algorithmic concepts necessary for programming computer graphics.
CO3 Apply different coding technique for solving real world problems.
CO4 Evaluate the software utilized in constructing computer graphics and multimedia applications.
CO5 Elaborate advanced concepts of computer architecture, Parallel Processing, inter processor communication and synchronization.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	1	3	-	-	-	-	-	-	-
CO2	3	1	1	1	3	-	-	-	**3**	-	-	-
CO3	3	3	2	2	3	-	-	-	**3**	-	-	-
CO4	3	3	2	3	3	-	-	-	**3**	-	-	-
CO5	3	3	3	3	3	-	-	-	**3**	**3**	1	1

Course Content:
Overview of Computing Paradigm [3L]
Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing Business driver for adopting cloud computing.

TWO-DIMENSIONAL GRAPHICS [7L]
Two dimensional geometric transformations, Matrix representations and homogeneous coordinates, composite transformations, Two dimensional viewing, viewing pipeline, viewing coordinate reference frame, window-to-viewport coordinate transformation, Two dimensional viewing functions, clipping operations, point, line, and polygon clipping algorithms.

ILLUMINATION AND COLOR MODELS [7L]
Height sources, basic illumination models, halftone patterns and dithering techniques, Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model, colour selection. Output primitives, points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms, Pixel addressing and object geometry.

THREE-DIMENSIONAL GRAPHICS [7L]
Three dimensional concepts, Three dimensional object representations, Polygon surfaces, Polygon tables, Plane equations, Polygon meshes, Curved Lines and surfaces, Spline representations, Bezier curves and surfaces, B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and

modelling transformations, Translation, Rotation, Scaling; Three-dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping.

MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING [6L]

Multimedia basics, Multimedia applications, Multimedia system architecture, evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia databases. Compression and decompression, Data and file format standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies.

HYPERMEDIA [6L]

Multimedia authoring and user interface, Hypermedia messaging, Mobile messaging, Hypermedia message component, Creating hypermedia message, Integrated multimedia message standards, Integrated document management, Distributed multimedia systems.

Text Books:

1. Hearn Baker Carithers, - "Computer Graphics with Open GL", Pearson New International Edition.
2. Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, New Delhi, 2007.
3. Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design , PHI, 2003.

Reference Books:

1. Judith Jeffcoate, ―Multimedia in practice: Technology and Applications, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, ―Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnel, ―Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, 2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan, 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, ―Fundamentals of Computer Graphics, CRC Press, 2010.
6. William M. Newman and Robert F.Sproul, ― Principles of Interactive Computer Graphics, Mc Graw Hill 1978.

COURSE NAME: DIGITAL IMAGE PROCESSING
COURSE CODE: IT603B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisite:
Mathematics, Computer Programming.

Course Objective:
The aim of this course is to introduce to the students the basics of digital image processing. The students will gain overview about the available techniques and possibilities of this field. They will learn basic image transformation, segmentation algorithms and problems of object measurements.

Course Outcome:
After completion of this course students will be able to

CO1	Review the fundamental concepts of a digital image processing.
CO2	Identify images in the spatial as well as frequency domain using various transformation techniques for improving the image quality.
CO3	Analyse various image compression techniques.
CO4	Evaluate and analyse image segmentation techniques.
CO5	Understand various image representation technologies.

CO-PO Mapping:

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

Course Contents:

Module I: [3L]
Introduction to Digital Image Processing: Elements of digital image processing systems, Elements of visual perception Brightness, contrast, hue, saturation, match band effect, Image sampling and quantization.

Module II: [8L]
Image Enhancement: Spatial Basic grey level transformation, Histogram equalization, Histogram specification techniques, Noise Distributions, Image subtraction and Image averaging, Smoothing, sharpening filters, Frequency Domain methods: Introduction to Fourier Transform and DFT, Discrete Cosine Transform (DCT) and its properties, Smoothing in Frequency- Domain, Sharpening in Frequency- Domain, Homomorphic filtering.

Module III: [5L]
Image Restoration: Model of Image Degradation/restoration process, Noise models, Unconstrained restoration, Lagrange multiplier, least mean square filtering, Constrained least mean square filtering, Wiener filtering.

Module IV: [3L]
Color Image Processing: Different color Models, Color Transformations, Smoothing & Sharpening Color Image, Color Segmentation, Noise.

Module V: [6L]
Image Compression: Need for data compression, Different types of compression, Variable length coding- Huffman Coding, Run Length Encoding, Arithmetic coding, Lossy Compression: Vector Quantization, Transform coding, Basics of Image compression standards: JPEG.

Module VI: [6L]
Image Segmentation: Thresholding, Region Base2d2qx2d segmentation, Region growing, Region splitting and Merging, Edge detection, Canny edge detector.

Module VII: [3L]
Image registration: Geometric transformations: translation, rotation, scaling, homomorphic coordinate system; ground control points, affine transformation.

Module VIII: [2L]
Representation & Description: Representation of segmented image, Boundary & Regional Descriptors, Use of Principal components for description.

Text books:
1. Digital Image Processing by Woods, Gonzalves, Pearson.
2. Digital Image Processing & Analysis by Chanda & Majumder, PHI.

Reference books:
1. Digital Image Processing by Jahne by Springer India.
2. Image Processing, Analysis & Machine Vision by Sonka, VIKAS.
3. Fundamentals of Digital Image Processing by Jain, PHI.

COURSE NAME: INTERNET OF THINGS
COURSE CODE: IT603C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites:
Operating System, Wireless Sensor Networks, Computer Networks, Cryptography, Communication Technology, Python Programming Language, and Cloud computing.

Course Objectives:
The objective of the course is to learn and understand Internet of Things (IoT) in detail and identifies the application potentials of this technology.

Course Outcome: After completion of this course student will be able to
CO1: Interpret the impact and challenges posed by IoT networks leading to new architectural models.
CO2: Illustrate the smart objects and the technologies to connect them to network
CO3: Compare different Application protocols for IoT.
CO4: Infer the role of Data Analytics and Security in IoT.
CO5: Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-
CO3	-	2	2	-	-	-	-	-	-	-	-	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-
CO5	-	-	3	-	-	-	-	-	-	-	-	-

Course Content:
Wireless Sensor Network [4L]:
Network and Communication aspects, Wireless medium access issues, MAC protocol, Routing protocols, Sensor deployment and Node discovery, Data aggregation and dissemination, Topology, Connectivity, Single-hop and Multi-hop communications.

Fundamental of IoT [4L]:
The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet, Technologies, Infrastructure, Networks and Communication, Design challenges, Development challenges, Security challenges, Other challenges.

IoT and M2M [5L]:
Main design principles and needed capabilities, IoT architecture outline, standards , M2M and IoT Technology Fundamentals, Devices and gateways, Local and wide area networking, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT Architectural Overview, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

IoT Architecture [6L]:
Introduction, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

IoT Privacy, Security and Governance [7L]:
Introduction, Overview of Governance, Privacy and Security Issues, Access Control, Authentication and

Authorization, Distributed trust in IoT, Secure Platform design, Smart Approach. Data Aggregation for the IoT in smart cities, Intrusion detection and prevention, Security attacks and functional threats.

IoT Layers Architecture [6L]:
PHY/MAC Layer - 3GPP MTC, IEEE 802.11, IEEE 802.15, Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7; Network Layer - IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP ; Transport Layer - TCP, MPTCP, UDP, DCCP, SCTP TLS, DTLS; Session Layer - HTTP, CoAP, XMPP, AMQP, MQTT; Service Layer - oneM2M, ETSI M2M, OMA, BBF.

IoT Applications for Value Creations [4L]:
Introduction, IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Big Data and Serialization, IoT for Retailing Industry, Oil and Gas Industry, Real-time monitoring and control of processes - Deploying smart machines, smart sensors, and smart controllers with proprietary communication and Internet technologies, Remote control operation of energy consuming devices.

Text Books:
1. Internet of Things : Architecture and Design Principles, Raj Kamal, McGraw Hill Education; First edition.
2. Internet of Things fundamentals, David, Pearson Education.
3. Internet of Things by Tripathy and Anuradha, CRC Press.

Reference Books:
1. Getting Started With The Internet Of Things: Connecting Sensors and Microcontrollers to the Cloud, Cuno Pfister O'Reilly
2. Internet of Things (A Hands-on-Approach), Vijay Madisetti and ArshdeepBahga, Orient Blackswan Private Limited - New Delhi; First edition.

COURSE NAME: DATA MINING AND KNOWLEDGE DISCOVERY
COURSE CODE: IT 604A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 35
CREDITS: 3

Prerequisite:
Database Management System, Mathematics.

Course Objective:
The student should be made to be familiar with the concepts of data warehouse and data mining and be acquainted with the tools and techniques used for knowledge discovery in databases.

Course Outcome
After completion of this course students will be able to

CO1: **Understand** the basic concepts of data warehousing and data mining.
CO2: **Apply** the various mining algorithms for extract knowledge from data warehouse.
CO3: **Analyse** different data warehousing methodologies and data mining algorithms.
CO4: Manipulate data preprocessing, data Warehouse and OLAP technology.
CO5: **Design** a data warehouse.

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

Course Contents:
Module I: [7L]
Data Warehouse:
Data Warehousing Components, Building A Data Warehouse, Mapping the Data Warehouse to A Multiprocessor Architecture, DBMS Schemas For Decision Support, Data Extraction, Cleanup, And Transformation Tools, Metadata

Module II: [7L]
Business Analysis:
Reporting And Query Tools and Applications, Tool Categories, The Need For Applications, Cognos Impromptu, Online Analytical Processing (OLAP), Need, Multidimensional Data Model, OLAP Guidelines, Multidimensional Versus Multi-relational OLAP, Categories of Tools, OLAP Tools And The Internet

Module III: [7L]
Data Mining:
Introduction, Data Types, Data Mining Functionalities, Interestingness of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of A Data Mining System With A Data Warehouse, Issues, Data Pre-processing.

Module IV: [7L]
Association Rule Mining and Classification:
Mining Frequent Patterns, Associations and Correlations, Mining Methods, Mining Various Kinds Of Association Rules, Correlation Analysis, Constraint Based Association Mining, Classification And Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification By Back Propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction.

Module V: [7L]
Clustering and Trends in Data Mining:
Cluster Analysis, Types of Data, Categorization of Major Clustering Methods, K-Means, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint, Based Cluster Analysis, Outlier Analysis, Data Mining Applications.

Text books:

1. Alex Berson And Stephen J. Smith, "Data Warehousing, Data Mining And OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han And Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

Reference books:

1. Data Mining, Practical Machine Learning Tools and Techniques, Third Edition; Ian H.
2. Witten, Eibe Frank, Mark A. Hall
3. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and
4. Stephen J. Smith, TataMcGraw Hill Education
5. Data warehouse Toolkit by Ralph Kimball, Wiley India
6. Data Warehousing in the real world; Anahory; Pearson Education.

COURSE NAME: CRYPTOGRAPHY AND NETWORK SECURITY
COURSE CODE: IT604B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 35
CREDITS: 3

Prerequisite:
Mathematics, Computer Networking,

Course Objective:
The objective of the course is to study the about how to maintain the Confidentiality, Integrity and Availability and Authenticity of the data over insecure channel by various means and to understand various protocols for network security to protect against the threats in the networks.

Course Outcome:
After completion of this course student will be able to
CO1: Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.
CO2: Analyze existing authentication and key agreement protocols, identify the weaknesses of these protocols.
CO.3: Have a strong understanding of different cryptographic protocols and techniques and be able to use them.
CO4: Apply methods for authentication, access control, intrusion detection and prevention.
CO5: Apply security principles to system design

CO-PO Mapping

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

Course Content:
Module 1: [5L]
Introduction: Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.

Module 2: [7L]
Cryptography: Concepts & Techniques Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, and Symmetric & Asymmetric key Cryptography, Key Range & Key Size

Module 3: [8L]
Symmetric Key Cryptography: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES (Data Encryption Standard) algorithm, IDEA (International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.

Module 4: [6L]
Public Key Cryptography: Overview of Asymmetric key Cryptography, Digital Signature and RSA Introduction, RSA algorithm, PKCS (Public Key Cryptography Standard), Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function

Module 5: [6L]
Internet Security: Internet Security Protocols, User Authentication Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

Module 6: [4L]
Security Practice: Electronic Mail Security Basics of mail security, Pretty Good Privacy, S/MIME.

Module7: [3L]
System Security: Firewall Introduction, Types of firewall, Firewall Configurations

Text Books:
1. Cryptography and Network Security, William Stallings, 2nd Edition, Pearson Education Asia
2. Network Security private communication in a public world, C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.

Reference Books:
1. Network Security Essentials: Applications and Standards by William Stallings, Pearson
2. Designing Network Security, Merike Kaeo, 2nd Edition, Pearson Books
3. Building Internet Firewalls, Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition
4. Cryptography: theory and practice by Douglas R. Stinson Chapman and Hall/CRC.

COURSE NAME: COMPILER DESIGN
COURSE CODE: IT604C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites:
Mathematics, Computer Programming, and Automata basic concept.

Course Objective:
The objective of the course is to introduce the major concept areas of language translation and compiler design and to develop an awareness of the function and complexity of modern compilers. This course is a study of the theory and practice required for the design and implementation of interpreters and compilers for programming languages.

Course Outcomes:
CO1 Able to define different types of translators used in programming
CO2 Explain symbol table organization and role of semantic analysis in compiler design
CO3 Able to construct a top down and bottom up parser
CO4 List various code generation techniques
CO5 Able to design a Lexical analyzer

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	2	1	--	--	--	--	--	--	--	--	2
CO2	2	--	2	--	--	--	--	--	--	--	--	2
CO3	2	2	2	--	2	--	--	--	--	--	--	2
CO4	2	--	--	--	--	--	--	--	--	--	--	2
CO5	1	2	2	--	2	--	--	--	--	--	--	2

Introduction to Compilers [3L]
Compilers and translators need of translators, structure of compiler: Phases of compilation and overview, Compiler construction tools

Lexical Analysis (scanner) [5L]
Role of lexical analyzer, design of lexical analyzer, regular expressions, Specification and recognition of tokens, input buffering A language specifying lexical analyzer. Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing number of states of DFA, Implementation of lexical analyzer, scanner generator (lex, flex).

Syntax Analysis (Parser) [9L]
Role of parsers, definition of parsing, Shift- reduce parsing, operator precedence parsing, predictive parsing. Context-free language and grammar, push-down automata, LL(1) grammar and top-down parsing, operator grammar, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator, Canonical LR parser.

Semantic Analysis [4L]
Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree.

Symbol Table [6L]
Its structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.

Intermediate Code Generation [5L]
Translation of different language features, different types of intermediate forms. Syntax directed definition,

construction of syntax trees, syntax directed translation scheme, and implementation of syntax directed translation, three address code, quadruples and triples.

Code optimization and target code generation [4L]
Code improvement local optimization, global optimization, loop optimization, peep-hole optimization.

Text Books
1. Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi& J.D. Ullman;
Addison Wesley.
2. Compiler Design by O.G. Kakde, Laxmi Publ.

Reference Books
1.Theory and practice of compiler writing, Tremblay & Sorenson, Mc. Graw Hill.
2. System software by Dhamdae, MGH.
3. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier

COURSE NAME: MOBILE COMPUTING
COURSE CODE: IT605A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 38
CREDIT: 2

Prerequisite: Principles of mobile computing, Basic concepts of network protocol.

Course Objective: To impart the knowledge to the students so that they will be able to learn about the concepts and principles of mobile computing, explore both theoretical and practical issues of mobile computing, develop skills of finding solutions and building software for mobile computing applications.

Course Outcome: After completion of this course students will be able to
CO1: Understand and identify the GSM, GPRS and Bluetooth software model for mobile computing.
CO2: The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
CO3: Understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
CO4: Analyze QoS over wire and wireless channels
CO5: Able to promote the awareness of the life-long learning, business ethics, professional ethics and current marketing scenarios.

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

Course Contents:
Module I: [2L]
Short history of wireless communication, Applications, Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread Spectrum, Cellular systems (DSSS & FHSS). Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.

Module II :[9L]
PCS Architecture, Cellular Telephony: Advanced Mobile Phone Service(AMPS); Global System for Mobile Communication (GSM); EIA/TIA IS-136 Digital Cellular System; EIA/TIA IS-95 Digital Cellular System, Cordless Telephony and Low-Tier PCS: Cordless Telephone, Second Generation (CT2); Digital European Cordless Telephone (DECT); UMTS, Personal Handy Phone System (PHS); Personal Access Communications System (PACS) ; Unlicensed Systems, 3G Wireless systems. Mobility Management: Handoff (Inter-BS, Intersystem), Roaming Management, Handoff Management - Detection and Assignment: Strategies for Handoff Detection, Channel Assignment, Handoff Management – Radio Link Transfer: Hard and Soft Handoff, Network Signaling : Signaling System No.7, Interconnection and Message Routing, Mobility Management.

Module III: [6L]
GSM: Mobile services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, Security, New data services, GSM Short Message Service, VOIP service for Mobile Networks : GSM on the Net, The iGSM Wireless VoIP Solution, The H.323 Network, iGSM Architecture, iGSM Procedures and Message Flows: Registration, Deregistration, Call Delivery to the IP Network: Implementation Issues; International Roaming for GSM, GSM Operations, Administration, & Maintenance, Mobile Number Portability. GPRS: Functional Groups, GPRS Architecture, GPRS Network Nodes:18.3.1 Mobile Station; Base Station System; GPRS Support Node; HLR and VLR, GPRS Interfaces: Um Interface; EDGE;Gb Interface; Gn and Gp Interfaces; Gs Interface; Gi Interface, GPRS Procedures.

Module IV: [8L]
Wireless LAN: Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium Access Control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control sublayer, Medium Access Control sublayer, Information bases and Networking. Bluetooth: User Scenarios, Physical Layer, MAC layer, Networking. Security, link management, Enterprise PCS: Office Level , Local Area Wireless: An Example of WPBX, Capacity Planning for WPBX, IrDA ZigBee, RFID, Wireless Broadband (WiMax)

Module V: [7L]
Support for Mobility: Mobile Computing Architecture: Three Tier Architecture for mobile computing, Design considerations, Mobile Computing through Internet. File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Mobile File System, Mobile databases. Language Support: Hypertext markup language (XHTML)-MP, Wireless markup language; WML script,Mobile Application Languages-XML, Voice XML. Java, J2ME and JavaCard. Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, WAP UAProf and Caching , User Agent Profile , Caching Model , Wireless Bearers for WAP , WAP Developer Toolkits and application environment, Wireless telephony application, Mobile agents, Application Server, Gateways, Portals, Service Discovery, Device Management Wireless devices and their Operating System : PalmOS; Windows CE; EPOC; Symbian OS; Linux for Mobile Devices. Mobile Agents Threats and Security Issues in Mobile Computing

Text books:
1. Jochen Schiller, "Mobile communications", Addison wisely, Pearson Education
2. Wireless and Mobile Network Architecture : Yi Bang Lin and ImrichChlamtech (Wiley).
3. Mobile Computing by RajKamal (Oxford).

Reference books:
1. Rappaort, "Wireless Communications Principals and Practices'
2. YI Bing Lin, "Wireless and Mobile Network Architectures', John Wiley
3. P. Nicopolitidis, "Wireless Networks', John Wiley
4. K. Pahlavan, P. Krishnamurthy, "Principles of Wireless Networks"
5. Uwe Hansmann, LotharMerk, Martin S. Nicklous, Thomas Stober, " Principles of Mobile Computing, Springer

COURSE NAME:VIRTUAL AND AUGMENTED REALITY
COURSE CODE:IT605B
CONTACT:3:0:0
TOTAL CONTACT HOURS:36
CREDITS:3

Prerequisite: Computer Architecture, Networking, Operating System.
Course Objective:
This course provides students with an opportunity to explore the research issues in Augmented Reality and Virtual Reality.
Course Outcome: After completion of this course students will be able to
CO1: Understand the basic concept of Virtual Reality
CO2: Apply the knowledge of virtual reality in the evaluation of different models.
CO3: Analyze different problems in the domain of Virtual Reality
CO4: Evaluate the different solutions provided in the field of virtual reality
CO5: Analyze the basic concept of Virtual Reality

	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	--	3	--	--	--	--	--	--	--	2	--
CO2	--	3	--	2	--	2	--	--	--	--	--	--
CO3	--	--	--	--	3	--	2	--	--	--	--	--
CO4	1	--	--	--	3	--	--	3	2	--	--	2
CO5	1	--	2	--	3	--	--	3	2	--	--	2

Course Contents:
MODULE I: Introduction [4L]
Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.

MODULE II: Multiple Models of Input and Output [6L]
Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.

MODULE III: Visual Computation [4L]
Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.

MODULE IV: Interactive Techniques [4L]
Body Track, Hand Gesture, 3D Manus, Object Grasp

MODULE V: Development Tools and Frameworks [4L]
Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc.

MODULE VI: Application of VR in Digital Entertainment:[6L]
VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

MODULE VII: Augmented and Mixed Reality: [8L]
Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Textbooks:

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press

Reference books:

1. MAlan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013
2. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

COURSE NAME: SOCIAL NETWORK ANALYSIS
COURSE CODE: IT 605C
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 35
CREDITS: 2

Prerequisite: Basic knowledge of graph theory and artificial intelligence, database applications.

Course Objective:
Students will learn to extract and manage data about network structure and dynamics, and to analyse, model and visualize such data.

Course Outcome
After completion of this course students will be able to
CO1: Understand the concept of semantic web and related applications.
CO2: Learn knowledge representation using ontology.
CO3: Understand human behaviour in social web and related communities.
CO4: Learn visualization of social networks.
CO5: Implement mining algorithms for social networks.

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

Course Contents:

Module I: [7L]
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 - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

Module II: [7L]
Modelling, Aggregating and Knowledge Representation:
Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling 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 - Advanced representations.

Module III: [7L]
Extraction and Mining Communities in Web Social Networks:
Extracting evolution of Web Community from a Series of Web Archive - 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.

Module IV: [7L]
Predicting Human Behaviour and Privacy Issues:
Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Module V: [7L]

Visualization And Applications Of Social Networks:

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

Text books:

1. Peter Mika, ―Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

Reference books:

1. Guandong Xu, Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and application, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web, Springer, 2009.

COURSE NAME: WEB TECHNOLOGY LAB
COURSE CODE:IT 691
CONTACT: 0:0:3
CREDITS:1.5

Prerequisite: Basic knowledge on Java and computer networking and database.

Course Objective:
Describing the web application architecture and protocols; Illustrating different technologies those are used to develop web applications; Describing different frameworks those used to develop web applications.

Course Outcome:
After completion of this course students will be able to
CO1: Apply the concept of web technology in designing solution
CO2: Analyze different features of web technology for best suitable solution providing
CO3: Evaluate different web application solution applying the concept of different front end and back end technologies
CO4: Create web application solution for different problems
CO5: To learn HTML tags and JavaScript Language programming concepts and techniques.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	3	3	3	--	--	--	--	--	--	--
CO2	2	3	3	3	3	--	--	--	--	--	--	--
CO3	2	3	3	3	3	--	--	--	2	3	--	3
CO4	2	3	3	2	2	--	--	--	2	2	--	3
CO5	1	3	2	3	3	--	--	--	2	3	--	3

Course Contents:
HTML Developing application using different HTML elements, designing forms using HTML, Apply DOM CSS Using different CSS Styles for designing interactive forms and interfaces. Java Script Using Java script variables, operators, control structure, functions and event handling, Form validation using java script, Node js server implementation, express js for implementing web application handling get, put, post, etc.

JDBC Connecting to databases using jdbc:odbc bridge and Type-4 drivers, Batch execution, Stored Procedure Servlet Developing web application using servlet: get/post, Developing filter application, Session handling. JSP Developing web application using JSP as view, Session handling using JSP, Using JSP components, Custom tag development.

AJAX Developing web application using AJAX: accessing XML, text files. Web Service Development web service as reusable components Innovative Experiments. Develop some innovative experiments.

Text books:
1.Professional Java Server Programming Allamaraju.

Reference books:
1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. A kilandeswari, PHI Learning, Delhi, 2013.
2. Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Kogent Learning Solutions INC.

COURSE NAME: MACHINE LEARNING LAB
COURSE CODE: IT692
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisite:
Probability, Linear Algebra, Calculus, R/Python Programming

Course Objective:
This course provides the knowledge to Install and use R/Python for simple programming tasks, extended R/Python libraries and packages.

CO1 : Apply machine learning algorithms such as supervised, semi-supervised, and unsupervised.
CO2: Analyze various machine learning techniques to investigate real world applications.
CO3: Evaluate and create model for finding the solution of real world industry issues and problems.
CO4: Evaluate and compare various techniques like Support Vector Machines, Decision Trees, and Instance Based Learning on different datasets.
CO5: Model the solution of real-life problems using Deep Learning techniques, Genetic Algorithms and Reinforcement Learning.

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

Course Contents:
1. Write R/Python program to calculate the square root of 2345, and perform a log2 transformation on the result.
2. Print the 1 to10 numbers in reverse order in R/Python Programming language.
3. Find 10 random numbers between 0 and100 in R/Python Programming language.
4. Compute the truth table for logical AND in R/Python Programming language.
5. Use R/Python to find all the numbers between 1 and n which are multiples of some m.
6. Write a program in R/Python to check the leap year or not.
7. Find the Factorial of a given Number in R/Python.
8. Program to check whether the given number is Prime or not in R/Python.
9. Check whether the given number is Arm strong number or not.
10. Program to display multiplication table in R.
11. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
12. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
13. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
14. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Text books:
1. The Art of R Programming, Norman Matloff, Cengage Learning.
2. R for Everyone, Lander, Pearson.

COURSE NAME: COMPUTER GRAPHICS AND MULTIMEDIA LAB
COURSE CODE: IT693A
CONTACT: 0:0:3
CREDIT: 1.5

Prerequisites: Computer Programming, Mathematics

Course Objectives:
The objective of the course is to become familiar with graphics programming and expertise in text, image, audio, video enhancement and manipulation using different software/tools through projects.

Course Outcome:
At the end of the course students will be able to:
CO1 Analyze the effects of scale and use on both presentation and lower level requirements
CO2 Apply 3D graphical scenes using open graphics library suits
CO3 Develop an interactive multimedia presentation by using multimedia devices
CO4 Implement image manipulation, enhancement, and basic transformations on objects and clipping algorithm on lines.
CO5 Identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

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

Course Content:
Module 1: Computer Graphics Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes, Circle (Midpoint). 2D Geometric transformations – Translation, Rotation Scaling, Reflection Shear, Window-Viewport. Composite 2D Transformations, Line Clipping
- 3D Transformations - Translation, Rotation, Scaling.
- 3D Projections – Parallel, Perspective.
- Creating 3D Scenes.

Module 2: Multimedia Application
- Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization.
- 2D Animation – To create Interactive animation using any authoring tool.
- VLC and Video Streaming
- HTML 5 and media publishing with Projects based learning.
- Web document creation using Dreamweaver.
- Creating Animation using Flash.

Text Books
1. Hearn Baker Carithers, - “Computer Graphics with Open GL”, Pearson New International Edition

Reference Books
1. Donald Hearn and Pauline Baker M, ―Computer Graphics”, Prentice Hall, New Delhi, 2007
2. Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design, PHI, 2003.

COURSE NAME: DIGITAL IMAGE PROCESSING LAB
COURSE CODE: IT693B
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite:
Knowledge on Computer Programming.

Course Objective:
The aim of this course is to familiarize the students in the image fundamentals and mathematical transforms necessary for image by the image processing software with respect to basic processing required to generate images.

Course Outcome:
After completion of this course students will be able to

CO1	Apply enhancing operations on the image using spatial filters. and frequency domain filters.
CO2	Analyse the characteristics of the image using different transformation techniques.
CO3	Estimate the efficiency of the compression techniques on the images.
CO4	Plan different segmentation operations of images.
CO5	Analyse and improve the quality of the image by various preprocessing techniques.

CO-PO Mapping:

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

Course Contents:
Simulation using MATLAB

1. Image sampling and quantization.
2. Analysis of spatial and intensity resolution of images.
3. Intensity transformation of images.
4. DFT analysis of images
5. Different types of Transforms
6. Histogram Processing
7. Image Enhancement-Spatial filtering
8. Image Enhancement- Filtering in frequency domain
9. Image segmentation – Edge detection, line detection and point detection.
10. Region based Segmentation
11. Analysis of images with different color models.
12. Image compression techniques
13. Image restoration
14. A mini project based on medical image processing

Text books:
1. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education

COURSE NAME: INTERNET OF THINGS LAB
COURSE CODE: IT693C
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites:
Basic knowledge of Internet of Things with a basic understanding of electronics and microprocessors.

Course Objectives:
This course focuses on the latest microcontrollers with application development, product design and prototyping.

Course Outcome:
After completion of this course student will be able to
CO1: Develop various sensor interfacing using Visual Programming Language
CO2: Analyze various Physical Computing Techniques
CO3: Evaluate Wireless Control of Remote Devices
CO4: Design Mobile Application which can interact with Sensors and Actuators
CO5: Develop Mobile Applications

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	3		3							
CO2	2	3										2
CO3	3	3					2					2
CO4	3	3				2	2		3	3		
CO5	3	3				2	2		3	3		

List of Experiments:
1. Digital I/O Interface - Multicolour Led, IR Sensor, PIR, SlotSensor.
2. Analog Read and Write - Potentiometer, Temperature Sensor, Led Brightness Control.
3. Dc Motor Control - Dc Motor Speed and Direction Control.
4. Read data from sensor and send it to a requesting client. (using socket communication) Note: The client and server should be connected to same local area network.
5. Fabrication and direction control of wheeled robot using Arduino.
6. Serial Communication - Device Control.
7. Wireless Module Interface - Bluetooth and Wifi.
8. Wireless Control of wheeled Robot using Bluetooth/Wifi.
9. Basic Android App Development using MIT App Inventor.
10. Smart Home Android App Development using App Inventor and Arduino.

Text Books:

1. Sylvia Libow Martinez, Gary S Stager, “Invent To Learn: Making, Tinkering, and Engineering in the Classroom”, Constructing Modern Knowledge Press, 2016.

Reference Books
1. Michael Margolis, “Arduino Cookbook”, Oreilly, 2011.

Detailed Syllabus
of
7th Semester

4th Year 7th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT701	A. Cloud Computing B. Internet Technology C. Big Data Analytics D. Pattern Recognition	3	0	0	3	3
2	ENGG	Major	IT702	A. Soft Computing B. Cyber Security C. Wireless Ad hoc Network D. NoSQL Database with MongoDB	3	0	0	3	3
3	ENGG	Major	IT703	A. Advanced Database Management System B. Block Chain Technology C. Advanced Computer Architecture D. Quantum Computing	3	0	0	3	3
4	ENGG	Minor	IT704	A. Digital Forensics B. Modelling and Simulation C. Deep Learning & Neural Networks D. Real Time Systems	3	0	0	3	3
B.PRACTICAL									
1	ENGG	Major	IT791	A. Cloud Computing Lab B. Internet Technology Lab C. Big Data Analytics Lab D. Pattern Recognition Lab	0	0	3	3	1.5
2	ENGG	Major	IT792	A. Soft Computing Lab B. Cyber Security Lab C. Wireless Ad hoc Network Lab D. NoSQL Database with MongoDB Lab	0	0	3	3	1.5
3		Internship	IT781	Industrial Training / Internship	0	0	0	0	2
4	PRJ	Project	IT782	Major Project-I	0	0	0	8	4
Total of Theory, Practical								26	21

PAPER NAME: CLOUD COMPUTING
PAPER CODE: IT701A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Networking, Operating System, Web Technology.
Course Objective:
The objective of the course is to learn and understand Cloud computing in details and identify the usage of it.
Course Outcome:
The objective of the course is to learn and understand Cloud computing in details and identify the usage of it.
After completion of the course students will be able to

CO1	Understand the basic architecture of cloud computing
CO2	Apply the knowledge of cloud computing in the evaluation of the computing model.
CO3	Analyze different features of Cloud Computing
CO4	Evaluate the different models and solutions provided in the field of cloud computing.
CO5	Design different solution with different services in cloud computing

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**1**	--	--	--	--	--	--	--	**1**
CO2	**2**	**2**	**3**	--	--	--	--	--	--	--	--	**2**
CO3	**1**	**3**	**2**	**3**	--	--	--	--	--	--	--	**2**
CO4	**1**	**3**	**2**	**3**	--	--	--	--	--	--	--	**2**
CO5	**3**	**3**	**3**	--	**3**	**2**	**2**	**3**	--	--	--	**3**

Course Contents:

Module I: Overview of Computing Paradigm [3L]
Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing Business driver for adopting cloud computing.

Module II: Introduction to Cloud Computing [3L]
Cloud Computing (NIST Model) Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties, Characteristics and Disadvantages Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing

Module III: Cloud Computing Architecture and Services [3L]

Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS) Infrastructure as a Service (IaaS) Platform as a Service (PaaS) Software as a Service (SaaS) Deployment Models Public Cloud Private Cloud Hybrid cloud Community cloud.

Module IV: Virtualization [6L]
Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM) Resource Virtualization Server, Basics of VMWare, advantages of VMware virtualization, - understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Module V: Cloud Storage Management [2L]
Storage as a service, Data storage in cloud computing (storage as a service)

Module VI: Service Oriented Architecture [5L]
Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP. Message exchange patterns- Service activity coordination-atomic transactions- Business Activities-Orchestration-Choreography, Service-Oriented Design Introduction to service-oriented design- WSDL-related

XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. WS-BPEL language basics WS Coordination

Module VII: Service Management in Cloud Computing [5L]
Service Level Agreements (SLAs) Billing and Accounting Comparing Scaling Hardware: Traditional. Cloud Economics of Scaling: Benefitting enormously Managing Data Looking at Data, Scalability and Cloud Services Database and Data Stores in Cloud Large Scale Data Processing.

Module VIII: Cloud Security [6L]
Infrastructure Security Network level security, Host level security, Application-level security Data security, Identity and Access Management Access Control Trust, Reputation, Risk Authentication in cloud computing

Module IX: Case Study on Open Source and Commercial Clouds [3L]
Google Cloud, Microsoft Azure, Amazon EC2

Textbooks:
1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

Reference books:
1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
2. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee, Gillam, Springer, 2012
3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

PAPER NAME: INTERNET TECHNOLOGY
PAPER CODE: IT701B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Computer Networking, Web Technology.
Course Objective:
Understanding the architecture of enterprise application and developing enterprise applications.
Course Outcome:
After completion of the course students will be able to

CO1	Understand advanced networking concepts and internet and web application architectures
CO2	Apply and Analyze d different advanced routing protocols being used in web application development
CO3	Evaluate and analyze different solution available in the field of networking and web application development such as http and the World Wide Web, HTML, and Java Scripts;
CO4	Implement solution for different critical network related issues as; implementing the design using the client/server model, testing, and documenting the solutions developed.

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	2	--	--	--	--	--	--	--	--
CO2	2	3	2	2	2	--	--	--	--	--	--	1
CO3	3	3	3	2	2	--	--	--	--	--	--	1
CO4	3	3	3	3	3	--	--	--	--	--	2	3

Course Content:

Module 1: An Overview on Internet [2L]
Properties of the Internet, Internet Architecture, Interconnection through IP Gateways or routers, Internet and Intranet.

Module 2: Internet Address: [6L]
Introduction, Universal identifiers, three primary classes of IP addresses, Classless IP address, Network and Broadcast addresses, Mapping internet addresses to physical addresses (ARP), ARP protocol format, Transport Gateways and subnet addressing, Multicast addressing. IPV6, Conversion from IPV4 to IPV6

Module 3: Internet Protocol: [4L]

The Internet Datagram, Routing direct and indirect delivery, Table driven IP routing, Protocol layering, Reliable stream transport, TCP performance, Bootstrap protocol (BOOTP).

Module 4: Routing: [4L]
The origin of Gateway routing tables, Original Internet Architecture and Cores, Core Gateways, Automatic route propagation, Vector distance (Bellman-Ford), routing, Gateway to Gateway Protocol (GGP), Autonomous system concept, Exterior Gateway Protocol (EGP), Interior Gateway Protocol (RIP, OSPF, HELLO), Routing Information Protocol (RIP), Combining RIP, HELLO, and EGP, Routing with partial information.

Module 5: Internet Servers: [4L]
DNS, DHCP Servers, FTP, TELNET, E-Mail

Module 6: Firewall & Networking [6L]

Introduction, Implementation of Firewall, Activities of Firewall, Configuration of firewall, Firewalls & SSL, SSL implementation, Bit implementation of SSL, Use of SSL.

Module 7: ASP .NET: [10L]
Architecture and Component, Page life cycle, Control: Check Box, Radio Button, List, Label. Session Management, Web Form Handling, Accessing database, Hosting of Web application.

Textbooks:
1. Computer Networks and Internets - Douglas E. Comer; PE.

Reference books:
1. Communication Networks - Leon-Garcia-Widjaja; TMH.
2. Internetworking with TCP / IP - Douglas E .Comer; PE.
3. TCP/IP protocol suite - Forouzan Behrouz A; TMH.

PAPER NAME: BIG DATA ANALYTICS
PAPER CODE: IT701C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statistics, Artificial Intelligence, Programming skills of Python.

Course Objective:
Comprehend the fundamental concepts of the Big Data Analytics exploring machine learning strategies such as Supervised and Unsupervised Learning etc. for analyzing various types of large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework).

Course Outcome:

After completion of the course students will be able to

CO1	Understand basic concepts and requirements of big data analytics
CO2	Apply the concept of Big Data analytics to handle huge dataset
CO3	Analyze big data with different available algorithm and ttheorem.
CO4	Design and develop different analytical solution organizing huge dataset

CO–PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	--	--	--	--	--	--	--	1
CO2	3	2	2	--	2	--	--	--	--	--	--	1
CO3	3	1	2	--	2	--	--	--	--	--	--	2
CO4	3	1	2	1	1	--	--	--	--	--	--	2

Course Content:

Module – 1: Introduction to Basic Analytics [10L]
Introduction: Big data overview, Analyst's perspective on data repositories, Current analytical architecture, Drivers of big data, Examples of big data analytics.
Life Cycle of Data Analytics: Phase 1: Discovery, Phase 2: Data preparation, Phase 3: Model planning, Phase 4: Model building, Phase 5: Communication of results, Phase 6: Making operational.
Basic Analytic Methods: Visualization, Dirty data, Data exploration versus presentation, Statistical methods for evaluation – hypothesis testing, difference of means, rank sum test, type I and type II errors, ANOVA.

Module - 2: Advanced Analytic Methods I [8L]
Clustering: Overview, K-means, Determining the number of clusters, Diagnostics.
Association Rules: Overview, Apriori algorithm, Evaluation of candidate rules, Application of association rules, Validation and testing, Diagnostics.
Regression: Linear regression - model description, Logistic regression – model description, other regression models.
Classification: Decision trees – overview, General algorithm, Decision tree algorithms, Evaluating a decision tree, Naïve Bayes – Bayes theorem, Naïve Bayes classifier, Diagnostics of classifiers.

Module – 3: Advanced Analytic Methods II [9L]

Time Series Analysis: Overview, Box-Jenkins methodology, Autocorrelation function (ACF), Autoregressive model, moving average model, ARMA and ARIMA model, Building and evaluating an ARIMA model.
Text Analysis: Steps in text analysis, collecting raw text, representing text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing documents by types, Determining sentiments.
Map Reduce and Hadoop:Analytics for unstructured data – map reduce, Apache Hadoop, Hadoop Ecosystem – Pig, Hive, Hbase, Mahout.

Module – 4: Advanced Analytic Methods III [9L]

Technology and Tools: SQL essentials - Join, Set, grouping extensions, Advanced SQL – Window functions, User-defined functions, Ordered aggregates, MADlib, NoSQL.

Integration of Techniques: Communicating and operationalizing an analytic project.

Creating final deliverables – Developing core materials, project goals, Main findings, Approach, Model description and model details, Recommendations, Providing technical specifications and code.

Data visualization basics - Key points, evolution of a graph, common representation methods, how to clean up a graphic.

Textbooks:

1. EMC Education Services (Editor), Data Science and Big Data Analytics. John Wiley & Sons, 2015.
2. Mike Barlow, Real-Time Big Data Analytics: Emerging Architecture. O'Reilly, 2013.

Reference books:

1. Nathan Marz and James Warren, Big Data: Principles and Best Practices for Scalable Real-time Data Systems. Manning Publications, 2015.
2. Venkat Ankam, Big Data Analytics. Packt Publishing Ltd., UK, 2016.

PAPER NAME: PATTERN RECOGNITION
PAPER CODE: IT701D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite:

Fundamentals of probability and linear algebra

Course Objective:

The objective of this course is to learn the fundamentals of pattern recognition and its relevance to classical and modern problems. The main objective is to be able to identify where, when and how pattern recognition can be applied.

Course Outcome:

After completion of the course students will be able to

CO1	Understand basic concepts in pattern recognition techniques, feature extraction techniques and representation of patterns in feature space.
CO2	Apply the various real-world applications in pattern recognition techniques.
CO3	Analyze the application of machine vision, speech recognition and movement recognition used in pattern recognition research.
CO4	Evaluate and create model for Machine Vision, Speech Recognition, Speaker Identification, and Process Identification.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1	1	1	--	--	--	--	--	--	3
CO2	2	2	2	1	1	1	--	--	--	--	--	2
CO3	2	1	1	1	3	--	--	--	--	--	--	2
CO4	3	1	2	1	1	--	--	--	--	--	--	2

Course Contents:

Module I: [6L]

Introduction to Pattern Recognition:

Importance of Pattern Recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-Supervised Learning.

Module II: [10L]

Classifiers Based on Bayes Decision Theory:

Introduction, Bayes Decision Theory: Minimizing the Classification Error Probability, Minimizing the Average Risk, Discriminant Functions and Decision Surfaces, Bayesian Classification for Normal Distributions: The Gaussian Probability Density Function, The Bayesian Classifier for Normally Distributed Classes, Decision Hyper planes, Minimum Distance Classifiers, Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability Estimation, Bayesian Inference, Maximum Entropy Estimation, Mixture Models, The Expectation Maximization (EM) Algorithm, Application to the Mixture Modelling Problem, Nonparametric Estimation, The Naive-Bayes Classifier, The Nearest Neighbour Rule, Bayesian Networks, Problems.

Module III: [10L]

Linear Classifiers

Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm: Proof of the Perceptron Algorithm Convergence, Variants of the Perceptron Algorithm, The Perceptron, The Pocket Algorithm, Kesler's Construction, Least Squares Methods: Mean Square Error Estimation, Multiclass Generalization, Stochastic Approximation and the LMS Algorithm, Sum of Error Squares Estimation, Mean Square Estimation Revisited: Mean Square Error Regression, MSE Estimates Posterior Class Probabilities, The Bias–Variance Dilemma, Logistic Discrimination, Support Vector Machines: Separable

Classes, Non separable Classes, The Multiclass Case, *v*-SVM, Support Vector Machines: A Geometric Viewpoint, Reduced Convex Hulls, Problems

Module IV: [10L]

Feature Selection

Introduction, Preprocessing: Outlier Removal, Data Normalization, Missing Data, The Peaking Phenomenon, Feature Selection Based on Statistical Hypothesis Testing: Hypothesis Testing Basics- The Known Variance Case, The Unknown Variance Case, Application of the *t*-Test in Feature Selection. The Receiver Operating Characteristics (ROC) Curve, Class Separability Measures, Divergence, Chernoff Bound and Bhattacharyya Distance, Scatter Matrices, Feature Subset Selection: Scalar Feature Selection, Feature Vector Selection, Suboptimal Searching Techniques, Optimal Feature Generation, Neural Networks and Feature Generation/Selection, Support Vector Machines: A Last Touch, The Bayesian Information Criterion.

Text books:

1. Pattern Recognition, S.Theodoridis and K.Koutroumbas, 4th Ed., Academic Press, 2009

Reference books:

1. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006
2. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, John Wiley, 2001

PAPER NAME: SOFT COMPUTING
PAPER CODE: IT702A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Mathematics, Set theory.

Course Objective:

To give students knowledge of soft computing theories fundamentals, that is of fundamentals of non-traditional technologies and approaches to solving hard real-world problems, namely of fundamentals of artificial neural networks, fuzzy sets, fuzzy logic and genetic algorithms.

Course Outcome:

After completion of the course students will be able to

CO1	Understand the basics of various soft computing techniques.
CO2	Apply different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.
CO3	Analyze the applications of various soft computing techniques.
CO4	Evaluate and create soft computing techniques to solve engineering or real-life problems.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2	--	--	--	2	--	--	1
CO2	3	3	2	2	--	--	--	--	1	--	--	1
CO3	3	3	2	2	1	--	--	--	1	--	--	2
CO4	3	3	3	2	2	--	--	--	2	--	--	2

Course Content:

Module I: [4L]

Introduction:
Soft Computing. Difference between Hard and Soft computing, Requirement of Soft Computing, Major Areas of Soft Computing, Applications of Soft Computing.

Module II: [**10L]**

Fuzzy Systems:
Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Min-max Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification**.**

Module III: [10L]

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

Module IV: [8L]

Genetic Algorithm: Neural Network, Learning rules and various activation functions, Single layer Perceptron's, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, recent Applications.

Module V: [4L]

Hybrid Systems: Introduction to Hybrid Systems, Neuro Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

Text books:

1. Fuzzy Logic with Engineering Applications, Timothy J. Ross, Willey.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S. Rajasekaran, G. A. Vijayalakshmi, PHI.
3. Genetic Algorithms: Search and Optimization, E. Goldberg

Reference books:

1. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee PHI.
2. Elements of Artificial Neural Network, Kishan Mehrotra, MIT Press.
3. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press.

PAPER NAME: CYBER SECURITY
PAPER CODE: IT702B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: The students to whom this course will be offered must have the familiarity in Computer Networking and basic concepts about Network Security and Cryptography.

Course Objective: The objectives of this course are to enable learner to understand, explore and acquire a critical understanding of Cyber threat, develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other Cyber Crimes.

Course Outcome:

After completion of the course students will be able to

CO1	Understand the policy issues related to electronic filing of documents.
CO2	Identify the importance of lawful recognition for transactions through electronic data interchange and other means of electronic communication.
CO3	Analyze the effectiveness of the prevailing information security law practices.
CO4	Judge the architecture that can cater to the needs of the social information security.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	--	1	1	--	2	--	1	--	--	--	1
CO2	1	3	2	1	--	2	--	2	--	--	--	1
CO3	1	2	2	2	--	1	--	2	--	--	--	1
CO4	1	2	2	2	1	3	--	3	--	--	--	1

Course Contents:

MODULE I: Introduction of Cybercrime: [6L]
Cybercrime and Offences, Forgery, Hacking, Software Piracy, Computer Network Intrusion, Jurisdiction to Prescribe/Legislative Jurisdiction; Jurisdiction to Adjudicate to Enforce; Cyber Jurisdiction in Civil, Criminals Plan Attacks, Passive Attack, Active Attacks, Unicitral Model Law.

MODULE II: Information Technology Act: [6L]
Overview of IT Act, Amendments and Limitations of IT Act, Legal Aspects, Indian Laws, IT Act 2000, Public Key Certificate, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

MODULE III: Cybercrime Mobile & Wireless Devices: [8L]
Security Challenges Posted by Mobile Devices, Cryptographic Security for Mobile Devices, Attacks on Mobile/Cell Phones, Theft, Virus, Hacking, Bluetooth; Different Viruses on Laptop.

MODULE IV: Tools and Methods used in Cybercrime: [8L]
Proxy Servers, Panword Checking, Random Checking, Trojan Horses and Backdoors; DOS &DDOS Attacks; SQL Injection: Buffer Over Flow. Most Common Attacks, Scripts Kiddies and Packaged Defense.

MODULE V: Phishing & Identity Theft: [4L]
Phising Methods, ID Theft, Online Identity Method.

MODULE VI: Case Study on Cyber Crimes: [4L]

Harassment Via E-Mails, Email Spoofing (Online a Method of Sending E-Mail using a False Name or E-Mail Address to Make It Appear that the E-Mail Comes from Some body other than the True Sender), Cyber-Stalking.

Textbooks:

1. Nina Gobole & Sunit Belapune. Cyber security, Pub: Wiley India.
2. Chris Reed & John Angel, Computer Law, OUP, New York, 2007.
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, 2012.
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, 2004.
5. K. Kumar, Cyber Laws: Intellectual property & E Commerce, Security,1st Edition, Dominant Publisher,2011.
6. Rodney D. Ryder, Guide to Cyber Laws, Second Edition, Wadhwa and Company, New Delhi, 2007.

Reference books:

1. Kenneth J. Knapp, Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions, IGI Global, 2009.
2. Jonathan Rosenoer, Cyber law: the Law of the Internet, Springerverlag, 1997.
3. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.
4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, 2003.
5. Vakul Sharma, Handbook of Cyber Law, Macmillan India Ltd, 2nd Edition, PHI,2003.
6. Sharma, S.R., Dimensions of Cyber Crime, Annual Publications Pvt. Ltd., 1st Edition, 2004.

PAPER NAME: WIRELESS ADHOC NETWORK
PAPER CODE: IT702C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Course Objective:

Explain fundamental principles of Ad-hoc Networks. Discuss a comprehensive understanding of Ad-hoc network protocols. Outline current and emerging trends in Ad-hoc Wireless Networks. Analyze energy management in ad-hoc wireless networks.

Course Outcome:

After completion of the course students will be able to

CO1	Design their own wireless network
CO2	Evaluate the existing network and improve its quality of service
CO3	Choose appropriate protocol for various applications
CO4	Examine security measures present at different level

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	--	1	1	--	2	--	1	--	--	--	1
CO2	1	3	2	1	--	2	--	2	--	--	--	1
CO3	1	2	2	2	--	1	--	2	--	--	--	1
CO4	1	2	2	2	1	3	--	3	--	--	--	1

Course Content:

Module-1: [6L]
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas

Module-2: [6L]
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.

Module-3: [9L]
Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.

Module-4: [8L]
Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.

Module-5: [7L]
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management

in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

Text Book:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

Reference Book:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002

PAPER NAME: NOSQL DATABASE WITH MongoDB
PAPER CODE: IT702D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Basic Knowledge about DBMS

Course Outcome:

After completion of the course students will be able to

CO1	Explain and compare different types of NoSQL Databases
CO2	Compare and contrast RDBMS with different NoSQL databases.
CO3	Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
CO4	Explain performance tune of Key-Value Pair NoSQL databases.
CO 5	Apply Nosql development tools on different types of NoSQL Databases.

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**1**	**1**	**--**	**--**	**--**	**--**	**--**	**2**	**--**	**1**
CO2	**2**	**2**	**3**	**--**	**--**	**--**	**2**	**--**	**--**	**--**	**--**	**2**
CO3	**1**	**3**	**2**	**3**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**2**
CO4	**1**	**3**	**2**	**3**	**--**	**--**	**--**	**--**	**--**	**1**	**--**	**2**
CO5	**3**	**3**	**3**	**--**	**3**	**2**	**2**	**3**	**--**	**--**	**--**	**3**

Course Content:

Module-1: [4L]
Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL.

Module-2: [8L]
Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

Module-3: [8L]
NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

Module-4: [8L]
Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

Module-5: [8L]
NoSQL Key/Value databases using Riak, Key-Value Databases,Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data,Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4,NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

Text Book:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

PAPER NAME: ADVANCED DATABASE MANAGEMENT SYSTEM
PAPER CODE: IT703A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Database Management System, Operating System, Computer Networking

Course Objective:

The objective of the course is to present an introduction to different database management systems, with an emphasis on advanced transaction processing and recovery system.

Course Outcome:

After completion of the course students will be able to

CO1	Evaluate and Apply Advanced Database Development Techniques.
CO2	Evaluate different Database Systems
CO3	Perform administrator's job for database systems.
CO4	Design & Implement Advanced Database Systems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	--	--	--	--	2	--	--	--
CO2	2	3	3	3	--	--	--	--	--	--	--	--
CO3	1	3	3	3	--	--	--	--	2	--	--	--
CO4	2	3	3	3	--	--	--	--	2	1	--	2

Course Contents:

Module – 1: Database-System Architectures: [3L]
Centralized and client–server architectures, Server system architectures, Parallel systems, Distributed systems, Network types.

Module - 2: Parallel Databases: [4L]
Parallel databases, I/O parallelism, Inter query parallelism, Intra query parallelism, Intra operation parallelism, Interoperation parallelism, Design of parallel systems.

Module – 3: Distributed Databases: [8L]

Homogeneous and heterogeneous databases, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control in distributed databases, Availability, Distributed query processing, Heterogeneous distributed databases, Directory systems.

Module – 4: Object-Based Databases: [4L]
Overview of object-based databases, Complex data types, Structured types and inheritance in SQL, Table inheritance, Array and multi set types in SQL, Introduction of object-identity and reference types in SQL, Object-oriented versus object-relational.

Module – 5: Advanced Application Development: [2L]
Performance tuning, Performance benchmarks, Standardization, Application migration.

Module – 6: Advanced Data Types & New Applications: [5L]
Motivation, Time in databases, Spatial and geographic data, Multimedia databases, Mobility and personal databases, Temporal database.

Module – 7: Advanced Transaction Processing: [6L]
Transaction-processing Monitors, Transactional workflows, E-Commerce, Main-memory databases, Real-time transaction systems, Long-duration transactions, Transaction management in multi-databases.

Module – 8: XML: [4L]
Motivation, Structure of XML data, XML document schema, Querying and transformation, Application program interfaces to XML, Storage of XML data, XML applications, UML.

Textbooks:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing.Company.

Reference books:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems (3/e), McGrawHill.
2. Peter Rob and Carlos Coronel, Database Systesm- Design, Implementation and Management (7/e), Cengage Learning.

PAPER NAME: BLOCK CHAIN TECHNOLOGY
PAPER CODE: IT703B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite:

The students must have concept of Distributed Systems, Computer Networks, Cryptography, Python Programming Language.

Course Objective:

The objective of the course is to learn and understand Blockchain technology in detail and identifies the application potentials of this technology.

Course Outcome:

After completion of the course students will be able to

CO1	Understand the basic concepts of blockchain and it's architectures.
CO2	Analyze different issues in the domain of blockchain and understand the practical applications of blockchain.
CO3	Evaluate and analyze different solutions for the real-life problems related to the blockchain.
CO4	Design different solution applying and analyzing concept of Block chain

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	--	--	--	--	--	--	--	--
CO2	2	--	3	2	--	--	--	--	--	--	--	--
CO3	3	3	2	3	--	--	--	--	--	--	--	--
CO4	3	--	3	--	--	--	--	--	--	--	3	3

Course Content:

MODULE I: Centralized Distributed Systems: [6L]
Client-Server Model, Distributed System, P2P Network Model, Distributed Database, Two General Problem in distributed database, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.

MODULE II: Security, Trust and Privacy: [6L]
Confidentiality; Integrity; Availability; Authentication; Authorization; Access Control; Accounting; Non-Repudiation, Symmetric Key and Asymmetric Key Cryptography, Hash function, Merkle tree hash, Digital Signatures – RSA, Schnorr, and ECDSA, Memory Hard Algorithm, Zero Knowledge Proof, User privacy.

MODULE III: Fundamentals of Blockchain: [6L]

Introduction, Benefits over traditional distributed database, Blockchain Network, Data structure of block, Block construction and addition, Block mining mechanisms, Merkle Pa-tricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain policy, Real-time application of Blockchain, Soft & Hard Fork, Private, Public, and Consortium blockchain.

MODULE IV: Consensus algorithms in Blockchain: [9L]
Distributed Consensus, Nakamoto consensus, Proof of Work (PoW), Proof of Stake (PoS), Proof of Burn (PoB), Delegated Proof of Stake (DPoS), Byzantine Fault Tolerance (BFT), Practical Byzantine Fault Tolerance (PBFT), Ripple Protocol Consensus Algorithm (RPCA), Difficulty Level, Sybil Attack, Energy utilization and alternate.

MODULE V: Cryptocurrency and Blockchain Applications: [9L]

History, Distributed Ledger Technology (DLT),Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contracts and Distributed Applications (Apps), GHOST, Vulnerability, Attacks, Sidechain, Namecoin, Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market and Global Economy, Application of Blockchain in Finance and Banking, Energy trading, Internet of Things (IoV, IoD, IIoT, Smart city, Smart Home, and so on), Medical Record Management System, Real estate business, Entertainment, Future scope of Blockchain.

Textbooks:

1. Roger Wattenhofer, Distributed Ledger Technology: The Science of the Blockchain, Second Edition, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Gold feder, Bitcoin and Cryp-tocurrencyTechnologies: A Comprehensive Introduction, Princeton University Press, 2016.
3. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Publication House, 2014.

Reference books:

1. Melanie Swan Blockchain: Blueprint for a new Economy, O'Reilly Publication House, 2015.
2. Andreas M. Antonopoulos and Dr. Gavin Wood, Mastering Ethereum Building Smart Contracts and DApps, O'Reilly Publication House, First Edition, 2018.

PAPER NAME: ADVANCED COMPUTER ARCHITECTURE
PAPER CODE: IT703C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Mathematics**,** Computer Organization and Architecture

Course Objective:
The objective of the course is to learn technical competence in computer architecture and performance comparisons of modern and high-performance computer systems.

Course Outcome:

After completion of the course students will be able to

CO1	Understand the cost, performance, Trends in Technology, data flow in arithmetic algorithms and Principles of computer design.
CO2	Model the architectural features of advanced processors.
CO3	Analyze the working of pipelining, exploring instruction level parallelism using static, dynamic & advanced techniques of scheduling
CO4	Explain memory organization and mapping techniques.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	--	--	1	--	--	--	--	--
CO2	2	2	3	3	--	--	1	--	--	--	--	1
CO3	2	3	2	3	--	--	1	--	--	--	--	1
CO4	2	3	3	1	--	--	1	--	--	--	--	-

Course Content:

Module 1: [7L]

Fundamentals of Computer Design: Review of Fundamentals of CPU, Memory and I/O, Trends in technology, power, energy and cost, Dependability, Performance Evaluation.

Module 2: [8L]

Instruction Level Parallelism: ILP concepts, Pipelining overview, Compiler Techniques for Exposing ILP, Dynamic Branch Prediction, Dynamic Scheduling, Multiple instruction Issue, Hardware Based Speculation, Static scheduling, Multi-threading, Limitations of ILP, Case Studies.

Module 3: [7L]

Data Level Parallelism: Vector architecture, SIMD extensions, Graphics Processing units, Loop level Parallelism.

Module 4: [7L]

Thread Level Parallelism: Symmetric and Distributed Shared Memory Architectures, Performance Issues, Synchronization, Models of Memory Consistency, Case studies: Intel i7 Processor, SMT & CMP Processors

Module 5: [7L]

Memory and I/O: Cache Performance, Reducing Cache Miss Penalty and Miss Rate, Reducing Hit Time, Main Memory and Performance, Memory Technology. Types of Storage Devices, Buses, RAID, Reliability, Availability and Dependability, I/O Performance Measures.

Textbooks:

1. Kai Hwang and Faye Briggs, “Computer Architecture and Parallel Processing”, Mc Graw-Hill International Edition, 2000.

Reference books:

1. Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier.
2. Sima D, Fountain T and Kacsuk P, ”Advanced Computer Architectures: A Design Space Approach”, Addison Wesley, 2000.

PAPER NAME: QUANTUM COMPUTING
PAPER CODE: IT703D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Concept of Logic Gate, Cryptography

Course Objective:

To introduce the fundamentals of quantum computing. The problem-solving approach using finite dimensional mathematics.

Course Outcome:

After completion of the course students will be able to

CO1	Understand basics of quantum computing
CO2	Understand physical implementation of Qubit
CO3	Understand Quantum algorithms and their implementation
CO4	Understand the Impact of Quantum Computing on Cryptography

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	--	--	--	--	--	--	--	--
CO2	2	--	3	2	--	--	--	--	--	--	--	--
CO3	3	3	2	3	--	--	--	--	--	--	--	--
CO4	3	--	3	--	--	--	--	--	--	--	3	3

Course Content:

Module-1: [4L]
Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. Complex Numbers: Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers

Module-2: [8L]
Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.
Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

Module-3: [8L]
Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture.
Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

Module-4: [8L]
Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

Module-5: [8L]
Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve. The Impact of Quantum Computing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications.

Text Book:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

Reference Book:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci Benenti G., Casati G. and Strini G.
2. Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific. Pittenger A. O.
3. An Introduction to Quantum Computing Algorithms.

PAPER NAME: DIGITAL FORENSICS
PAPER CODE: IT704A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite:

Course Objective:
To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices. To understand how to examine digital evidences such as the data acquisition, identification analysis.

Course Outcome:
After completion of the course students will be able to

CO1	To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
CO2	To understand how to examine digital evidences such as the data acquisition, identification analysis.
CO3	Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
CO4	To be well-trained as next-generation computer crime investigators.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	--	--	1	--	--	--	--	--
CO2	2	2	3	3	--	--	1	--	--	--	--	1
CO3	2	3	2	3	--	--	1	--	--	--	--	1
CO4	2	3	3	1	--	--	1	--	--	--	--	-

Course Content:

Module-1: [4L]
Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Module-2: [8L]
Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Module-3: [10L]
Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Module-4: [8L]
Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Module-5: [6L]
Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Text Book:

1. Warren G. Kruse II and Jay G. Heiser, “Computer Forensics: Incident Response Essentials”, Addison Wesley, 2002.

Reference Book:

1. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., “Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
2. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

PAPER NAME: MODELLING AND SIMULATION
PAPER CODE: IT704B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite:
Programming and Data Structures, Discrete Mathematics and Probability, Numerical Analysis, Basic Electronics.

Course Objective:
The objective of the course is to conceptualize basics of simulation and modeling for applying dynamic and probability concept of simulation and discrete simulation system; to enable students to analyze Continuous Uniformly Distributed Random Numbers and to assess the strengths and weaknesses of various methods and to analyze their behavior.

Course Outcome:

After completion of the course students will be able to

CO1	Summarize the issues in Modeling and Simulation
CO2	Explain the System Dynamics & Probability concepts in Simulation.
CO3	Solve the Simulation of Queuing Systems.
CO4	Analyze the Simulation output
CO5	Identify the application area of Modeling and Simulation and apply in the corresponding fields.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	--	--	--	--	--	--	--	--	
CO2	3	2	3	2	3	--	--	--	--	--	--	2
CO3	3	3	2	2	3	--	--	--	--	--	--	2
CO4	3	3	2	2	3	--	--	--	--	--	--	2
CO5	2	3	2	2	3	--	--	--	--	--	--	2

Course Content:

Module I: [10L]

Introduction to Modeling and Simulation:
Nature of Simulation. Systems, Models and Simulation, Continuous and Discrete Systems, system modeling, Components of a simulation study, Introduction to Static and Dynamic System simulation, Application areas, Advantages, Disadvantages and pitfalls of Simulation.

Module II: [10L]

System Dynamics & Probability concepts in Simulation:
Exponential growth and decay models, Generalization of growth models, Discrete and Continuous probability functions, Continuous Uniformly Distributed Random Numbers, Generation of a Random numbers, Generating Discrete distributions, Non-Uniform Continuously Distributed Random Numbers, Rejection Method.

Module III: [10L]

Simulation of Queuing Systems and Discrete System Simulation:
Poisson arrival patterns, Exponential distribution, Service times, Normal Distribution Queuing Disciplines, Simulation of single and two server queue. Application of queuing theory in computer system. Discrete Events, Generation of arrival patterns, Simulation programming tasks, Gathering statistics, Measuring occupancy and Utilization, Recording Distributions and Transit times.

Module IV: [6L]

Analysis of Simulation output:
Sensitivity Analysis, Validation of Model Results

Text Books:
1. Jerry Banks, John Carson, B.L.Nelson and D.M.Nicol " Discrete Event System Simulation", Fifth Edition, Pearson
2. Narsingh Deo, 1979, System Simulation with Digital Computers, PHI.

Reference Books:
1. Geoffrey Gordon, "System Simulation", PHI.
2. Averill M. Law and W.David Kelton, "Simulation Modelling and Analysis", Third Edition, McGraw Hill
3. J. N. Kapoor. Mathematical Modelling, Wiley eastern Limited.

PAPER NAME: DEEP LEARNING & NEURAL NETWORKS
PAPER CODE: IT704C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Linear Algebra, Machine Learning

Course Objective: The objective of the course is to present an introduction to deep learning systems, with an emphasis on introducing major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Course Outcome:

After completion of the course students will be able to

CO1	Understand the basics of Machine Learning & Deep Learning techniques that make it useful to real-world problems.
CO2	Apply Deep learning and neural network algorithms such as supervised, semi-supervised, and unsupervised.
CO3	Analyze various Deep learning and neural network techniques to investigate real world applications.
CO4	Evaluate and create model for finding the solution of real-world industry issues and problems.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	1	1	--	--	1	--	--	--	--	2
CO2	3	3	3	2	2	--	--	--	--	--	2	2
CO3	2	2	1	2	3	--	--	--	1	--	--	3
CO4	3	3	3	1	2	--	--	--	--	--	--	3

Course Content:

Module I: Introduction [6L]
Feed forward Neural networks. Gradient descent and the back propagation algorithm. Unit saturation, aka the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima. Heuristics for faster training. Regularization. Dropout.

Module II: Convolution Neural Networks [4L]
Architectures, convolution / pooling layers.

Module III: Recurrent Neural Networks [4L]

LSTM, GRU, Encoder Decoder architectures

Module IV: Deep Unsupervised Learning [6L]
Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM.

Module V: Models [3L]
Attention and memory models, Dynamic memory networks

Module VI: Computer Vision [6L]
Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks.

Module VII: Applications of Deep Learning to NLP [7L]
Introduction to NLP and Vector Space Model of Semantics
Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of- Words model (CBOW)**,** Glove, Evaluations and Applications in word similarity, analogy reasoning

Textbooks:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015).
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education

Reference books:

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006**.**

PAPER NAME: REAL TIME SYSTEMS
PAPER CODE: IT704D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Pre-requisite: Operating System

Course Outcome:

After completion of the course students will be able to

CO1	To study the basic of tasks and scheduling
CO2	To understand programming languages and databases
CO3	To analyze real time communication
CO4	To analyze evaluation techniques and reliability models for Hardware Redundancy
CO5	To understand clock synchronization

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	--	--	--	--	--	--	--	--	
CO2	3	2	2	3	3	--	--	1	--	--	--	2
CO3	3	3	2	2	3	--	--	--	--	--	--	1
CO4	3	3	2	2	3	--	1	--	--	--	--	2
CO5	2	3	2	2	3	--	--	--	--	--	--	2

Course Content:

Module-1: [8L]
Introduction to task scheduling
Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms, RM algorithm with different cases-Priority ceiling precedence constraints- using of primary and alternative tasks.

Module-2: [8L]
UNI and multiprocessor scheduling-
Uniprocessor scheduling of IRIS tasks, Task assignment, Utilization balancing – Next fit- Bin packing- Myopic off-line - Focused addressing and bidding- Buddy strategy- Fault Tolerant Scheduling. -Aperiodic scheduling - Spring algorithm, Horn algorithm- Bratley. - Sporadic scheduling.

Module-3: [8L]
Real time Communication: Introduction –
VTCSMA – PB CSMA- Deterministic collision resolution protocol- DCR for multi packet messages- dynamic planning based- Communication with periodic and aperiodic messages.

Module-4: [8L]
Real time databases:
Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Twophase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time System.

Module-5: [4L]
Real time modelling and case studies:
Petrinets and applications in real-time modeling, Air traffic controller system – Distributed air defense system.

Text Book:

1. C.M. Krishna, Kang G. Shin, “Real Time Systems”, Tata McGraw - Hil,

Reference book:

1. Giorgio C. Buttazzo, “Hard real-time computing systems: predictable scheduling algorithms and applications”, Springer.
2. C. Siva Ram Murthy, G. Manimaran, “Resource management in real-time systems and networks”, PHI.

PAPER NAME: CLOUD COMPUTING LAB
PAPER CODE: IT791A
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Prerequisite:
Networking, Operating System, Web Technology.

Course Objective:
The objective of the course is to learn and apply the concept of cloud computing in real world application

Course Outcome:
After completion of this course students will be able to

CO1	Apply the concept cloud computing to solve practical use cases
CO2	Analyzing different services in cloud computing
CO3	Evaluate different available services provided by cloud vendors
CO4	Design Cloud based application

CO-PO Mapping:

	PO1	**PO2**		**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3		--	--	--	--	--	--	--	--	--	3
CO2	3	3		3	2	2	--	--	--	--	--	--	1
CO3	3	3		3	2	3	--	--	--	--	--	--	2
CO4	3	3		3	4	2	--	--	--	--	--	--	3

Course Contents:
Module 1: Virtual Machine:
Creation of vpc, vnet, virtual machine, Private and Public IP configuration

Module 2: Application Development:
Implementation of SOAP Web services in JAVA Applications.
Use Azure to launch the web applications. Test Simple Application

Module 3: Security:
Identity and access management, Multifactor Authentication.

Module 4: Bot and AI service:
Test AWS and AZURE Bot and AI services

Text books:
1. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Reference books:
1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

PAPER NAME: INTERNET TECHNOLOGY LAB
PAPER CODE: IT791B
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Prerequisite:
Computer Networking, Web Technology

Course Objective
The objective of the course is to make students understand different routing algorithm and mail server configurations and explaining C# and .NET Frame work for implementing web applications

Course Outcome
After completion of this course students will be able to

CO1	Understanding and apply the basic networking concepts for configuration of network server and routing protocols
CO2	Analyzing and understanding the concept of .NET framework
CO3	Apply the concept of .NET for implementing web applications
CO4	Evaluate different web application to implement optimal solutions for real life problems.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	3	3	--	--	--	--	--	--	--
CO2	2	3	2	3	3	--	--	--	--	--	--	--
CO3	2	3	3	3	3	--	--	--	--	--	--	--
CO4	2	3	3	3	3	--	3	3	3	--	3	3

Course Contents:

Configuration of Routing Protocol
Configure, implement and debug the following: Use open-source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using netstat) Mail Server Configuration: Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

C#
Getting Started with .Net Framework, Exploring Visual Studio .NET, Inside a C# Program, Data Types, Statements, Arrays, Using Strings, Objects, Classes and Structs, Properties, Inheritance, Indexers, Delegates, Events, Namespaces, Generics, Collections and Data Structures, Exception Handling, Threading, Using Streams and Files, Reflection, Assemblies, versioning, Windows Forms, Controls, Data binding to Conrols, Advanced Database Programming using ADO.net, Using GDI +,Networking,.net Remoting, Manipulating XML.

ASP.NET
Building a Web Application, Examples Using Standard Controls, Using HTML Controls, Validating Form Input Controls using Validation Controls, Understanding Applications and State, Applying Styles, Themes, and Skins, Creating a Layout Using Master Pages, Binding to Databases using Controls, Data Management with ADO.net, Creating a Site Navigation Hierarchy, Navigation Controls , Membership and Role Management, Login Controls, Securing Applications, Caching For Performance, Working with XML, Using Crystal Reports in WebForms

DBMS
Introduction, Using SQL to work with database, retrieving and manipulating data with SQL, working with ADO.NET, ADO.NET architecture, ASP.NET data control, data source control, deploying the web site. Crystal reports. LINQ: Operators, implementations, LINQ to objects, XML, ADO.NET, Query Syntax.

Text books:

1. Beginning ASP.NET 4 in C# 2010 Matthew MacDonald

Reference books:

1. ASP .NET Complete Reference Matthew Mac Donald
2. C# Complete Reference Herbert Schildt

PAPER NAME: BIG DATA ANALYTICS LAB
PAPER CODE: IT791C
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Course Objective:
The objective of this course is to impart necessary and practical knowledge of components of Big Data Analytics and develop skills required to build real-life based projects.

Course Outcome
After completion of this course students will be able to

CO1	Understand and implement the basics of data structures like linked list, stack, queue, set and map in Java.
CO2	Demonstrate the knowledge of Big Data Analytics and implement different file management task in Hadoop.
CO3	Understand Map Reduce Paradigm and develop data applications using variety of Systems.
CO4	Analyze and perform different operations on data using Pig Latin Scripts.
CO5	Illustrate and apply different operations on relations and databases using Hive.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	--	--	--	--	--	--	--	2
CO2	3	2	2	2	--	--	--	--	--	--	--	2
CO3	3	2	2	3	--	--	--	--	--	--	--	2
CO4	3	2	2	2	--	--	--	--	--	--	--	2
CO5	3	3	2	3	--	--	--	--	--	--	--	2

Course Contents:
1. Implement the following Data structures in Java
i)Linked Lists ii)Stacks iii)Queues iv)Set v)Map
2. Perform setting up and Installing Hadoop in its three operating modes:
Standalone, Pseudo distributed, Fully distributed.
3. Implement the following file management tasks in Hadoop:
• Adding files and directories
• Retrieving files
• Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.
6. Implement Matrix Multiplication with Hadoop Map Reduce.
7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
8. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
9. Solve some real life big data problems.

PAPER NAME: PATTERN RECOGNITION LAB
PAPER CODE: IT791D
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Pre-requisite: Fundamentals of probability and linear algebra

Course Outcome:
After completion of the course students will be able to

CO1	Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
CO2	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
CO3	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
CO4	Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
CO5	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	--	--	--	--	--	--	--	2
CO2	3	-	-	2	--	--	--	--	--	--	--	2
CO3	3	2	2	3	--	--	--	--	--	--	--	2
CO4	3	2	2	2	--	--	--	--	--	--	--	2
CO5	-	3	2	3	--	--	--	--	--	--	--	2

Course Content:

List of Experiment:

1. Feature Representation :
   The high level goals of the experiment are:
   A. To understand the role of feature extraction as a filter of information and the effect of this filtering process on our ability to classify.
   B. To understand the effect of various types of features on the distribution of points in feature space.
   C. To generate your own feature set by combining existing set of features, or defining new ones.
   D. To appreciate the appropriateness of different feature sets to different classification problems.

2. Mean and Covariance :

   The high level goals of the experiment are:
   A. To gain an understanding of these metrics; need to understand the effect of these parameters on the shape of the data distribution under various assumptions of densities.
   B. This will allow us to visualize the nature of distribution, given the mean vector and the covariance matrix.

3. Linear Perceptron Learning :
   The high level goals of the experiment are:
   A. To understand the working of linear perceptron learning algorithm.
   B. To understand the effect of various parameters on the learning rate and convergence of the algorithm.
   C. To understand the effect of data distribution on learnability of the algorithm.
   D. To understand the implication of learning a constrained plane in d+1-dimensional space.

4. Generation of Random Variables :

The high level goals of the experiment are:

A. To understand the nature of randomness and how they are characterized.
B. To understand the difference between discrete and continuous random numbers.
C. To understand the process of generation of random numbers with a desired density/distribution.
D. To understand the practical limitations and advantages of randomness generated using algorithms.

5. Bayesian Classification

The high level goals of the experiment are:

A. To understand the computation of likelihood of a class, given a sample.
B. To understand the the use of density/distribution functions to model a class.
C. To understand the effect of prior probabilities in Bayesian classification.
D. To understand how two (or more) density functions interact in the feature space to decide a decision boundary between classes.
E. To understand how the decision boundary varies based on nature of the density functions.

6. MLE: Learning the classifier from data :

The high level goals of the experiment are:

A. To understand the modelling of a class in terms of density functions and priors.
B. To understand the estimation of the parameters of a model from a set of samples.
C. To understand the effect of sample size on decision boundary.

7. Data Clustering: K-Means, MST-based

The high level goals of the experiment are:

A. Understand the idea of data clustering.
B. Understand how the choice a clustering algorithm is important for desired results.
C. Understand the described two clustering methods K-means and MST based.
D. Understand the difference between the two approaches used and the different results that these may give on similar data.

Text books:

1. Pattern Recognition, S.Theodoridis and K.Koutroumbas, 4th Ed., Academic Press, 2009

Reference books:

1. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006
2. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, John Wiley, 2001

PAPER NAME: SOFT COMPUTING LAB
PAPER CODE: IT792A
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Prerequisite:
Set theory and basic computation.

Course Objective:
To give students knowledge of soft computing theories fundamentals, that is of fundamentals of non-traditional technologies and approaches to solving hard real-world problems, namely of fundamentals of artificial neural networks, fuzzy sets, fuzzy logic and genetic algorithms.

Course Outcome:
After completion of this course students will be able to

CO1	Apply different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.
CO2	Analyze and implement real life problems based on soft computing techniques.
CO3	Evaluate and create soft computing model to solve real life problems of the society.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	2	2	--	--	--	1	--	1	1
CO2	3	2	2	2	--	--	--	--	1	--	1	1
CO3	2	3	2	2	1	--	--	--	1	--	1	2

Course Contents:

1) Overview of Matrix, Matrix Operations, Giving input to Matrix, Displaying elements of Matrix.
2) Performing Operations on Matrix like Addition, Subtraction, and Multiplication.
3) Performing Transpose Operations on Matrix.
4) Plotting of mathematical functions like log(x), sin(x), cos(x). etc
5) Write a Program in MATLAB to check whether a number is even or odd
6) Write a program in MATLAB to find out the sum of "N" natural numbers.
7) Write a Program in MATLAB to generate the Fibonacci series upto N , where N is the desired value input by user
8) Write a MATLAB program to solve MATRIX based problems.
9) Write a MATLAB Program to implement LMS Learning rule.
10) Write a MATLAB program to verify McCulloch OR Function.
11) Write a MATLAB program to verify Hebb's Rule.
12) Write a MATLAB program to implement various Fuzzy Operations. (EgUnion , Intersection , Complement, XOR Operation) For two Fuzzy Set

P = (0.3/a) + (0.9/b) + (1.0/c) + (0.7/d) + (0.5/e) + (0.4/f) + (0.6/g)
Q = (1/a) + (1/b) + (0.5/c) + (0.2/d) + (0.2/e) + (0.1/f) + (0.4/g)

13) Write a MATLAB program to implement Max-Min Composition

For Two Fuzzy sets
P = [0.3 0.7 ; 0.9 0.4 ; 0.2 0.5]
Q = [0.4 0.1 0.8;0.3 0.7 0.6]

14) Implementation of Union , Intersection , Complement , XOR Operation and Demorgan's Law
15) Write a MATLAB program to implement MAX Composition for the two set of Matrix

S = [0.3 0.7;0.9 0.4;0.2 0.5]
R = [0.4 0.1 0.8;0.3 0.7 0.6]

16) Write a MATLAB program to implement Defuzzification α-cut method

For the following fuzzy set
F = (0.6/a) + (0.3/b) + (0.7/c) + (1.0/d).
Projects assigned by instructor to model and solve real world problems.

Text books:

1. Fuzzy Logic with Engineering Applications, Timothy J. Ross, Willey.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
3. Genetic Algorithms: Search and Optimization, E. Goldberg.

Reference books:

1. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee PHI.
2. Elements of Artificial Neural Network, Kishan Mehrotra, MIT Press.
3. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press

PAPER NAME: CYBER SECURITY LAB
PAPER CODE: IT792B
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Pre-requisite: A course on "Network Security and Cryptography".

Course Outcome:

After completion of the course students will be able to

CO1	Get the skill to identify cyber threats/attacks.
CO2	Get the knowledge to solve security issues in day to day life.
CO3	Able to use Autopsy tools
CO4	Perform Memory capture and analysis
CO5	Demonstrate Network analysis using Network miner tools

CO–PO Mapping:

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

Course Content:

List of Experiments

1. Perform an Experiment for port scanning with nmap
2. Set Up a honeypot and monitor the honeypot on the network
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetriccrypto algorithm, Hash and Digital/PKI signatures.
4. Generate minimum 10 passwords of length 12 characters using open SSL command
5. Perform practical approach to implement Footprinting-Gathering target information usingDmitry-Dmagic, UAtester
6. Working with sniffers for monitoring network communication (Wireshark).
7. Using Snort, perform real time traffic analysis and packet logging.
8. Perform email analysis using the Autopsy tool.
9. Perform Registry analysis and get boot time logging using process monitor tool
10. Perform File type detection using Autopsy tool
11. Perform Memory capture and analysis using FTK imager tool
12. Perform Network analysis using the Network Miner tool

TEXT BOOKS:

1. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auerback Publications,2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J.Sammons, Syngress Publishing, 2012.

REFERENCE BOOKS:

1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H.Malin, E. Casey and J. M. Aquilina, Syngress, 2012.
3. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes,Syngress, 2007.

PAPER NAME: WIRELESS AD HOC NETWORK LAB
PAPER CODE: IT792C
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Prerequisite:
Course Outcome:
After comp**letion of the course students will be able to**

CO1	Simulate different topologies of Ad-hoc networks.
CO2	Implement the physical and MAC layer protocols of Ad-hoc networks.
CO3	Apply TCP and UDP protocols for Ad-hoc networks.
CO4	Implement the LEACH and PEGASIS protocols of WSNs.
CO5	Demonstrate the SPIN protocol of WSNs.

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1							2				
CO2		1		2								
CO3				1				2				
CO4			1		2							
CO5		1		1	2							

Course Content:

LIST OF EXPERIMENTS:
Note: Implement Experiment No: 1 to 5 using NS2/NS3 Simulation Tool.
Implement Experiment No: 6 to 8 using MATLAB Tool.

1. Create a sample wireless topology using Simulation Tool.
2. Create a mobile Ad-hoc networks using Simulation Tool.
3. Implement an Ad-hoc On-demand Distance Vector protocol using Simulation Tool.
4. Implement a Transmission Control Protocol using Simulation Tool.
5. Implement an User Datagram Protocol using Simulation Tool.
6. Implement a Low Energy Adaptive Hierarchy protocol using Simulation Tool.
7. Implement a Power Efficient Gathering in Sensor Information System using Simulation Tool.
8. Implement a Sensor Protocol for Information via Negotiation (SPIN) using Simulation Tool.

ADDITIONAL EXPERIMENTS:

Note: Implement Experiment No: 3using NS2/NS3 Simulation Tool.
Implement Experiment No: 1,2 and 4MATLAB Tool.

1. Implement a Power Efficient and Delay Aware MAC protocol using Simulation Tool.
2. Implement a Predictive Wake-up MAC protocol using Simulation Tool.
3. Implement a Proactive and Reactive based MAC protocol using Simulation Tool.
4. Implement a Scheduling based protocol for WSNs using Simulation Tool.

TEXT BOOKS:

1. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Second Edition, Pearson Publication, 2015.

PAPER NAME: NOSQL DATABASE WITH MongoDB LAB
PAPER CODE: IT792D
CONTACT: 0:0:3
TOTAL CONTACT HOURS: 12
CREDIT: 1.5

Course Outcome:

After completion of the course students will be able to

CO1	Assimilate fundamental concepts in the context of a number of different NOSQL products.
CO2	Construct refined logical database model with consideration of Data semantics and dependency.
CO3	Execute various CRUD operations with MongoDB.
CO4	Build a database system and demonstrate competence with the fundamental tasks involved with its modelling, designing and implementation.
CO5	Use the MongoDB tools to develop and deploy various applications.

CO–PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1		3									
CO2		1		2								
CO3				1								
CO4			1		2							
CO5		1		1	2							

Course Content:

The objective of this lab is to introduce some features of non-relational or NoSQL databases using MongoDB. MongoDB stores data in JSON objects which it calls documents and uses a custom language for queries

1. **Downloading and Installation of MongoDB:** Setting path in environment variable; Identify MongoDB environment; Using Mongo Shell; Configuration file in MongoDB

2. **Creation & Insertion of Data in Database:** Creating database employee;
   Create collections emp_personal_details with emp_id, emp_name, emp_address ,emp_DOB, emp_age, emp_mobile number
   Create another collection emp_professional_details with emp_id, emp_name, designation , salary ,incentive, working hours;
   Insert 10 records in collection emp_personal_details and emp_professional_details
   Show all the employees having designation manager;
   Show all the employees having salary 6000

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3. **CRUD operations :Querying the Database:**
   Update the collection emp_personal_details , add field status and setit to retired where age is greater than 60 .
   Update collection emp_professional_details, give incentive 5000 toemployees whose working hours is greater than 45 per week
   Add 1000 to salary employee whose designation is accountant.
   Delete some record and then restore it from backup3.Export the collection in csv and json format 4.Delete some records and import the collections
4. **Replication:** Create replica set of employee database and insert records in primarynode and display the same records in secondary nodes

5. Index Creation

Create index on emp_id in collection emp_professional_details ; Create multiple index on emp_id,emp_name in collectionemp_professonal details

Find sum of salaries of employee having designation clerk.

Filter the employees having designation software engineer and findthe minimum salary.

6. Pipeline operation :Application of commands(unwind, skip, limit etc.)

Use unwind command and show the employees whose mobilenumber is stored in array

Use skip command to skip first 3 records and display rest of records

Use limit command to show only first four records of collection

7. Creation of Backup Dataset:

Create backup of collections emp_personal_details and emp_professional_Details

TESTBOOK:

Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019

WEB Reference:

https://www.ibm.com/cloud/learn/nosql-databases
https://www.geeksforgeeks.org/introduction-to-nosql/
https://www.geeksforgeeks.org/introduction-to-nosql/

Detailed Syllabus
of
8th Semester

4th Year 8th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	IT801	A. Data Sciences B. Business Analytics C. Cluster and Grid Computing D. Distributed Database	3	0	0	3	3
2	ENGG	Major	IT802	A. Human Computer Interaction B. Natural Language Processing C. Distributed Computing D. Information and Coding Theory	3	0	0	3	3
3	ENGG	Minor	IT803	A. Bio-Informatics B. Embedded System C. Human Resource Management D. Computer Vision	3	0	0	3	3
4	HUM	Ability EnhancementCourse	HU(IT)801	Principles of Management	2	0	0	2	2
B.PRACTICAL									
1			IT881	Grand Viva	0	0	0	0	2
2	PRJ	Project	IT882	Major Project-II	0	0	0	12	6
Total of Theory, Practical								23	19

PAPER NAME: DATA SCIENCES
PAPER CODE: IT801A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Basic knowledge in data storage and retrieval, Knowledge in Quantitative Aptitude and Statistics, Proficiency in Algorithms and Computer Programming Skills.

Course Objective:
Demonstrate knowledge of statistical data analysis techniques utilized in business decision making, Use data mining software to solve real-world problems.

Course Outcome
After completion of this course students will be able to

Course Outcome
After completion of this course student will be able to

CO1	Summarize the issues in Modeling and Simulation
CO2	Explain the System Dynamics & Probability concepts in Simulation.
CO3	Solve the Simulation of Queuing Systems
CO4	Analyze the Simulation output
CO5	Identify the application area of Modeling and Simulation and apply in the corresponding fields

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	--	--	--	--	--	--	--	--	--
CO2	3	3	3	2	3	--	--	--	--	--	--	3
CO3	3	3	3	2	3	--	--	--	--	--	--	3
CO4	3	3	2	3	3	--	--	--	--	--	--	2

Course Contents:

Module 1: Introduction [5L]
Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Module 2: Data Collection and Data Pre-Processing [8L]
Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Module 3: Exploratory Data Analytics [8L]
Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA

Module 4: Model Development [8L]
Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot –Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample, Evaluation – Prediction and Decision Making.

Module 5: Model Evaluation [7L]
Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting , Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing, Multiple Parameters by using Grid Search.

Textbooks:

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

Reference books:

1. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

PAPER NAME: BUSINESS ANALYTICS
PAPER CODE: IT801B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Basic knowledge of Statistical Inference, Multiple Linear Regression and Probability Distributions. Proficiency in Algorithms and Computer Programming Skills.

Course Objective: The objective of this course is to cover fundamental algorithms and techniques used in Business Analytics its applications along with the statistical foundations.

Course Outcome:

After completion of the course students will be able to

CO1	Find a meaningful pattern in data
CO2	Graphically interpret data
CO3	Implement the analytic techniques
CO4	Handle large scale analytics projects from various domains

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	2	3	--	--	--	2	--	--	--
CO2	2	3	3	3	3	--	--	--	--	--	--	--
CO3	2	3	3	3	3	--	--	--	2	--	--	--
CO4	2	3	3	3	3	--	--	--	2	1	--	2

Course Contents:

Module 1: [4L]
Foundations of Business Analytics: Introduction to Business Analytics, Analytics on Spreadsheets. Data Definitions and Analysis Techniques. Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Introduction to statistical learning and R-Programming

Module 2: [4L]
Product-Market Fit: Gap Analysis, Carrying Out Gap Analysis, Steps in Gap Analysis, Conducting a Representative Survey for Gap Analysis, Predicting Consumer Behavior and Gap Analysis in Smartphone Market.

Module 3: [6L]
Analytical Modeling by Factor and Cluster Analysis, Factor Analysis Concepts, Application of Factor Analysis Concepts of Cluster Analysis, Similarity Measures, Application of Cluster Analysis.

Module 4: [7L]
Analytical Modeling by Logistics Regression and Discriminant Analysis: Linear Discriminant Analysis Model, Predictive Modeling using Discriminant Analysis, Application of Linear Discriminant Analysis for Credit Scoring of Loan Applicants. Theoretical Formulation of Logistics Regression, Mathematical Interpretation of Logistics Regression, Indicator for Model Fit, Applying Logistics Regression, Application of Logistics Regression in Predicting Risk in Portfolio Management Testing the Reliability/Consistency of the Different Factors Measured.

Module 5: [4L]
Segmentation of primary target market by Heuristic Modeling: Introduction to RFM Analysis, Enhancing Response Rates with RFM Analysis.

Module 6: [5L]
Segmentation of target market based on large databases using Decision Tree approach. Introduction to Chi-square Automatic Interaction Detection (CHAID), Predictive Modelling by CHAID.

Case Studies and Projects: [6L]
Understanding business scenarios, Feature engineering and visualization. Scalable and parallel computing with Hadoop and Map-Reduce, Sensitivity Analysis, Practice and analysis with R.

Textbooks:
1. Business Analytics: An Application Focus, Purba Halady Rao, Prentice Hall.
2. Business Analytics, James R. Evans, Pearson.

Reference books:
1. Modeling Techniques in Predictive Analytics, Thomas W. Miller, Pearson
2. Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data, Thomas H. Davenport, Pearson.
3. Fundamentals of Business Analytics, Seema Acharya, Wiley India.
4. Business Intelligence: A Managerial Perspective on Analytics, Ramesh Sharda, Dursun Delen, Efraim Turban, David King, Prentice Hall

PAPER NAME: CLUSTER AND GRID COMPUTING
PAPER CODE: IT801C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Networking, Operating System, Computer Architecture

Course Objective:
The objective of the course is to learn and understand Cluster and Grid computing in details and identify the usage of it.

Course Outcome:
After completion of this course students will be able to

CO1:	Understand the basic architecture of Cluster and Grid Computing
CO2:	Apply the knowledge of Cluster and Cluster computing in the evaluation of the computing model
CO3:	Analyze different problems in the domain of Cluster and Grid computing
CO4:	Evaluate the different models and solutions provided in the field of Cluster and Grid computing

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	2	3	--	--	--	2	--	--	--
CO2	2	3	3	3	3	--	--	--	--	--	--	--
CO3	2	3	3	3	3	--	--	--	2	--	--	--
CO4	2	3	3	3	3	--	--	--	2	1	--	2

Course Contents:

Module 1: Cluster Computing [3L]
Approaches to Parallel Computing, How to Achieve Low Cost Parallel Computing through Clusters, Definition and Architecture of a Cluster, What is the Functionality a Cluster can Offer? Categories of Clusters

Module 2: Cluster Middleware [3L]
Levels and Layers of Single System Image (SSI), Cluster Middleware Design Objectives, Resource Management and Scheduling, Cluster Programming Environment and Tools

Module 3: Cluster Architecture [4L]
Early Cluster Architectures, High Throughput Computing Clusters, Condor.

Module 4: Network Protocols and IO [5L]
Networks and Inter-connection/Switching Devices, Design Issues in Interconnection Networking/Switching, Design Architecture-General Principles and Trade-offs, HiPPI, ATM (Asynchronous Transmission Mode), Gigabit Ethernet

Module 5: Introduction to Grid Computing [4L]
The Data Centre, the Grid and the Distributed / High Performance Computing, Cluster Computing and Grid Computing, Meta computing – the Precursor of Grid Computing, Scientific, Business and e-Governance Grids, Web Services and Grid Computing, Business Computing and the Grid – a Potential Win – win Situation, e-Governance and the Grid.

Module 6: Technologies and Architecture [2L]
Clustering and Grid Computing, Issues in Data Grids, Key Functional Requirements in Grid Computing, Standards for Grid Computing, Recent Technological Trends in Large Data Grids

Module 7: Grid Monitoring [4L]
Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- R-GMA - Grid ICE – MDS- Service Level Agreements (SLAs) - Other Monitoring Systems- Ganglia, Grid Mon, Hawkeye and Network Weather Service.

Module 8: Grid Security and Resource Management [3L]
Grid Security-A Brief Security Primer-PKI-X509 Certificates-Grid Security-Grid Scheduling and Resource Management, Grid way and Grid bus Broker-principles of Local Schedulers Overview of Condor, SGE, PBS, LSF-Grid Scheduling with QoS

Module 9: Data Management and Grid Protocol [4L]
Data Management-Categories and Origins of Structured Data-Data Management Challenges Architectural Approaches-Collective Data Management Services-Federation Services-Grid Portals-Generations of Grid Portals.

Module 10: Grid Middleware [4L]
List of globally available Middleware - Case Studies-Recent version of Globus Toolkit and gLite - Architecture, Components and Features. Features of Next generation grid.

Textbooks:
1.C.S.R.Prabhu – "Grid and Cluster Computing"-PHI(2008)

Reference books:
1. Fran Berman , Geoffrey Fox, Anthony J.G. Hey, Grid Computing: Making The Global Infrastructure a Reality,Wiley, 2003
2. Maozhen Li , Mark Baker , The Grid: Core Technologies, Wiley, 2005
3. JoshyJoseph , Craig Fellenstein Grid Computing, IBM Press, 2004

PAPER NAME: DISTRIBUTED DATABASE
PAPER CODE: IT801D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Good knowledge in Database Management System.

Course Objective: To learn the principal and foundation of distributed database. To learn the architecture, design issue and integrity control of distributed database. To learn the details of query processing and query optimization technique. To learn the concept of transaction management in distributed database.

Course Outcome:

After completion of the course students will be able to

CO1	Describe database management system internals, understand and describe internal algorithms in detail.
CO2	Identify and be able to use recent and advanced database techniques (e.g., in concurrency control, buffer management, and recovery
CO3	Decide on configuration issues related to database operation and performance. Identify which parameters are suitable and what are its implications
CO4	Analyze and optimize transactional code, identifying causes of possible anomalies and correct them.
CO5	Decide on optimization issues given a known database workload, by manipulating indexes, choosing more adequate data types, and modifying queries.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	--	2	2	2	--	--	--	--	2	2	3	2
CO2	**1**	2	**3**	2	--	--	--	--	--	--	2	2
CO3	**2**	**3**	2	3	--	--	--	--	--	--	1	2
CO4	**2**	**3**	2	2	--	--	--	--	--	--	2	2
CO5	2	3	2	3	--	--	--	--	--	--	2	1

Course Contents:

Module I: [9L]
Introductory concepts and design of (DDBMS) Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

Module II: [9L]
Query Processing [4L] Overview of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing; Translation of global queries. Transaction Management Introduction to Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

Module III: [5L]
Partitioned network; check point and cold start; Management of distributed transaction; Architectural aspect; Node and link failure recoveries

Module IV: [3L]
Distributed data dictionary management. Distributed database administration. Heterogeneous databases- federated database, reference architecture, loosely and tightly coupled.

Module V: [5L]
Distributed Object Database Management systems Fundamental Object concepts and Object models; Object distribution

design; Architectural issues; Object management; Distributed object storage; Object query processing

Module IV: [5L] Current trends & developments related to Distributed database applications technologies Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI; Distributed document-based systems; XML and Workflow management.

Text books:

1. Distributed Databases - Principles and Systems; Stefano Ceri; GuiseppePelagatti; Tata McGraw Hill;1985.
2. Fundamental of Database Systems; Elmasri&Navathe; PearsonEducation;Asia

Reference books:

1. Database System Concepts;Korth&Sudarshan;TMH
2. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall

PAPER NAME: HUMAN COMPUTER INTERACTION
PAPER CODE: IT802A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Course Objective:
The objective of this course is to provide technical knowledge of the foundations of Human Computer Interaction.

Course Outcome
After completion of this course students will be able to

CO1	Understand the design and development processes and life cycle of Human Computer Interaction
CO2	Apply the interface design standards/guidelines for cross cultural and disabled users.
CO3	Analyze product usability evaluations and testing methods.
CO4	Design and Develop Human Computer Interaction in proper architectural structures.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	--	--	--	--	--	--	--	--	--
CO2	3	2	1	--	--	--	--	--	--	--	--	1
CO3	2	2	1	--	--	--	--	--	--	--	--	--
CO4	3	2	2	--	--	--	--	--	--	--	--	1

Course Contents:

MODULE I: HCI Foundations: [8L]
Input–output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems, Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning.

MODULE II: Designing: [10L]
Programming Interactive systems- Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, The context of the interaction, Experience, engagement and fun, Paradigms for interaction, Cantered design and testing- Interaction design basics-The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping, Design for non-Mouse interfaces, HCI in the software process, Iterative design and prototyping, Design rules, Principles to support usability, Standards and Guidelines, Golden rules and heuristics, HCI patterns.

MODULE III: Implementation Support:[8L]
Elements of windowing systems, Programming the application, Using tool kits User interface management systems, Evaluation techniques, Evaluation through expert analysis, Evaluation through user participation, Universal design, User support.

MODULE IV: Models and Theories:[10L]
Cognitive models, Goal and task hierarchies, Linguistic models, The challenge of display-based systems, Physical and device models, Cognitive architectures. Collaboration and communication - Face-to-face communication, Conversation, Text-based communication, Group working, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design. Human factors and security - Groupware, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware Implementing synchronous groupware, Mixed, Augmented and Virtual Reality.

Textbooks:

1. A Dix, Janet Finlay, G D Abowd, R Beale., Human-Computer Interaction, 3rd Edition, Pearson Publishers,2008.
2. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2010.

Reference books:

1. Brian Fling, ―Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)
2. Bill Scott and Theresa Neil, ―Designing Web Interfaces, First Edition, O'Reilly, 2009. (UNIT-V)

PAPER NAME: NATURAL LANGUAGE PROCESSING
PAPER CODE: IT802B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Mathematics, Computer Programming, Formal Language and Automata Theory

Course Objective:
The objective of the course is to learn the basics of NLTK toolkit, principles of NLP through programming, to build an application using different algorithms and natural language processing techniques.

Course Outcome:
After completion of this course students will be able to

CO1	Understand the basics of text processing including basic pre-processing, spelling correction, language modeling, Part-of-Speech tagging, Constituency and Dependency Parsing, Lexical Semantics, distributional Semantics and topic models
CO2	Apply the text mining such as entity linking, relation extraction, text summarization, text classification, sentiment analysis and opinion mining.
CO3	Analyze the application of text mining such as entity linking, relation extraction, text summarization, text classification, sentiment analysis and opinion mining
CO4	Evaluate and create various texts mining model to solve real world tasks using NLP tool kits

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	3	3	2	--	--	--	--	--	3
CO2	2	3	2	1	3	2	--	--	--	--	--	1
CO3	3	1	2	1	3	3	--	--	--	--	--	2
CO4	3	3	2	3	2	2	--	--	--	--	--	2

Course Contents:

Module I: [5L]
Introduction: Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms, Language, Thought, and Understanding, The State of the Art and the Near-Term Future. Regular Expressions and Automata: Regular Expressions, Finite-State Automata, Regular Languages and FSAs.

Module II: [5L]
Word Classes and Part-of –Speech Tagging: (Mostly) English Word Classes, Tag sets for English, Part-of –Speech Tagging, Rule-Based Part-of –Speech Tagging, Stochastic Part-of –Speech Tagging, Transformation-Based Tagging, Other Issues.

Module III: [5L]
Context-Free Grammars for English: Constituency, Context-Free Rules and Trees, Sentences-Level Constructions, The Noun Phrase, Coordination, Agreement, The Verb Phrase and Sub categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence and Normal Form, Finite-State and Context- Free Grammars, Grammars and Human Processing.

Module IV: [5L]
Parsing with Context-Free Grammars: Parsing as Search, A Basic Top-Down Parser, Problems with the Basic Top-Down Parser, The Early Algorithm, Finite – State Parsing Methods.

Module V: [5L]
Features and Unification: Feature Structures, Unification of Features Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints, Types and Inheritance.

Module VI: [5L]
Representing Meaning: Computational Desiderata for Representations, Meaning Structure of Language, First Order Predicate Calculus, and Some Linguistically Relevant Concepts. Semantic Analysis: Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Early Parser, Idioms and Composionality, Robust Semantic Analysis.

Module VII: [6L]
Discourse: Reference Resolution, Text Coherence, Discourse Structure, Psycholinguistic Studies of Reference and Coherence. Natural Language Generation: Introduction to Language Generation, An Architecture for Generation, Surface Realization, Discourse Planning, Other Issues.

Textbooks:
1. Steven Bird, Ewan Klein, and Edward Loper. "Natural Language Processing– Analyzing Text with the Natural Language Toolkit". 2009, O'Reilly, 1ed.
2. Robert Dale, Hermani Moisi, Harold Somers, Handbook Of Natural Language Processing, Markcel Dekker Inc.

Reference books:
1. Ruslan Mitkov, The Oxford Handbook of Computational Linguistics, Oxford University Press, 2003.
2. Daniel Jurafsky, James Martin, Speech and Language Processing, Prentice Hall,
3. James Allen, Natural Language Processing, Pearson Education, 2003.
4. Christopher D.Manning& Henrich Schutze, Foundations Of Statistical Natural Language Processing, The MIT Press, 2001
5. Douglas Biber, Susan Conrad, Randi Reppen, Corpus Linguistics – Investigating Language Structure And Use, Cambridge University Press, 2000.
6. David Singleton, Language And The Lexicon: An Introduction, Arnold Publishers, 2000.

PAPER NAME: DISTRIBUTED COMPUTING
PAPER CODE: IT802C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Have to knowledge about Computer Network, operating system and Computer architecture. Required C and UNIX knowledge.

Course Objective: This course covers general issues of design and implementation of distributed operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, sharing and replication of data and files

Course Outcome:

After completion of the course students will be able to

CO1	To define the distributed operating system, architecture, goal of DOS and its designing issues
CO2	To categorize the technique of inter-process communication
CO3	To choose the local clock instead of global clock and the different mutual exclusion and deadlock algorithms.
CO4	To organize the distributed file system and shared memory architecture.
CO5	To evaluate the idea about the designing policy of different distributed operating system like AMOEBA, MACH, DCE.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	--	--	--	--	--	--	--	2
CO2	3	2	2	2	--	--	--	--	--	--	--	2
CO3	3	2	2	3	--	--	--	--	--	--	--	2
CO4	3	2	2	2	--	--	--	--	--	--	--	2

Course Contents:

Module I: [6L]
Functions of an Operating System, Design Approaches, Review of Network Operating System and Distributed Operating System, Issue in the design of Distributed Operating, Overview of Computer Networks, Modes of communication, System Process, Interrupt Handling, Handling Systems calls, Protection of resources, Micro-Kernel Operating System, client server architecture.

Module II: [6L]
The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs, Inter process communication (Linux IPC Mechanism), Remote Procedure calls, RPC exception handling, security issues, RPC in Heterogeneous Environment, Case studies.

Module III:[8L]
Clocks: Logical clocks, Physical clocks, Vector Clock, clock synchronization algorithms, Mutual Exclusion, Non-Token Based Algorithms – Lamppost's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Election Algorithms-Bully algo etc., Dead locks in Distributed Systems, Thrashing, Resource Management (Load Balancing approach, Load Sharing approach), Process Management, process Migration, Thread, and Case studies.

Module IV: [8L]
Overview of shared memory, Architecture, Algorithm, Protocols, Design Issues, consistency model, Page based Distributed Shared Memory, Shared variable Distributed shared Memory, and Object based Distributed shared Memory, Heterogeneous DSM, Distributed Scheduling, Issues, Components, Algorithms Case studies.

Module V: [8L]

File models, File access, File sharing, file-caching, File Replication, Features of Naming system terminologies and concepts of naming, fault Tolerance, Network File System (case study), 8NFS on Linux Directory Services, Security in Distributed File system, Tools (Cuda, , Amazon AWS, OpenStack, Cilk, gdb, threads, OpenMP, Hadoop), Case studies.

Textbooks:

1. P.K. Sinha Distributed Operating system (Willey publication)
2. M. Beck et al Linux Kernel, Internal Addition Wesley,1997.

Reference books:

1. T. L. Casavant and M. Singhal, Distributed Computing Systems, IEEE Computer Society Press (1994) ISBN0-8186-3032-9
2. R. Chow and T. Johnson, Distributed Operating Systems & Algorithms, AddisonWesley (1997) ISBN0-201-49838-3
3. G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts & Design, 3rd edition, Addison-Wesley (2001) ISBN0-201-61918-0
4. D. L. Galli, Distributed Operating Systems, Prentice-Hall (2000) ISBN0-13-079843-6

PAPER NAME: INFORMATION AND CODING THEORY
PAPER CODE: IT802D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Mathematics, Basic Electronics

Course Objective:
This course provides a basic understanding of the fundamental theories and laws of information theory and coding theory and the construction of both source codes and error-detection-correction codes

Course Outcome
After completion of this course student will be able to

CO1	Understand the concepts of information, mutual information, entropy and various source coding techniques for a reliable digital communication.
CO2	Analyze the need for source coding and error control techniques in a communication system.
CO3	Apply linear algebra, concept of Galois field, conjugate roots, minimal polynomial in channel coding techniques for error control.
CO4	Generate different error control codes like linear block codes, cyclic codes, BCH codes, and perform error detection and correction.
CO5	Design the circuit for different error control coding techniques.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	--	--	--	--	--	--	--	--
CO2	3	3	3	2	--	--	--	--	--	--	--	--
CO3	3	3	3	2	--	--	--	--	--	--	--	--
CO4	3	3	3	2	--	--	--	--	--	--	--	--
CO5	3	3	3	2	--	--	--	--	--	--	--	2

Course Contents:
Module I: **[3L]**
Introduction to Information theory]:
Uncertainty and information Basic definition of information, zero memory source, entropy, channel model and channel matrix, mutual information, information measures for continuous random variables, source coding theorem, Shannon - Fano coding, Huffman codes, Kraft Inequality

Module II: **[7L]**
Channel Capacity and Coding:
Channel coding, Information rate, channel capacity, information capacity theorem, The Shannon limit.

Module III: **[5L]**
Linear and Block Codes for Error Correction:
Introduction to Linear and Block Codes, properties, Matrix description of linear block codes, parity check matrix, decoding of a linear block code, Standard array and syndrome detection, Error correction and detection capability of linear block code, hamming codes, Block Diagram to generate a linear block code and its decoder

Module IV: **[5L]**
Cyclic Codes:
Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, decoding cyclic codes, Encoding and Decoding circuit, Golay codes.

Module V: **[8L]**
BCH Codes:
Set, group, fields, Galois field Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes. Introduction to Reed Solomon Codes.

Module VI: **[8L]**

Convolutional Codes:

Encoding, state diagram, Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes: Viterbi decoding, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Text Books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Introduction to Error Control Codes - Salvatore Gravano, Oxford

Reference Books:

1. Information and Coding - N Abramson; McGraw Hill.
2. Introduction to Information Theory - M Mansurpur; McGraw Hill.
3. Information Theory - R B Ash; Prentice Hall.
4. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.
5. Todd K Moon,- Error Correction Coding: Mathematical Methods and Algorithms, John Wiley

PAPER NAME: BIO-INFORMATICS
PAPER CODE: IT803A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
Concepts of Computer Networking, Network Security, Database Management Systems

Course Objective:
The basic objective is to learn about different bio molecules, their structures and functions, various data sets in bioinformatics, computational techniques useful in bioinformatics.

Course Outcome:
After completion of this course students will be able to

CO1	Acquire the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications
CO2	Understand the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks
CO3	Acquire the knowledge of the DNA Sequence Analysis
CO4	Analyze the performance of different types of Probabilistic models used in Computational Biology

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	3	3	2	--	--	--	--	--	--
CO2	2	3	2	--	3	2	--	--	--	--	--	1
CO3	3	--	2	--	3	3	--	--	--	--	--	2
CO4	3	3	2	3	2	2	--	--	--	--	--	2

Course Contents:

Module I: Introduction to Molecular Biology [10L]
Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA: Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation Introduction to Metabolic Pathways.

Module II: Sequence Databases [5L]
Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank, OMIM, Taxonomy browser, PubMed

Module III: DNA Sequence Analysis [10L]
DNA Mapping and Assembly: Size of Human DNA, Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.

Module IV: Introduction Probabilistic models used in Computational Biology [7L]
Probabilistic Models; Hidden Markov Model: Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics: Gene finding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model: Architecture, Principle, Application in Bioinformatics.

Module V: Biological Data Classification and Clustering [4L]
Assigning protein function and predicting splice sites: Decision Tree

Textbooks:

1. Bio Informatics and Molecular Evolution by Paul G. Higgs and Teresa K. Attwood
2. Bio Informatics Computing by Bryan Bergeron

Reference books:

1. Bio Informatics and Functional Geneomics, by Jonathan Pevsner
2. Gene Cloning DNA Analysis, by T.A. Brown

PAPER NAME: EMBEDDED SYSTEM
PAPER CODE: IT803B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Familiarity with the functionalities of basic digital computer system. Fundamentals of Computer Architecture.

Course Objective:

1. To understand the Concept of Parallel Processing and its applications
2. To implement the Hardware for Arithmetic Operations
3. To analyse the performance of different scalar Computers
4. To understand the Pipelining Concept for a given set of Instructions
5. To learn the performance of pipelining and non-pipelining environment in a processor

Course Outcome:

After completion of the course students will be able to

CO1	To acquire the knowledge of parallelism and pipelining
CO2	To develop knowledge of parallel processing
CO3	To combine the concept and design techniques of interconnection network
CO4	To acquire the knowledge of shared memory architecture
CO5	To describe the fundamentals of embedded system architecture

CO-PO Mapping

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

Course Contents:

Module I: [5L]
Introduction to the Embedded System: Embedded system Vs General computing systems, Purpose of Embedded systems, classifications of embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC, ASIC.

Module II:[9L]
Serial and parallel communication: devices and protocols, wireless communication: devices and protocols, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth

Module III:[5L]
Program Modeling Concepts ; Fundamental issues in Hardware software co-design, Unified Modeling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

Module IV: [5L]
Real Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.

Module IV: [12L]

PIC microcontroller: introduction, architecture, comparison of PIC with other CISC and RISC based systems and microprocessors, assembly language programming, addressing modes, R21 B.Tech. CSE 128 | P a g e instruction set, Interfacing with various sensors and actuators using PIC microcontroller. Programming concepts and embedded programming, embedded architecture.

Textbooks:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)

Reference books:

1. Embedded Systems : Rajkamal (TMH)
2. Embedded Systems : L. B. Das (Pearson)

PAPER NAME: HUMAN RESOURCE MANAGEMENT
PAPER CODE: IT803C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisite:
The students to whom this course will be offered must have concept of Project Management.

Course Objective:
Learn fundamental HRM frameworks and analyze the overall role of HRM in business. It improves their ability to think about how HRM should be used as a tool to execute strategies and achieve a competitive advantage.

Course Outcome
After completion of this course students will be able to

CO1	Explain the importance of human resources and their effective management in organizations and the meanings of terminology used.
CO2	Apply the tools used in managing employees Effectively and Record governmental regulations affecting employees and employers.
CO3	Analyze the key issues related to administering the human elements such as motivation, compensation, appraisal, career planning, diversity, ethics, and training.
CO4	Evaluate the different tools used in planning and maintenance of human resource needs.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	--	1	1	--	--	--	--	2	3	2	3	--
CO2	--	--	--	--	2	2	1	1	--	2	3	--
CO3	--	--	--	--	2	--	--	1	--	2	3	2
CO4	--	--	--	--	--	--	2	--	--	2	3	2

Course Contents:

MODULE I: Introduction: [4L]
Introduction to Human Resource Management and its definition, functions of Human Resource Management & its relation to other managerial functions. Nature, Scope and Importance of Human Resource Management in Industry, Role & position of Personnel function in the organization.

MODULE II: Procurement and Placement: [3L]
Need for Human Resource Planning, Process of Human Resource Planning, Methods of Recruitment, Psychological tests and interviewing, Meaning and Importance of Placement and Induction, Employment Exchanges Act 1959, The Contract Labour Act 1970.

MODULE III: Training & Development: [3L]
Difference between training and Development, Principles of Training, Employee Development, Promotion-Merit v/s seniority Performance Appraisal, Career Development & Planning.

MODULE IV: Job analysis & Design: [2L]
Job Analysis, Job Description & Job Description, Job Specification

MODULE V: Job Satisfaction: [8L]
Job satisfaction and its importance, Motivation, Factors affecting motivation, introduction to Motivation Theory, Workers' Participation, Quality of work life. The Compensation Function: Basic concepts in wage administration, company's wage policy, Job Evaluation, Issues in wage administration, Bonus & Incentives, Payment of Wages Act 1936, Minimum Wages Act 1961.

MODULE VI: Integration: [8L]
Human Relations and Industrial Relations, Difference between Human Relations and Industrial Relations, Factors required for good Human Relation Policy in Industry, Employee Employer relationship Causes and Effects of Industrial disputes, Employees Grievances & their Redressal, Administration of Discipline, Communication in

organization, Absenteeism, Labour Turnover, Changing face of the Indian work force and their environment, Importance of collective Bargaining; Role of trade unions in maintaining cordial Industrial Relations.

MODULE VII: Maintenance: [8L]

Fringe & retirement terminal benefits, Administration of welfare amenities, Meaning and Importance of Employee Safety, Accidents-Causes & their Prevention, Safety Previsions under the Factories Act 1948, Welfare of Employees and its Importance, Social security, Family Pension Scheme, ESI Act 1948, Workmen's Gratuity Act 1972, Future challenges for Human Resource Management.

Textbooks:

1.T.N. Chhabra-Human Resource Management, Dhanpat Rai & Co.

Reference books:

1. Lowin B .Flippo –Principles of Personnel Management, McGraw-Hill
2. R.C.Saxena- Labour Problems and Social Welfare, K.Math & Co.
3. A Minappaand, M.S.Saiyada- Personnel Management, TataMc.Graw-Hill
4. C. B. Mamoria –Personnel Management, Himalaya Publishing House

PAPER NAME: COMPUTER VISION
PAPER CODE: IT803D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites:

Course Objective: Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi- dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Course Outcome:

After completion of the course students will be able to

CO1	To identify the Image formation process
CO2	To understand the 3D vision techniques
CO3	To implement the different features from an image and accordingly analyze the Image
CO4	To develop applications using the Computer Vision Techniques
CO5	To explain the basics of video processing, motion computation and 3D vision and geometry

CO–PO Mapping:

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

Course Contents:
Module I: [2L]
Introduction:
Introduction to Computer Vision: Low-level, Mid-level, High-level, Impact of Computer Vision, components and its applications.

Module II: [5L]
Digital Image Formation and low-level processing:
Overview: Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective etc. Fourier Transform, Convolution and Filtering, Light and Color and Image Filtering, Image Enhancement, Restoration, Histogram Processing

Module III: [5L]
Depth estimation and multi-camera views:
Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Image sensing, pixel arrays, CCD cameras. Image coding, Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel.

Module IV: [7L]
Feature Extraction:
Edge detection - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, Image preprocessing, Image representations (continuous and discrete), Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Module V: [4L]
Image Segmentation:
Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis.

Module VI: [7L]
Pattern Analysis:
Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Module VII: [3L]

Motion Analysis:
Background Subtraction and Modeling, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Module VIII: [3L]

Shape representation:
Inferring 3D shape from shading; surface geometry.Boundary descriptors; codons; super-quadrics.

Textbooks:
1. Szeliski, R., 2010. Computer vision: algorithms and applications. Springer Science & Business Media.
2. Forsyth, D.A. and Ponce, J., 2003. A modern approach. Computer vision: a modern approach, 17, pp.21-48.

Reference books:
1. Hartley, R. and Zisserman A., 2003. Multipleview geometryin Computer vision.Cambridge university press.
2. Fukunaga, K., 2013. Introduction to statistical patternrecognition.Elsevier.
3. Gonzalez, R.C. and Woods, R.E., 1992. Digital image processing addison-wesley. Reading, Ma,2.
4. Gonzalez, R.C., Woods, R.E. and Eddins, S.L., 2004. Digital image processing using MATLAB.PearsonEducationIndia.

PAPER NAME: PRINCIPLES OF MANAGEMENT
PAPER CODE: HU(IT)801
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDIT: 2

Prerequisites:

Course Outcome:

After completion of the course students will be able to

CO1	To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context
CO2	To understand and apply a variety of management and organizational theories in practice
CO3	To be able to mirror existing practices or to generate their own innovative management competencies required for today's complex and global workplace
CO4	To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organizations

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	_	_	_	_	_	1	1	1	1	2	_	_
CO2	_	_	_	_	_	1	1	3	1	2	_	_
CO3	_	_	_	_	_	3	2	-	_	1	_	3
CO4	_	_	_	_	_		2	1	3	_	_	_

Course Contents:

Module I: [4L]

Introduction to Management: definitions, managerial roles and functions; Science or Art perspectives- External environment-global, innovative andentrepreneurial perspectives of Management. Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management

Module II:[4L]

Early Contributions and Ethics in Management: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributionsof Mayo, McGregor's Theory, Ouchi's Theory Z .Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social
responsibility- Managerial Ethics

Module III: Trees [6L]

Planning: Nature and importance of planning, -types of plans Steps in planning, Levels of planning - The Planning Process. – MBO Organizing for decision making: Nature of organizing, organization levels and span of control in management Organizational design and structure – departmentation, line and staff concepts.
Leading and Controlling: Leading Vs Managing – Trait approach and Contingency approaches to leadership - Dimensions of Leadership. Leadership Behavior and styles – Transactional and Transformational Leadership
Basic control process control as a feedback system – Feed Forward Control
Requirements for effective control – control techniques – Overall controls and preventive controls – Global controlling.

Module IV: [6L]

Management of Physical Resources Plant: site selection procedures, factors affecting selection. Layout-types and relative merits and demerits.
Maintenance-Objectives, different types of associated decisions, strategies for effective maintenance, computer applications. Material: Functions, objectives, planning and control including inventory models with or without storage costs, price break (excluding dynamic and probabilistic considerations). Different classes of inventory. Material Requirement Planning (MRP).

Module V: [4L]
Quality management: Quality definition, quality planning, quality control and quality management, Total quality management, ISO 9000 systems, simple quality control techniques like control charts and acceptance sampling, Kaizen & Six Sigma.

Module VI: [2L]
Marketing management consumer behavior, market research, product design and development pricing and promotion.

Textbooks:

1. Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill.
2. L.M. Prasad, Principles of Management, Sultan Chand & sons, New Delhi.

Reference books:

1. Sherlekar & sherlekar, Principles of Management, Himalaya Publishing House, New Delhi.
2. Stephen Robbins, Organizational Behavior, Pearson Education, New Delhi
3. Production And Operations Management—K. ASWATHAPPA K. Shridhara Bhat, Himalayan publishing House

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