B.Tech.(Computer Science& Engineering)

STRUCTURE & SYLLABUS
(2020-2021)

(Effective from the academic Session 2020-2021)

Department of Computer Science & Engineering and Application

Sambalpur University Institute of Information Technology

(SUIIT)

Sambalpur University, Jyoti Vihar-768019, Burla

PROGRAM OUTCOME

On completion of BTECH degree, the graduates will be able to:

PO-1	**Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions
PO-2	**Effective Communication**: Will be able to speak, read, write and listen clearly in person and through electronic media in English and in one Indian Language
PO-3	**Social Interaction** (Interpersonal Relation): Elicit views of others, mediate disagreements and prepared to work in team
PO-4	**Entrepreneurship Capability**: Demonstrate qualities to be prepared to become an entrepreneurship
PO-5	**Ethics**: Recognize different value systems including your own, understand the moral dimensions and accept responsibility for them
PO-6	**Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development
PO-7	**Life-Long Learning**: Acquire the ability to engage in independent and life-long learning in the context of socio-technological changes

Course Structure
(B.Tech Computer Science and Engineering)

	Semester – I							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC111	Mathematics-I	FC(BS)	4	0	0	**4**	Common to all branch
2	PHC112	Physics-I	FC(BS)	3	0	0	**3**	
3	CSC113	Programming in C	FC(CS)	3	0	1	**3**	
4	EEC114	Basic Electrical Engineering	FC(BE)	3	0	1	**3**	
5	HSC115	Communicative English	FC(HS)	3	0	0	**3**	
6	EEL116	Basic Electrical Lab.	FC(BE)	0	3	0	**2**	
7	CSL117	Programming in C Lab.	FC(CS)	0	3	0	**2**	
8	PHL118	Physics Lab.	FC(BS)	0	3	0	**2**	
	Total Credit:						**22**	

	Semester – II							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 121	Mathematics-II	FC(BS)	4	0	0	**4**	Common to all branches
2	PHC 122	Physics-II	FC(BS)	3	0	0	**4**	
3	ECC 123	Basic Electronics	FC(BE)	3	0	1	**3**	
4	CSC 124	Data Structures using C	FC(CS)	3	0	1	**3**	
5	HSC125	*Environmental Studies (Non-Credit)	FC(HS)	3	0	0	**0**	
6	ECL 126	Basic Electronics Lab.	FC(BE)	0	3	0	**2**	
7	EDC 127	Engineering Graphics Lab.	FC(BE)	0	3	0	**2**	
8	CSL 128	Data Structure using C Lab.	FC(CS)	0	3	0	**2**	
	Total Credit:						**20**	

	Semester – III							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 231	Mathematics-III	FC(BS)	4	0	0	4	
2	ECC 232	Data Communication	PC(CE)	4	0	0	3	
3	CSC 233	Object Oriented Programming	FC(CS)	4	0	0	3	
4	ECC 234	Digital Circuits and Systems	FC(BE)	4	0	0	3	
5	CSC 235	Computer Organization and Architecture	PC(CE)	4	0	0	4	
6	CSL 236	Object Oriented Programming Lab.	FC(CS)	0	3	0	2	
7	ECL 237	Digital Circuits Lab.	FC(BE)	0	3	0	2	
	Total Credit:						**21**	

	Semester – IV							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 241	Mathematics-IV	FC(BS)	4	0	0	4	

2	ECC 242	Microprocessors & Microcontrollers	FC(BE)	3	0	0	3	
3	HSC 243	Organizational Behavior	OE(OE)	3	0	1	3	
4	CSC 244	Analysis and Design of Algorithms	PC(CE)	3	0	0	3	
5	CSC 245	Operating Systems	PC(CE)	3	0	0	4	
6	ECL 246	Analysis and Design of Algorithms Lab.	FC(BE)	0	3	0	2	
8	CSL 247	Microprocessors & Microcontrollers Lab.	PC(BE)	0	3	0	2	
	Total Credit:						**21**	

	Semester – V							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 351	Discrete Mathematics	FC (BS)	3	0	1	**3**	
2	CSC 352	Theory of Computation	PC(CE)	3	0	0	**3**	
3	CSC 353	Database Management Systems	PC(CE)	3	0	1	**3**	
4	XXXXXX	Professional Elective-I	PE(CE)	3	0	0	**3**	
5	HSC 354	Engineering Economics	OE (OE)	3	0	1	**3**	
6	CSL 355	Database Management System Lab.	PC(CE)	0	3	0	**2**	
7	CSL 356	Web Technology Lab	PC(CE)	0	3	0	**2**	
8	XXXXXX	MOOCs-I (Elective)	MOOC	-	-	-	**3**	
	Total Credit:						**22**	

	Semester – VI							
S.No.	**Corse Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	CSC 361	Computer Networks	PC(CE)	4	0	0	**3**	
2	CSC 362	Software Engineering	PC(CE)	3	0	1	**3**	
3	XXXXXX	Professional Elective-II	PE (CE)	3	0	1	**3**	
4	XXXXXX	Professional Elective-III	PE (CE)	4	0	0	**3**	
5	XXXXXX	Open Elective-I	IE (IE)	4	0	0	**3**	
6	CSL 363	Computer Network Lab	PC(CE)	0	3	0	**2**	
7	CSL 364	Software Engineering Lab	PC(CE)	0	3	0	**2**	
8	XXXXXX	MOOC-II (Elective)	MOOC	-	-	-	**3**	
	Total Credit:						**22**	

	Semester – VII							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	CSC 471	Data Warehousing and Data Mining	PC(CE)	3	0	0	**3**	
2	CSC 472	Compiler Design	PC(CE)	3	0	0	**3**	
3	XXX XXX	Professional Elective-IV	PE (CE)	3	0	0	**3**	
4	XXX XXX	Professional Elective-V	PE (CE)	3	0	0	**3**	
5	XXX XXX	Open Elective-II	OE (OE)	3	0	0	**3**	
6	CSP 473	Minor Project	PP (PW)	4	0	0	**4**	

7	CSS 474	Seminar	TS(PW)				**2**	
	Total Credit:						**21**	

	Semester – VIII							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	XXX XX	Professional Elective-VI	PC(CE)	4	0	0	**3**	
2	XXXXXX	Open Elective-III	OE(OE)	3	0	0	**3**	
3	XXXXXX	Open Elective-IV	OE(OE)	3	0	0	**3**	
4	CSP 482	Major Project	PP (PW)	0	0	0	**8**	
5	CSV 483	Comprehensive Viva-voce	PP (CV)	0	0	0	**2**	
	Total Credit:						**19**	

SEMESTER WISE CREDIT DISTRIBUTION									
Year	**Credit (40)**		**Credit (40)**		**Credit (40)**		**Credit (40)**		
Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**TOTAL**
Total Credit	**22**	**20**	**21**	**21**	**22**	**22**	**21**	**19**	**168**

OPEN ELECTIVES					
Open Elective-I					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E01	Embedded Systems	4	0	0	3
OPE E02	Optimization Techniques	4	0	0	3
OPE E03	Management Information Systems	4	0	0	3
OPE E04	Digital Signal Processing	4	0	0	3
OPE E05	Middleware Technologies	4	0	0	3
Open Elective-II					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E06	Internet of Things	3	0	0	3
OPE E07	Simulation and Modeling	3	0	0	3
OPE E08	Digital Image Processing	3	0	0	3
OPE E09	Principle of Programming Language	3	0	0	3
OPE E10	Mobile Computing	3	0	0	3
Open Elective-III					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E11	Information Theory and Coding	3	0	0	3
OPE E12	Pattern Recognition	3	0	0	3
HSC 483	Entrepreneurship Management	3	0	0	3
OPE E14	Computer Oriented Numerical Methods	3	0	0	3
Open Elective-IV					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E15	Machine Learning	3	0	0	3
OPE E16	Software Project Management	3	0	0	3
OPE E17	Remote Sensing and Geographic Information Systems	3	0	0	3
OPE E18	Personal Development	3	0	0	3
OPE E19	E-Commerce	3	0	0	3

PROFESSIONAL ELECTIVES					
Professional Elective-I					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E01	Computer Graphics	4	0	0	3
CSE E02	Web Technology	4	0	0	3
CSE E03	Real Time Systems	4	0	0	3
CSE E04	Advanced Operating Systems	4	0	0	3
CSE E05	Advanced Data Structures	4	0	0	3
Professional Elective-II					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E06	Advanced Computer Architecture	4	0	0	3
CSE E07	Human Computer Interaction	4	0	0	**3**
CSE E08	Parallel Computing	4	0	0	3
CSE E09	Wireless Communications	4	0	0	3
CSE E10	Distributed Database Systems	4	0	0	3
Professional Elective-III					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E11	Artificial Intelligence	4	0	0	3
CSE E12	Grid Computing	4	0	0	3
CSE E13	Semantic Web	4	0	0	3
CSE E14	Advanced Software Engineering	4	0	0	3
CSE E15	Storage Area Networks	4	0	0	3
Professional Elective-IV					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E16	Wireless Sensor Networks	4	0	0	3
CSE E17	Distributed Systems	4	0	0	3
CSE E18	Software Design and Validations	4	0	0	3
CSE E19	High Performance Computing	4	0	0	3
CSE E20	Natural Language Processing	4	0	0	3
Professional Elective-V					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E21	Cryptography and Network Security	4	0	0	3
CSE E22	Ethical Hacking	4	0	0	3
CSE E23	Introduction to Bioinformatics	4	0	0	3
CSE E24	Game Programming	4	0	0	3
Professional Elective-VI					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E25	Big Data Analytics	4	0	0	3
CSE E26	Object Oriented Analysis and Design	4	0	0	3
CSE E27	Advanced Database Systems	4	0	0	3
CSE E28	Cyber Laws	4	0	0	3

MOOCs-I Electives (Credit : 3)		
Code	**Course Title**	**Remark**
MOE 351	Cloud Computing	All
MOE 352	Cloud Computing and Distributed System	All
MOE 353	Android Mobile Applications Development	All
MOE 354	Data Analytics with Python	All
MOE 355	Blockchain and Its Applications	All
MOE 356	Data Analytics with R	All
MOE 357	*MOOC Elective given by the Department Teacher Council	All
(Alternative to MOOC-I : To be offered as elective by the department)		
MOA 358	Cloud Computing (LTPC : 3-0-0-3)	All

MOOCs-II Electives (Credit : 3)		
Code	**Course Title**	**Remark**
MOE 361	Data Science for Engineers	All
MOE 362	Problem solving aspects and Python programming	All
MOE 363	IoT / Introduction to 4.0 and Industrial IOT	All
MOE 364	Ethical Hacking	All
MOE 365	Deep Learning	All
MOE 366	Computer Vision and Image Processing	All
MOE 367	Hardware Security	All
MOE 368	*MOOC Elective given by the Department Teacher Council	All
(Alternative to MOOC-II : To be offered as elective by the department)		
MOA 359	Soft Computing (LTPC : 3-0-0-3)	All

*In case mentioned courses are not available in the portal and for any other issues, the teacher council CSE&A, SUIIT may propose one equivalent credit MOOC course that is available in the portal.

MASSIVE OPEN ONLINE COURSES (MOOCs)

- A student has to complete the MOOCs courses/elective papers as recommended by the department.
- As the elective papers are of three (03) credits, therefore the MOOCs courses will also have the same three credits.
- Thus, two MOOCs courses/elective papers each of three (03) credits will be included in the fifth and sixth semester of B-Tech program as per the resolution of academic council held on 25-11-2021.
- Existing evaluation and grading scheme of SUIIT will be applicable for the MOOCs courses/elective papers.
- There will be two options. (i)The students can register for these courses through SWAYAM (Govt. of India) directly as per the courses offered in Odd/Even Semesters by SWAYAM. (ii) Being an elective paper, the concerned department can also offer the MOOCs course as a subject in the respective semester.
- For students enrolled in SWAYAM, it usually charges minimal fee per course and awards a certificate of completion. Students need to register for the course on payment of their own and submit the certificate to the institute.
- For registration to MOOCs, the students shall abide by the norms and policies proposed by SWAYAM.
- For technical seminar, students shall choose a topic from the latest technological developments / research in Electrical and Electronics Engineering or in allied fields in consultation with the faculty. They shall submit synopsis for the presentation in an approved format on the day of presentation.
- Project work and Comprehensive Viva-Voce shall be as per Academic & Examination Guidelines of SUIIT.

The approved syllabus of B-Tech 2020-24 batch will be implemented for 2021-25 batch.

	Semester – I							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC111	Mathematics-I	FC(BS)	4	0	0	**4**	Common to all branch
2	PHC112	Physics-I	FC(BS)	3	0	0	**3**	
3	CSC113	Programming in C	FC(CS)	3	0	1	**3**	
4	EEC114	Basic Electrical Engineering	FC(BE)	3	0	1	**3**	
5	HSC115	Communicative English	FC(HS)	3	0	0	**3**	
6	EEL116	Basic Electrical Lab.	FC(BE)	0	3	0	**2**	
7	CSL117	Programming in C Lab.	FC(CS)	0	3	0	**2**	
8	PHL118	Physics Lab.	FC(BS)	0	3	0	**2**	
				Total Credit:			**22**	

Mathematics-I

Course Code	**MAC111**	**L-P-T-Cr.:**	**4**	**0**	**0**	**4**	**Semester:**	**I**

Category: Foundation Course

Prerequisite: Calculus and basic Fundaments (Intermediate Mathematics)

Objective:

- To provide the background mathematics and to analyze the structure of different shapes for application of subsequent CSE courses in mathematically oriented topics.
- Engineering applications are introduced in the relevant topics. The concept of Vector differentiation and integration that finds applications in various fields like solid mechanics, fluid flow, heat problems and potential theory.

Course Outcome:

CO-1	Remember and understand the basic concepts/Principles of Mathematics I
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: SEQUENCES-SERIES (12 hours)

Basic definitions of Sequences and series – Convergence and divergence – Ratio test – Comparison test – Integral test- Cauchy's root test- Raabe's test – Absolute and Conditional Convergence.

UNIT – II: FUNCTIONS OF SINGLE VARIABLE & APPLICATION (12 hours)

Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem- Generalized Mean value theorem (all theorems with proof) Functions of several variables – Functional dependence - Jacobian – Maxima and Minima of functions of two variables with constraints and without constraints. Radius, center and Circle of Curvature - Evolutes and Envelops - Curve tracing – Cartesian, polar and parametric curves.

UNIT – III: INTEGRATION (12 hours)

Riemann Sums, Integral Representation for lengths, Areas, Volumes and Surface area in Cartesian and polar coordinates. Multiple integrals – double and triple integrals – change of order of integration – change of variable. The Euler-Lagrange Equation.

UNIT – IV: VECTOR CALCULUS (12 hours)

Vector calculus: Gradient – Divergence – Curl and their related properties Potential function – Laplacian and second order operators. Line integral - - work done – Surface integrals – Flux of a vector valued Function. Vector integrals theorems: Green's – Stocke's and Gauss's Divergence Theorems (Statement and their Verifications).

TEXT BOOKS:

1. Advance Engineering Mathematics by *Jain and S.R.K. Iyengar*, Narosa Publications.
2. Calculus of Variations with Applications to Physics and Engineering by Robert Weinstock (Soft Copy Dover)

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, *EriwinKreyszig's 8th Edition*. Wiley Indian Publisher.
2. Higher Engineering Mathematics by *B.V. Ramana* (Tata McGraw-Hill)
3. Higher Engineering Mathematics - *B.S. Grewal*, Khanna Publications.

PHYSICS - I

Course Code	**PHC112**	**L-P-T-Cr.:**	**3**	**0**	**0**	**3**	**Semester:**	**I**

Category: Foundation Course

Prerequisite: B Basic Physics and Mathematics at intermediate level.

Objective:

- To teach the students about basic concepts of measurement, errors, relativity, mechanical and optical properties of waves, electricity, magnetism and superconductivity.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PHYSICS - I
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: MEASUREMENTS, ERRORS, SPECIAL THEORY OF RELATIVITY (12 hours)

Errors - types and sources of errors, Galilean transformation equations, concept of ether, Michelson-Morley Experiment, Einstein's postulates, Lorentz transformation equations, length contraction, time dilation, simultaneity in relativity, addition of velocity, variation of mass with velocity, mass- energy relation, energy-momentum relation

UNIT – II: WAVES & OSCILLATIONS (12 hours)

Simple harmonic motion (SHM), superposition of two linear SHM's (with same frequency) Lissajous' figures, damped vibrations (differential equation and its solution), critical damping, forced vibration, amplitude and velocity resonance, sharpness of resonance and quality factor. Ultrasonics –Production of ultrasonics by Piezo-electric and magnetostriction, applications.

UNIT – III: WAVE OPTICS (12 hours)

Interference, intensity distributions in interference, Fringe position and fringe width, thin film interference (uniform thickness), Newton's ring, Fraunhoffer Diffraction (single slit and grating), Polarization, double refraction, wave plates, Production of plane, elliptical and circular polarized light, Optical rotation, Polarizer

UNIT – IV: ELECTRICITY, MAGNETISM AND SUPERCONDUCTIVITY (12 hours)

Electricity- Coloumb’s law, electric field and potential due to continuous charge distribution, Gauss’s law of electrostatics and its application, Faraday’s law, dipole, polar and non-polar molecules, Polarization vector, polarizability, dielectrics and dielectric constant, electric susceptibility, Lorentz local field, Claussius-Mossotti equation.

Magnetism- Lorentz force, Biot-Savart law and its application, Ampere’s law and its applications, Divergence and Curl of magnetic field, Magnetic potential.

Superconductivity- Zero resistance, Critical temperature T_c, Perfect diamagnetism, Meissner Effect, Critical field H_c, Type I and Type II superconductors

TEXT BOOKS:

1. *R. Murughessan*, Modern Physics
2. *Subramanyam & BrijLal*, Optics
3. *Subramanyam &BrijLal, R.N. Choudhary*, Waves & Vibrations
4. *K.K. Tiwari*, Electricity & Magnetism

REFERENCE BOOKS:

PROGRAMMING IN C

Course Code	**CSC113**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	**I**

Category: Foundation Course

Prerequisite: Na

Objective

To understand the various steps in Program development.
To understand the basic concepts in C Programming Language.
To learn how to write modular and readable C Programs
To learn to write programs (using structured programming approach) in C to solve problems.
To make the student understand simple sorting and searching methods.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PROGRAMMING IN C
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Computer Fundamentals and Introduction to C: Role of computer and programming languages, compiler, interpreter, loader and linker, classification of programming languages, structured programming, concepts, algorithms and flowcharts.
Basics of C: Developing programs in C, a simple C program, structure of a C program, concept of a variable, data types in C, variables, program statement, declaration. All tokens, literals, operators and expressions, type conversions in C. Non-formatted input and output, formatted input and output.

UNIT – II: **(10 hours)**

Control Statements: Introduction, conditional execution (if, if-else, nested if), selection (switch), unconditional types (break, continue, goto).Loops: Iteration and repetitive execution (for, while, do-while) nested loops. Arrays and Strings: Introduction, definition, one dimensional array, two dimensional arrays, accessing elements and storing elements.String- Introduction, C characters and strings, character handling library, string conversion functions, standard input output library functions, comparison functions of string handling, string manipulation functions, search and memory functions of string handling library.

UNIT – III: **(10 hours)**

Functions: Designing structured programs, functions, basics, parameter passing,call by value and call by reference mechanism to working with functions-example programs, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions andpassing arrays to functions.Dynamic memory allocation.
Pointers: Introduction, Pointer variable definition and initialization,void pointer, null pointer, use of pointers, pointer operators, pointer to a pointer, const keyword, constant pointer and pointer to a constant.Relationship between pointer and array, array of pointers and pointers to array.

UNIT – IV: **(10 Hours)**

Structures: Declaring structures and structure variables, accessing members of a structure, arrays of structures, arrays within a structure. structures and functions, pointers to structures. Union: Declaring union and its members, accessing and initializing members of a union, structure versus union.
Input and output: concept of a file, opening a file, closing a file; Working with text files, reading from and writing into text files, error handling and C program examples.

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, Programming in C, 2/e, Oxford University Press, 2013.
2. A Structured Programming Approach Using C, B.A. Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.

REFERENCE BOOKS:

1. R.S.Bichkar, Programming in C, University Press (India) Pvt. Ltd., 2012.
2. K.R.Venugopal and S.K.Prasad, Mastering C, McGraw Hill, 2009.
3. B.A.Forouzan and R.F.Gilberg, Computer Science: A Structured Programming Approach using C, 3/e, Cengage Learning.
4. E.Balaguruswamy, Programming in ANSI C, 6/e, McGraw Hill.
5. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education, India.

BASIC ELECTRICAL ENGINEERING

Course Code **EEC114** **L-P-T-Cr.:** **3 0 1 3** **Semester:** **I**

Category: Foundation Course

Prerequisite: None

Objective:

- The objective of the subject is to provide a basic idea about basics of electrical engineering to engineering students irrespective of the discipline

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Basic electrical engineering
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Preliminaries: Basic electrical components (Active and Passive), Ideal Sources, Dependent and Independent Sources, Voltage and Current relations of resistor, capacitor and inductor**Network Theorems in DC Networks:** Ohm's Law, Kirchhoff's laws, Nodal and Mesh analysis, Super Node and Super Mesh Analysis, Superposition Theorem,Thevenin and Norton's theorem.**Single Phase AC Circuits:** Single phase EMF generation, average and effective values of sinusoids, j operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits. Transient response of R-L, R-C circuit with DC excitation **Resonance in AC Circuit:** Series and Parallel Resonance. **Three Phase AC Circuit:** Three phase EMF generation, delta and star connection, Line and Phase quantities. Solutions of 3-phase circuits with balanced load. Power and Power Factor in 3-phase balanced circuits.

UNIT – II: **(10 hours)**

Magnetic Circuits: Faraday's law, induced EMF, BiotSavart's law, Inductance, Self and Mutual Inductance, Dot Convention, Magneto Motive Force, Reluctance, Permeability, Relative Permeability, Ampere's Law, Types of Magnetic Material, B-H Curve, Hysteresis and Eddy current losses.

UNIT – III: **(10 hours)**

DC Generator: Different types, Principle of Operation of DC generator, EMF equation, Types of generator and methods of excitation. **DC Motor**: Back e.m.f., speed and torque of a DC Motor, Conditions for maximum Power. Speed control of DC shunt motor.

Transformers: Construction and Principle of operation of single-phase transformer, EMF equation, Single-phase autotransformer.

UNIT – IV: **(08 Hours)**

Induction Motor: Construction and principle of operation, types; Slip-torque characteristics. **Synchronous Machines:** Construction & principle of operation of Synchronous generator and motor. EMF equation, Voltage regulation, Applications and starting of Synchronous motor.

Measuring Instruments: Moving iron and Moving Coil Instruments, DC PMMC instruments and their range extension, Dynamometer type Watt meters, Induction type Energy Meter.

TEXT BOOKS:

1. Edward Hughes (revised by Ian McKenzie Smith), Electrical and Electronic Technology, Pearson Education Limited, Indian Reprint, 2002.
2. AbhijitChakrabarti, SudiptaNath, Chandan Kumar Chanda, Basic Electrical Engineering, Tata McGraw Hill
3. D C Kulshreshtha, Basic Electrical Engineering, Tata McGraw Hill

REFERENCE BOOKS:

1. B L Theraja, A K Theraja,A Textbook ofElectrical Technology, S Chand
2. V N Mittle, ArvindMittle, Basic Electrical Engineering, McGraw Hill
3. Vincent Del Toro, Electrical Engineering Fundamentals, Pearson
4. Parker Smith, Problems in Electrical Engineering, CBS Publishers
5. Jimmie J.Cathey, Syed A. Nasar,Schaum's Outline Basic Electrical Engineering, McGraw Hill

COMMUNICATIVE ENGLISH

Course Code **HSC115** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **I**

Category: Foundation Course

Prerequisite: Na

Objective:

- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning.
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency in spoken English and neutralize mother tongue influence.
- To train students to use language appropriately for interviews, group discussion and public speaking.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Communicative English
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Features of Indian English – Correction of sentences- Structures-Tenses-ambiguity-Idiomatic distortions. Informal conversation vs. Formal expression Verbal and non-verbal communication, barriers to effective communication–kinesics

UNIT – II: **(10 hours)**

Types of Communication - Oral, aural, Writing and reading - Word-Power -Vocabulary-Jargon-rate of speech, pitch, tone - Clarity of voice Technical presentations-types of presentation–video conferencing--participation in meetings- chairing sessions.

UNIT – III: **(10 hours)**

Formal and informal interviews–ambiance and polemics-interviewing indifferent settings and for different purposes e.g., eliciting and giving information, recruiting, performance appraisal.
Written communication - differences between spoken and written communication – features of effective writing such as clarity, brevity, appropriate tone clarity, balance etc.-GRE.TOEFL models.

UNIT – IV: **(10 hours)**

Letter-writing-business letters– proforma culture – format – style– effectiveness, promptness-Analysis of sample letters collected from industry-email, fax.
TechnicalReportwriting-BusinessandTechnicalReports–Typesofreports-progressreports,outline reports – Annual reports – format –analysis of sample reports from industry -Synopsis and thesis writing

TEXT BOOKS:

1. Essentials of Business Communication, Rajendra Pal, J S Korlaha : Sultan Chand& Sons
2. Basic Communication Skills for Technology, Andrea J. Rutherford : Pearson Education
3. Advanced Communication Skills, V. Prasad, Atma Ram Publications, New Delhi.

REFERENCE BOOKS:

1. *Raymond V. Lesikav; John D. Pettit Jr.*, Business Communication, Theory& Application, All India Traveler Bookseller.
2. Business Communication, *RK Madhukar*, Vikas Publishing House Pvt. Ltd
3. *Edmond H Weiss*: Writing Remedies: Practical Exercises for Technical Writing, Universities Press,
4. Cliffs Test Preparation for GRE and TOEFL: Computer Based Test, IDG Books. India(P) Ltd..
5. GRE and TOEFL; Kaplan and Baron's English in Mind, *Herbert Puchta and Jeff Stranks*, Cambridge

BASIC ELECTRICAL LAB

Course Code **EEL116** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **I**

Category: Laboratory Course

Prerequisite: None

Objective:

- The objective of the course is to provide a basic idea of different components/ machines used in Electrical Engineering.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Basic electrical lab
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF EXPERIMENTS:

1. Preparation of symbol charts for various components and instruments and study the constructional & operational features.
2. Measurement of armature and field resistance of DC shunt motor by volt-amp method.
3. Study the characteristics of magnetic material using B-H curve .
4. Speed control of DC shunt motor using armature and flux control method.
5. Determination of open circuit characteristics (OCC) of DC shunt generator at different speeds
6. Measurement of earth resistance using insulation tester.
7. Measurement of power and power factor of balanced 3-phase star connected load by 2-wattmeter method.
8. Measurement of energy by a single phase induction type energy meter using direct loading.
9. Connection and starting of single-phase induction motor.

REFERENCE BOOKS:

1. Subhransu Sekhar Dash, K Vijayakumar, Electrical Engineering Practice Lab Manual, Vijay Nicole Imprints Private Limited
2. K Jeyachandran, S Natarajan, S Balasubramanian, A Primer on Engineering Practices Laboratory, Anuradha Publication
3. T Jeyapoovan, M Saravanapandian, S Pranitha, Engineering Practices Lab Manuals,Vikas Publishing House

PROGRAMMING IN C LAB

Course Code	**CSL117**	**L-P-T-Cr.:**	**0**	**3**	**0**	**2**	**Semester:**	**I**

Category: Laboratory Course

Prerequisite: Fundamentals of Computer and basics of Mathematics

Objective:

- To introduce students to the basic knowledge of programming fundamentals of C language.
- To impart writing skill of C programming to the students and solving problems.
- To impart the concepts like looping, array, functions, pointers, file, structure.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Programming in c lab
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF TOPICS FOR WRITING C-PROGRAMS:

1. Print statements, variables and simple arithmetic operations, mathematical series…etc.
2. Conditional statements (if, if…else, if…else if…else, switch case statement)
3. Loops : (while(…){…}, do{…}while(…), for(…,…,…){}). Some other experiments related to like printing a pattern on the screen…etc.
4. Arrays : One dimensional, multi directional.
5. Strings
6. Pointers
7. User defined Functions
8. Structures and Unions
9. Files : Various operations on Text, Binary Files
10. Command Line Arguments
11. Sorting and Searching algorithms: Basic searching and sorting techniques on linear array.

The above Lab. exercises to be carried out in 45 Hours (15 Lab. Classes).

PHYSICS LAB

Course Code **PHL118** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **I**

Category: Laboratory Course

Prerequisite: Physics -I

Objective: This course provides basic information about mechanics involved in higher Physics, Lesser and Optical Fiber which are foundation of Information Technology.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PHYSICS LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF EXPERIMENTS

1. To determine acceleration due to gravity of earth using compound pendulum.
2. To determine moment of inertia of fly wheel.
3. To study power resonance in series and parallel LCR circuit.
4. To determine refractive index and dispersive power of material of prism.
5. To verify Faraday's electromagnetic induction law.
6. To determine slit width using laser diffraction.
7. To calculate horizontal component of earth magnetic field with the help of tangent galvanometer.
8. To determine wavelength of source light using Newton's ring experiment.

TEXT BOOKS:

1. Physics Practical book, *P.K. Verma*
2. Physics Practical book, *Agrawal, Jain & Sharma*

REFERENCE BOOKS:

	Semester – II							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 121	Mathematics-II	FC(BS)	4	0	0	**4**	Common to all branches
2	PHC 122	Physics-II	FC(BS)	3	0	0	**4**	
3	ECC 123	Basic Electronics	FC(BE)	3	0	1	**3**	
4	CSC 124	Data Structures using C	FC(CS)	3	0	1	**3**	
5	HSC125	*Environmental Studies (Non-Credit)	FC(HS)	3	0	0	**0**	
6	ECL 126	Basic Electronics Lab.	FC(BE)	0	3	0	**2**	
7	EDC 127	Engineering Graphics Lab.	FC(BE)	0	3	0	**2**	
8	CSL 128	Data Structure using CLab.	FC(CS)	0	3	0	**2**	
						Total Credit:	**20**	

MATHEMATICS – II

Course Code	**MAC 121**	**L-P-T-Cr.:**	**4**	**0**	**0**	**4**	**Semester:**	**II**

Category: Foundation Course

Prerequisite: Basic knowledge in Calculus

Objective: The objective of the course is to introduce the concepts of differential equations and the transformations required in modeling of dynamical and discrete systems in nature.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MATHEMATICS – II
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (10 hours)

Overview of Differential equations: homogeneous, exact, linear and Bernoulli. Application to Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories and Geometrical Applications. Linear differential equation of second order and higher order with constant coefficients. RHS term of the type $f(x) = e^{ax}$, sin ax, cosax ,$e^{ax}V(x)$, $X^nV(x)$, method of variation of parameters. Applications to bending of beams, Electrical circuits, Simple harmonic motion, Partial differential equation: Heat, Laplace & wave equation.

UNIT – II: LAPLACE TRANSFORM AND APPLICATION TO ODE (10 hours)

Laplace transform of standard functions: Inverse transform – first Shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second Shifting theorem – Dirac's delta function – Convolution theorem – Periodic function – Differentiation and integration of transforms- Application of Laplace transforms to ordinary differential equations.

UNIT – III: DIFFERENCE EQUATION &Z -TRANSFORM (10 hours)

Introduction to difference equation and its applications in Engineering: Z – Transform – inverse Z –transform – properties – Damping rule – Shifting rule (left, right) – Initial and Final value theorems. Convolution theorem – solution of difference equation by z – transforms

UNIT – IV: FOURIER SERIES AND FOURIER TRANSFORM (10 hours)

Fourier series: determination of Fourier coefficients – Fourier series – even an odd functions. Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – properties – inverse transform - Finite Fourier transforms.

TEXT BOOKS:

1. Advance Engineering Mathematics by *Jain and S.R.K. Iyengar*, Narosa Publications.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, *EriwinKreyszig's 8th Edition*. Wiley Indian Publisher.
2. Higher Engineering Mathematics by *B.V. Ramana* (Tata McGraw-Hill)
3. Higher Engineering Mathematics - *B.S. Grewal*, Khanna Publications

PHYSICS-II

Course Code **PHC 122** **L-P-T-Cr.:** **3 0 0 4** **Semester:** **II**

Category: Foundation Course

Prerequisite: Basic concepts of differentiation and integration, vectors and their properties, electrostatics and magnetism

Objective:

- This course was designed so as students could be familiar with the nature of electromagnetic waves and their various properties in different media, wave-matter duality and its equations, Laser and optical fibres and their applications.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Physics II
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: VECTOR CALCULUS & ELECTROMAGNETIC THEORY (10 hours)

Vector Calculus- Del operator, gradient of a scalar field, divergence and curl of a vector fields, significance of gradient, divergence and curl, line integral, surface integral, volume integral, Gauss divergence and Stoke's theorems.

Electromagnetic Theory - Integral and differential forms of Gauss's laws for electrostatics and magnetism, Faraday's law of electromagnetic inductions, Ampere's circuital law, equation of continuity, modified Ampere's law (Maxwell-Ampere's law), concept of displacement current, Maxwell's equations (general form and in charge free space), Electromagnetic wave in charge free space and its solutions, wave impedance.

UNIT – II: QUANTUM MECHANICS (10 hours)

Planck's hypothesis, de Broglie matter waves, derivation of wavelength of matter wave in different forms, Heisenberg's uncertainty principle and its applications, Phase velocity and group velocity, dispersion, Schrödinger wave equation (time independent and dependent) and its applications (particle in one dimensional box, tunnelling effect etc.), Born's interpretation of wave equation, normalization of wave equation.

UNIT – III: LASER AND FIBER OPTICS (14 hours)

Laser- Absorption, spontaneous and stimulated emission of light, Einstein A and B coefficients, pumping, metastable state, population inversion, resonant cavity, lasing action, three and four level lasers, types of lasers (Ruby, He-Ne, Nd-YAG, semiconductor), properties and applications of laser.

Fiber Optics- Introduction, total internal reflection, numerical aperture and various fiber parameters, step index and graded index fibers, mode of propagation, single mode and multimode fibers, application and losses of optical fiber.

UNIT – IV: FREE ELECTRON THEORY AND BAND THEORY OF SOLIDS (12 hours)

Free Electron Theory – Free electron gas, Drude Lorentz theory, Electrical and thermal conductivity, Wiedemann Franz ratio, Electrical resistivity and temperature, Fermi-Dirac Statistics and distribution function, Heat capacity of conduction electron, Thermo-electric effect, Hall Effect.
Band Theory – Energy spectra in atoms, molecules and solids, Wave equation in periodic potential and Bloch theorem, Kronig Penney model, Density of states, effective mass, Distinction between metals, insulators and semiconductors.

TEXT BOOKS:

1. D.J. Griffith, Mathew N O Sadiku, Principles of electromagnetic
2. K.R. Nambier, B.B. Laud, Laser and non-linear optics
3. D.J. Griffith, SatyaPrakash, Quantum Mechanics
4. Modern Physics, R. Murugesan

BASIC ELECTRONICS

Course Code	**ECC 123**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	**II**

Category: Foundation Course

Prerequisite: Basics of semiconductor Physics.

Objective:

- To learn fundamentals of diodes, BJTs, FETs, and use of BJTs & FETs in design of amplifiers and oscillators.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Basic electronics
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION TO ELECTRONICS (12 hours)

Electronic devices and their applications , signals, analog & digital signals, amplifiers. Linear wave shaping circuits: RC LPF, Integrator, RC HPF, Differentiator. Properties of semiconductor classification of solid, energy band in si, intrinsic & extrinsic semiconductors, current flow in semiconductors, Hall effect, diffusion current, drift current, mobility & resistivity.

UNIT – II: SEMICONDUCTOR DIODES (12 hours)

p-n junction theory, V–I characteristics, load line analysis, equivalent circuit of diode, analysis of diode circuit, transition capacitance & diffusion capacitance. Application of diode circuit ; Rectifiers, clippers, clampers. Filter circuits, Special purpose diodes : Zener diode, LED, Photo diode, tunnel diode, varactor diode, Shockley diode. Basics of LASER.

UNIT – III: BJTs AND FETs (12 hours)

BJT : structure & operation , different transistor configurations & their characteristics, DC analysis of BJT, Field effect transistors (FETs) : Types, structure & operation of JFET and MOSFET, Depletion mode & enhancement mode MOSFET, Device characteristics, MOSFET as a switch.

UNIT – IV: FEEDBACK AMPLIFIERS & OSCILLATORS (12 hours)

General principles of feedback amplifier, .Oscillators : principles of oscillations, Barkhausen criteria for oscillation, types of oscillator circuits and their operations. Operational amplifiers (OP-AMPs)and applications : Ideal op-amp, inverting & non inverting amplifier, adder, integrator & differentiator. Active filters.

TEXT BOOKS:

1. Microelectronics Circuit:Theory and applications,Sedra and Smith,Oxford University Press.

REFERENCE BOOKS:

1. Integrated Electronics, Millman and Halkias, Mc. Graw Hill Publications.
2. Electronics Devices and Circuits, Sanjeev Gupta, Dhanpat Rai, Publications.
3. Digital Logic and Computer Design, Morris Mano, PHI, EEE
4. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education
5. Electronics Fundamentals and Applications, D Chattopadhyay and P. C Rakshit, New Age International Publications.

DATA STRUCTURE USING C

Course Code **CSC 124** **L-P-T-Cr.:** **3 0 1 3** **Semester:** **II**

Category: Foundation Course

Prerequisite: Concept of C programming, Basics of Computer Architecture (Primary and Secondary storage structure)

Objective:

- To get clear understanding about the basic data structures and their operations, the concepts of algorithms, basic search and sort algorithms.
- Student will also gain adequate knowledge to choose appropriate data structure and algorithm to solve a problem.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DATA STRUCTURE USING C
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION, SORTING, AND SEARCHING TECHNIQUES (10 hours)

Introduction: Basic Terminology, Elementary Data Organization, Structure operations, Algorithm Complexity and Time-Space trade-off.
Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices and Vectors.
Searching: Sequential search, binary search, comparison and analysis.
Sorting: Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting.

UNIT – II: LINEAR DATA STRUCTURES (10 hours)

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push& Pop, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack, Applications of recursion in problems like 'Tower of Hanoi.
Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.
Linked list: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Polynomial representation and addition, Generalized linked list.

UNIT – III: NON-LINEAR DATA STRUCTURES (10 hours)

Trees: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, Red-Black tree, B-trees.

Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

UNIT – IV: HASHING AND FILE STRUCTURES **(10 hours)**

Hashing: Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation
File Organization and Structures: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B^+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.

TEXT BOOKS:

1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia.
2. Data Management and File Structures, Mary E.S. Loomis, PHI

REFERENCE BOOKS:

1. Richard F. Gilberg & Behrouz A. Forouzan, Data Structures: A pseudo code approach with C, CENGAGE Learning
2. A. M. Tenenbaum, "Data Structures using C & C++", PHI
   Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Asia Pvt.Ltd.(Singapore)

ENVIRONMENTAL STUDIES

Course Code	**HSC125**	**L-P-T-Cr.:**	**3**	**0**	**0**	**0**	**Semester:**	**II**

Category: Foundation Course

Prerequisite: Na

Objective:

- To understand concepts concept on environment and ecology, concept of population, community and biodiversity, concept on environmental problems and management strategies.

Course Outcome :

CO-1	Remember and understand the basic concepts/Principles of ENVIRONMENTAL STUDIES
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY (10 hours)

Concept of environment and ecosystem, Different spheres of the Earth System. Structure and Function of an ecosystem. Producer, Consumers, Decomposers, Energy Flow in the Ecosystem. Ecological succession. Food Chains, Food Webs and Ecological Pyramids. Concept of Biodiversity and its value. Methods for Biodiversity Conservation. Biogeographic provinces. Hot-spots of biodiversity.

UNIT – II: RENEWABLE AND NON-RENEWABLE RESOURCES (10 hours)

Concept of Resource and Wastes, Different Values of Resources. Classification of Resources. Forest, Water, Land, Mineral, Food and Energy resources. Exploitation and Use of Resources and their effects on the environment and ecosystem. Principles and Methods of conservation of natural resources.

UNIT – III: STRATEGIES ENVIRONMENTAL POLLUTION AND DISASTERS (10 hours)

Concept of Contaminants, Pollutants, Pollution and Contamination. Threshold values for deciding pollution status. Pollution of Air, Water and Soil. Pollution due to Solid waste, E-Waste, Bio-Medical Wastes etc. Noise and Thermal PollutionOzone Layer Depletion. Global Warming. Acid Rain. Concept of disaster – Natural & Man-made disaster, Flood, Earthquake, Cyclones and Landslides. Nuclear Accidents.

UNIT – IV: SOCIAL ISSUES AND THE ENVIRONMENT (10 hours)

Population explosion its effects and programmes for its management. Unsustainable and Sustainable Developments. Water Conservation, Rain water harvesting, Watershed management. Environmental protection Act, Air Act, Water Act, E-Waste and Biomedical Wastes management and handling rules.

TEXT BOOKS:

1. Textbook of Environmental studies, *Erach Bharucha*, UGC
2. Fundamental concepts in Environmental Studies, *D D Mishra*, S Chand & Co Ltd

BASIC ELECTRONICS LAB

Course Code **ECL 126** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **II**

Category: Laboratory Course

Prerequisite: Basics of semiconductor Physics.

Objective:

- To learn fundamentals of diodes, BJTs, FETs, and use of BJTs & FETs in design of amplifiers and oscillators.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of BASIC ELECTRONICS LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Basic Knowledge:

1. To study Electronics Symbols.
2. To Study of Active Components such as (Transistors, Integrated Circuit, etc.)
3. To Study of Passive Components such as (Resistor, Capacitor, Diode, Inductor etc.).
4. To Study Electronic Devices such as (Multi-meter, Bread-Board, Power Supply, Digital Storage oscilloscope and Function Generator.)

Experiment List:

1. To Study the VI characteristics of PN Junction Diode in forward and reverse bias.
2. To Study the VI characteristics of Light Emitting Diode.
3. To Study the VI characteristics of Zener Diode in reverse bias.
4. To Study the Half Wave Rectifier with filter.
5. To Study the Full Wave Rectifier with filter.
6. To Study Zener Diode as Voltage Regulator.
7. To Study Diode Clipper Circuit.
8. Positive Clipper.
9. Negative Clipper.
10. Positive Biased Clipper.
11. To Study Diode Clamper Circuit.
12. Positive Clamper.
13. Negative Clamper.
14. Positive Biased Clamper.
15. To Study the Voltage Regulator using IC LM7805 and LM7809.
16. To Study Transistor Input Characteristics in Common Emitter Configuration.
17. To Study Transistor Output Characteristics in Common Emitter Configuration.

ENGINEERING GRAPHICS LAB

Course Code **EDC 127** **L-P-T-Cr.:** **0 3 0 2** **Semester: II**

Category: Foundation Course

Prerequisite: Lab to be carried out using FreeCAD

Objective:

- The objective of this Course is to provide the basic knowledge about Engineering Drawing.
- Detailed concepts are given in projections, technical drawing, dimensioning and specifications using FreeCAD, so useful for a student in preparing for an engineering career

Course outcome:

CO-1	Remember and understand the basic concepts/Principles ENGINEERING GRAPHICS LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: Introduction to Engineering Drawing& FreeCAD

Principles of Engineering Graphics and their significance, usage of FreeCAD toolboxes, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales;

UNIT – II: Orthographic &Isometric Projections

Principles of Orthographic Projections Conventions- Projections of Points and lines inclined to both planes; Projections of planesinclined Planes - Auxiliary Planes
Principles of Isometric projection – IsometricScale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple andcompound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa,Conventions;

UNIT – III: Projections of Regular Solids & Sections and Sectional Views of Right Angular Solids

Inclined to both the Planes- AuxiliaryViews
Prism, Cylinder,Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism,Pyramid, Cylinder and Cone

TEXT BOOKS:

1. *Daniel Falck& Brad Collette* (2008), FreeCAD How To, Packt Publishing
2. *Bhat, N.D.& M. Panchal* (2008), Engineering Drawing, Charotar Publishing House

REFERENCE BOOKS:

1. *Shah, M.B. & B.C. Rana* (2008), Engineering Drawing and Computer Graphics, Pearson Education
2. *Dhawan, R.K.* (2007), A Text Book of Engineering Drawing, S. Chand Publications
3. *Narayana, K.L. & P Kannaiah* (2008), Text book on Engineering Drawing, Scitech Publishers

DATA STRUCTURE USING C LAB

Course Code **CSL 128** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **II**

Category: Laboratory Course

Prerequisite: Concept of C programming, Basics of Computer Architecture (Primary and Secondary storage structure)

Learning Objective:

- To make the student learn a object oriented way of solving problems
- To make the student write ADTS for all data structures.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles DATA STRUCTURE USING C LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

List Of Experiments:

1. Write a program tocreate an array dynamically, accept its members and sort the array using following sorting algorithm. Also count the total number of swaps.
   a) Bubble sort
   b) Selection sort
   c) nsertion sort
   d) Quick sort
   e) Merge sort
2. Write a function search an element from the array using following searching techniques:
   a) Linear search
   b) Recursive linear search
   c) Binary search
   d) Recursive binary search
   e) Ternary search
3. Write a structure for an integer stack, implementpush, pop, and peek, IsEmpty and IsFull function. Write a main function and call the functions based on user's choice.

```
typedef struct stack{

int top;

int data[max];

}Stack;
```

4. Write a structure for an integer queue, implement enqueue, dequeue, and traverse, IsEmpty and IsFull function. Write a main function and call the functions based on user's choice.

```
typedef struct queue{

intfront,rear;

int data[max];

}Queue;
```

5. Write a program to implement queue using two stacks. Include mystack.h and do the program.
6. Write a structure for an integer circular queue, implementenqueue, dequeue, and traverse, IsEmpty and IsFull function. Write a main function and call the functions based on user's choice.

```
typedef struct circularQueue{

intfront,rear;

int data[max];

}Queue;
```

7. Create a singly linked list of integers, write functions to add elements at different places (beginning, end, at a specified position), delete a node from different positions (beginning, end, at a specified position) and traverse the linked list based on user's choice.
8. Write a program to implement stack using linked list.
9. Write a program to implement Queue using linked list.
10. Create a singly circular linked list of integers, write functions to add elements at different places (beginning, end, at a specified position), delete a node from different positions (beginning, end, at a specified position) and traverse the linked list based on user's choice.
11. Create a doubly linked list of characters, write functions to add elements at different places (beginning, end, at a specified position), delete a node from different positions (beginning, end, at a specified position) and traverse the linked list in both directions based on user's choice.
12. Declare a binary search tree (BST) where information at each node would be a single integer. Write recursive and non recursive (use mystack.h) functions for
    a) Inserting a key
    b) Deleting a key from the tree.
    c) Searching an element
    d) Inorder , Preorder and Postorder traversal
    e) Finding height of the tree
    f) Count number of nodes
    g) Display leaf nodes
13. Declare an AVL Tree where information at each node would be a single integer. Write recursive functions for
    a) Inserting a key
    b) Deleting a key from the tree.
    c) Searching an element
14. Write a program to implement single threaded binary tree and perform the following functions.
    a) Inserting a key
    b) Deletion of a key
    c) In-order traversal using the thread
    d) Maximum depth of the tree
15. Write a program for Breadth First Traversal of a graph.
16. Write a program for Depth First Traversal of a graph.
17. Write a program to check whether there is a path between two vertices of graph.
18. Given a directed graph. Write a program to find shortest path among all the nodes of a graph using Floyd Warshall Algorithm.
19. Given an undirected, connected and weighted graph, find Minimum Spanning Tree (MST) of the graph using Kruskal's Algorithm.
20. Given an undirected, connected and weighted graph, find Minimum Spanning Tree (MST) of the graph using Prim's Algorithm.

	Semester – III							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 231	Mathematics-III	FC(BS)	4	0	0	4	
2	ECC 232	Data Communication	PC(CE)	4	0	0	3	
3	CSC 233	Object Oriented Programming	FC(CS)	4	0	0	3	
4	ECC 234	Digital Circuits and Systems	FC(BE)	4	0	0	3	
5	CSC 235	Computer Organization and Architecture	PC(CE)	4	0	0	4	
6	CSL 236	Object Oriented Programming Lab.	FC(CS)	0	3	0	2	
7	ECL 237	Digital Circuits Lab.	FC(BE)	0	3	0	2	
						Total Credit:	**21**	

MATHEMATICS - III

Course Code	**MAC 231**	**L-P-T-Cr.:**	**4**	**0**	**0**	**4**	**Semester:**	**III**

Category: Foundation Course

Prerequisite: Basic Knowledge in Counting, permutation & combination, calculus, complex and real numbers.

Objective:

- To introduce the concept of probability and statistics and their implementation in real life situations.
- To give a foundation of complex function and their approach to different types of series & integration.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MATHEMATICS – III
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: PROBABILITY (12 hours)

Probability: Sample space and events – The axioms of probability – some elementary theorems – conditional probability – Bayes' theorem. Random variables – discrete and continuous distribution – distribution functions- Binomial, poison and Normal distribution- sampling distribution – population and samples – proportions, sums and differences.

UNIT – II: STATISTICS (12 hours)

Estimations: Point estimation – interval estimation – Bayesian estimation. Testing of hypothesis: means – hypothesis concerning one or two means – Type I and Type II errors. One tail, tow-tail tests. Test of significance – student's t- test. F-test, test. Estimation of proportion.

UNIT – III: COMPLEX FUNCTIONS (12 hours)

Functions of complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson Method.

UNIT – IV: COMPLEX INTEGRATION (12 hours)

Line integral – evaluation along path and by definite integration – Cauchy's integral theorem – Cauchy's integral formula – Taylor's series expansion- singularities (isolated, pole, essential) – Residues – evaluation of residue by Laurent series. Residue theorem. Evaluation of integrals of different type.

TEXT BOOKS:

Introduction to Probability and Statistics by *William Mendenhall* ,Cengage learning.
Higher Engineering Mathematics by *B.V. Ramana* (Tata McGraw-Hill)

REFERENCE BOOKS:

Advanced Engineering Mathematics, *Eriwin Kreyszig's 8th Edition*. Wiley Indian Publisher.
Advance Engineering Mathematics by *Jain and S.R.K. Iyengar*, Narosa Publications

DATA COMMUNICATIONS

Course Code	**ECC 232**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**III**

Category: Foundation Course

Prerequisite: Basic Computer Science.

Objective:

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DATA COMMUNICATIONS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Analog Communication: Block diagram of Electrical communication system, Types of Amplitude modulation, AM, DSB SC, SSB SC,VSB, Power and BW requirements, Diode detector, Product demodulation for DSB SC & SSB SC. Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

UNIT – II: **(12 hours)**

Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM, Time Divison Multiplexing, Frequency Divison Multiplexing, Asynchronous Multiplexing.

UNIT – III: **(12 hours)**

Digital Communication: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM, ADPCM and comparison.
Digital Modulation: ASK, FSK, PSK, and DPSK, QPSK demodulation, coherent and non-coherent reception, Comparison of binary and quaternary modulation schemes, M-ary modulation techniques.

UNIT – IV: **(12 hours)**

Protocol Architecture: Need for protocol architecture, TCP/IP protocol architecture, OSI model, TCP/IP Vs OSI model.
Information Theory and Coding: Discrete messages and information content, source coding, Shanon 's theorem, channel capacity, Block codes- coding and decoding, burst error correction(BRC), Convolutional coding, decoding convolutional code, comparison of error rates in coded and uncoded transmission, turbo codes.

TEXT BOOKS:

1. Communication Systems, Simon Haykin, John Wiley.
2. Principles of Communications – H. Taub and D. Schilling, Gouthamsaha, TMH.

REFERENCE BOOKS:

1. Communication Systems Analog and Digital – R.P. Singh and S D Sapre, TMH, 2nd Edition, 2008.
2. Digital and Analog Communication Systems – K Sam Shanmugam,WSE,2006.
3. Electronic &Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
4. Modern Digital and Analog communication Systems – B.P Lathi, Oxford 3rd edition.

OBJECT ORIENTED PROGRAMMING

Course Code **CSC 233** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **III**

Category: Foundation Course

Prerequisite: Basic knowledge of C

Objective:

- The Aim of the course is to acquaint the student with C++ and the applications of C++.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of OBJECT ORIENTED PROGRAMMING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction to OOP: Procedure oriented programming, object oriented programming, basic concepts of OOP, benefits and applications of OOP, simple C++ program,, namespace scope, structure of C++ Program, creating, compiling and linking a file.
Tokens: Keywords, identifiers, constants, basic data types, user defined data types, storage classes, derived data types, dynamic initialization of variables, reference variables, operators in C++, scope resolution operator, member dereferencing operators, memory management operators.

UNIT – II: **(10 hours)**

Control Structures, Classes and Objects: Specifying a class, defining member functions, C++ program with class, private member functions, arrays within class, memory allocation for objects, static data members, static member functions, arrays of objects, returning objects.Functions in C++: Main function, function prototyping, call by reference, return by reference, inline functions, default arguments.
More about Functions: Function Overloading, friendly functions: friend function, a function friendly to two classes, objects as function arguments.

UNIT – III: **(10 hours)**

Constructors and Destructors: Constructors, parameterized constructors, multiple constructors in a class, constructors with default arguments, copy constructors, dynamic constructors, destructors.
Inheritance: Introduction to inheritance, single inheritance, making a private member inheritable (protected member), multi-level inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance
Operator Overloading: Rules for overloading operators, overloading unary operators, overloading binary operators.Pointers: Introduction to Pointers, declaring and initializing pointers, arithmetic operations on pointers, pointers with arrays, arrays of pointers, pointers to objects, 'this' pointer.

UNIT – IV: **(10 hours)**

Polymorphism and Virtual Functions: Compile-time polymorphism, run-time polymorphism, virtual functions.Managing Console I/O Operations: Unformatted I/O operations, formatted console I/O operations (width ( ), precision( ), fill( ), managing output with manipulators(setw( ) , endl).Templates: Introduction, function templates, class templates. Exception Handling: Introduction, exception handling mechanism, throwing mechanism, catching mechanism.

Text Book:

1. E.Balaguruswamy, Object Oriented Programming with C++, 6/e, McGraw Hill, 2013.

References:

1. SouravSahay, Object Oriented Programming with C++, 2/e, Oxford University Press, 2012.
2. Behrouz A. Forouzan and Richard F. Gilberg, Computer Science: A Structured Approach using C++, 2/e, Cengage Learning, 2003.
   Ashok N. Kamthane, Object Oriented Programming with ANSI and Turbo C++, 1/e, Pearson Education, 2006.

DIGITAL CIRCUITS AND SYSTEMS

Course Code **ECC 234** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **III**

Category: Foundation Course

Prerequisite: Basic Electronics, Analog Electronics

Objective:

- To learn basics of digital electronics circuit

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DIGITAL CIRCUITS AND SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

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UNIT – I: **(12 hours)**

Review of NUMBER SYSTEM -binary, octal, decimal and hexadecimal number systems and conversions.1's complements, 2'complement, binary addition, subtraction, multiplication & division. Logic gates and boolean algebra: NAND & NOR Implementation, De Morgan's law, Duality theorem**,** Gate level Minimization. Digital Logic Gates for Multiple inputs. Boolean functions, Canonical & standard form; min terms & max term,. The Map Method, K Map for two, three, four variables. Product of Sum (POS), Sum of product (SOP) simplification, Don't care conditions.Error detection& correction: Parity Generator and Checker Circuit.

UNIT – II: **(12 hours)**

Combinational Logic Circuits and Logic Families: Analysis & Design of Binary Half Adder & Full Adder circuit, CarryLookAheadadder. Half and Full-subtractor circuit, Decoders, Decoder for Seven segment display, decoder for binary to grey and grey to binary code. Encoders, Priority encoders, Multiplexers and Demultiplexers, Magnitude Comparator.Digital Integrated logic Circuits (Logic Families): RTL, DTL, TTL, ECL, MOS & C-MOS Logic circuits.,

UNIT – III: **(12 hours)**

Sequential Logic Circuit : Sequential Circuit, Latches, Flip-flop (S-R, J-K,D,T,M/S), edge triggering and level triggering. **Register &Counters:** Universal Shift Register (SISO, SIPO, PISO, PIPO), Synchronous Counter, Ripple counter, Modulo-n Counter, Up-Down Counter, Asynchronous Counter, , Ring Counters. Analysis of Clocked Sequential circuits.Analog to digital converter (ADC) & Digital to analog converters (DAC).

UNIT – IV: **(12 hours)**

Memory & Programmable Logic: Classification of memories–ROM, ROM organization, PROM, EPROM, EEPROM, EAPROM,RAM, RAMorganization.
ProgrammableLogic Devices, Programmable LogicArray(PLA), ProgrammableArray Logic(PAL), Field ProgrammableGate Arrays(FPGA).

TEXT BOOKS:

1. Digital Design, 3rd edition by M. Morris Mano, PHI

REFERENCE BOOKS

1. Digital Fundamentals – Floyd & Jain, Pearson education
2. Digital Principles & Applications – Malvino, Leach & Saha, 6th Edition, Tata Mc Graw Hill
3. Switching Theory & Digital Electronics – V. K. Jain, Khanna Publishers

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code **CSC 235** **L-P-T-Cr.:** **4 0 0 4** **Semester:** **III**

Category: Program Core Course

Prerequisite: Na

Objective:

- To understand how computers are constructed out of set of functional units.
- To understand how these functional units operate, interact and communicate.
- Understand the design of processors, the structure and operation of memory, pipelining, system integration and peripherals.
- To understand the system interconnection and the different I/O techniques.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Computer organization & architecture.
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

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UNIT – I: **(10 hours)**

Register Transfer and Micro operations: Register transfer language, register transfer, bus and memory transfers, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic shift unit.

UNIT – II: **(10 hours)**

Basic Computer Organization and Design: Instruction codes, Computer Registers,Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Complete Computer Description.
Micro Programmed Control: Control memory, Address sequencing, Micro program example, design of control unit

UNIT – III: **(10 hours)**

Central Processing Unit: Introduction, General register organization, Stack organization, Instruction formats, addressing modes, Data transfer and manipulation, Program control.
Pipeline and Vector Processing: Parallel processing, pipelining, arithmetic pipeline, Instruction pipeline. introduction to multiprocessors.
Computer Arithmetic: Introduction, addition and subtraction, decimal arithmetic unit, booth multiplication algorithm.

UNIT – IV: **(10 hours)**

Input/Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access (DMA).The Memory System: Memory

Hierarchy, Auxiliary memory, Associative memory, Cache memories, cache memory techniques, Virtual memory

TEXT BOOKS:

1. M.Morris Mano, Computer System Architecture, 3/e, Pearson education, 2008.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5/e, McGraw Hill, 2001.

REFERENCE BOOKS:

1. John P. Hayes, Computer Architecture and Organization, 3/e, McGraw Hill, 1998.
2. William Stallings, Computer Organization and Architecture, 6/e, Pearson, PHI, 2012.

OBJECT ORIENTED PROGRAMMING LAB

Course Code	**CSL 236**	**L-P-T-Cr.:**	**0**	**3**	**0**	**2**	**Semester:**	**III**

Category: Laboratory Course

Prerequisite: A course on "Computer Programming & Data Structures".

Objective:

- To introduce Java compiler and eclipse platform. To make the student learn an object oriented way of solving problems using java.
- To make the students to write programs using multithreading concepts and handle exceptions.
- To make the students to write programs that connects to a database and be able to perform various operations.
- To make the students to create the Graphical User Interface using Applets, AWT Components & Swing Components.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of OBJECT ORIENTED PROGRAMMING LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

1. Data types & variables.
2. Decision control structures: if, nested if etc.
3. Program with loop control structures: do, while, for etc.
4. Inheritance, polymorphism, packages, generics.
5. Program with modern features of java.
6. Interfaces and Inner classes
7. Implementing wrapper classes
8. Implementing generics.
9. Working with files.

DIGITAL CIRCUITS LABS

Course Code	**ECL 237**	**L-P-T-Cr.:**	**0**	**3**	**0**	**2**	**Semester:**	**III**

Category: Laboratory Course

Prerequisite: Knowledge of basic logic gates.

Objective:

- To learn and Understand the working of different combinational and sequential logic circuits.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DIGITAL CIRCUITS LABS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Experiment List (Digital Circuit Lab) :

1. Verification of Logic Gates.
2. Realization of Gates Using NAND Gate.
3. Realization of Gates Using NOR Gate.
4. Half and Full Adder using Gates.
5. Encoder / Decoder (4:2 / 2:4).
6. Multiplexer / De-multiplexer (2:1 / 1:2).
7. Flip-Flop (RS, T, D, JK).
8. BCD to Seven Segment Display.
9. Shift Register (2-Bit).

	Semester – IV							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 241	Mathematics-IV	FC(BS)	4	0	0	4	
2	ECC 242	Microprocessors&Microcontrollers	FC(BE)	3	0	0	3	
3	HSC 243	Organizational Behavior	OE(OE)	3	0	1	3	
4	CSC 244	Analysis and Design of Algorithms	PC(CE)	3	0	0	3	
5	CSC 245	Operating Systems	PC(CE)	3	0	0	4	
6	ECL 246	Analysis and Design of Algorithms Lab.	FC(BE)	0	3	0	2	
8	CSL 247	Microprocessors&Microcontrollers Lab.	PC(BE)	0	3	0	2	
9	MOC 248	Google Cloud Computing Foundations(MOOCs-1)	MOOC	0	0	0	3	
						Total Credit:	**24**	

MATHEMATICS – IV

Course Code **MAC 241** **L-P-T-Cr.:** **4 0 0 4** **Semester:** **IV**

Category: Foundation Course

Prerequisite: of matrices, polynomials, differentiations & integrations.

Objective: •The objective is to give the details of problems and solution procedures for various aspects of matrices, vectors and their orthogonalizations.
Also to give various numeric schemes for some advanced as well as classical problems in different situations in research**.**

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MATHEMATICS – IV
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: MATRICES & SYSTEM OF LINEAR EQUATIONS (12 hours)

Elementary row transformations – rank – Echelon form- normal form – gauss elimination – Direct method – LU decomposition – solution of tridiagonal system- Eigen value – Eigen vectors – Cayley-Hamilton theorem- Model and Spectral matrices – Hermitian- orthogonal- quadratic form - semi definite – unitary

UNIT – II: VECTOR SPACE (12 hours)

Space coordinates – vectors (addition and Scalar multiplication) – dot product – Application to Geometry-vector Space – Subspaces – span of a set – More about sub space – Linear Dependence, Independence – dimension and Basis, Linear Transformation, Matrix representation. Inner product-norm, Orthoganalisation process.

UNIT – III: NUMERICAL COMPUTATION AND INTERPOLATION. (12 hours)

Computer arithmetic, floating point numbers, operations, normalization, their consequences, Absolute, relative and percentage errors. Iterative method, Numerical solution of polynomials: Bisection method, False position, secant and Newton-Raphson method. Interpolation.

UNIT – IV: NUMERICAL INTEGRATION AND NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS (12 hours)

Basics of Numerical Integration: Newton-cotes rules: Trapezoidal and Simpson's rule, and their generalization, Modified Euler's method, Taylor series method and Runge-Kutta method(upto 4th order)

TEXT BOOKS:

1. Linear Algebra and Its Application by *Gilbert Starng* , Thomson Books
2. Numerical methods by Jain, Iyenger& Jain, New Age International publishers

REFERENCE BOOKS:

1. Higher Engineering Mathematics by *B.V. Ramana* (Tata McGraw-Hill)
2. Higher Engineering Mathematics - *B.S. Grewal*, Khanna Publications.

MICROPROCESSOR AND MICRO CONTROLLER

Course Code **ECC 242** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **IV**

Category: Foundation Course

Prerequisite: Digital Electronics

Objective:

- To learn fundamental concepts of Intels 8085, 8086 microprocessor, 8051 microcontroller architectural features

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MICROPROCESSOR AND MICRO CONTROLLER
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: 8085 AND 8086MICROPROCESSORS (12 hours)

8085 Microprocessor: Architecture, Pin diagram, Physical memory organization, Interrupts of 8085.

UNIT – II: 8086 MICROPROCESSORS (12 hours)

8086 Microprocessor: Architecture, signal descriptions, common function signals, Minimum and Maximum mode signals, addressing modes, interrupt structure.

UNIT – III: I/O INTERFACING (12 hours)

Interfacing with 8086 Interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254.

Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.

UNIT – IV: 8051 MICRO-CONTROLLER (12 hours)

Overview of 8051 microcontroller, Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, Interrupts, timer/Counter and serial communication.

TEXT BOOKS:

1. Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, Penram International Publishing
2. Advance Microprocessor and Peripherals, By, A.K. Roy and K.M. Bhurchandi, Tata McGraw-Hill Education
3. Mazidi and Mazidi, The 8051 Micro controller and Embedded Systems, pearson Education.

REFERENCE BOOKS:

1. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, andApplications , by Walter A. Triebel&Avtar Singh,
2. Micro processors and Interfacing, D. V. Hall, TMGH.
   The 8051 microcontroller , Kenneth. J. Ayala. Cengage learning.

3. Microcontrollers and application, Ajay. V. Deshmukh, TMGH.
4. Micro Computer System 8086/8088 Family Architecture. Programming and Design - By Liu and GA Gibson, PHI.

ORGANIZATIONAL BEHAVIOUR

Course Code **HSC 243** **L-P-T-Cr.:** **3 0 1 3** **Semester:** **IV**

Category: Foundation Course

Prerequisite: Basic knowledge in communication and management

Objective: The objectives of this paper are to familiarize the student with basic management concepts and behavioural processes in the organization and job field. Students will be able to examine group and individual behaviour**.**

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ORGANIZATIONAL BEHAVIOUR
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR (12 hours)

Organizational Behaviour- Definition, need, importance of organizational behaviour, nature and scope, Frame work – Organizational behaviour models; Organizational behaviour modification; Personality – types – Factors influencing personality – Theories; Learning- Types of learners, The learning process, Learning theories; Attitudes – Characteristics – Components – Formation – Measurement, Values; Perceptions – Importance, Factors influencing perception, Interpersonal perception, Impression Management.

UNIT – II: GROUP BEHAVIOUR (12 hours)

Organization structure – Formation – Groups in organizations – Influence; **Group dynamics** – Emergence of informal leaders and working norms, Group decision making techniques. **Communication** – Control; **Motivation** – importance – Types – Effects on work behavior;

UNIT – III: LEADERSHIP & POWER DYNAMICS (12 hours)

Leadership – Meaning, Importance, Leadership styles – Theories – Leaders vs. Managers; **Team** building - Interpersonal relations; **Sources of power** – Power centers – Power and Politics.

UNIT – IV: DYNAMICS OF ORGANIZATIONAL BEHAVIOUR (12 hours)

Organizational culture and climate – Factors affecting organizational climate – Importance.
Job satisfaction – Determinants – Measurements – Influence on behavior.; Organizational change – Importance, Stability vs. Change, Proactive vs. Reaction change, the change process, Resistance to change, Managing change; Stress – Work Stressors, Prevention and Management of stress, Balancing work and Life. Organizational development – Characteristics – objectives –Organizational effectiveness.

TEXT BOOKS:

1. *Stephen P. Robins*, Organizational Behavior, PHI Learning / Pearson Education.
2. *Fred Luthans*, Organizational Behavior, McGraw Hill.
3. *K Aswasthapa*, Organizational Behaviour, Himalaya Publishing House, Mumbai

REFERENCE BOOKS:

1. *Schermerhorn, Hunt and Osborn*, Organizational behavior, John Wiley.
2. *Udai Pareek*, Understanding Organizational Behaviour, Oxford Higher Education.
3. *Mc Shane & Von Glinov*, Organizational Behaviour, Tata McGraw Hill.
4. *Hellrigal, Slocum and Woodman*, Organizational Behavior, Cengage Learning

ANALYSIS AND DESIGN OF ALGORITHMS

Course Code **CSC 244** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **IV**

Category: Programme Core Course

Prerequisite: Data Structure

Objective: The student should be made to:

- Learn the algorithm analysis techniques.
- Become familiar with the different algorithm design techniques.
- Understand the limitations of Algorithm power.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ANALYSIS AND DESIGN OF ALGORITHM
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Introduction, Definition, Chrematistics of algorithm, Growth of Functions, Asymptoticanalysis, Amortized analysis, standard notations and common functions, Recurrences, solution of recurrences by substitution, recursion tree, induction method, and Mastermethods, Algorithm design techniques, worst case analysis of Merge sort, Quick sort andBinary search, Design & Analysis of Divide and conquer algorithms.

UNIT – II: **(12 hours)**

Heapsort mechanism, Heaps, Building a heap, Theheapsort algorithm, Priority Queue,Lower bounds for sorting. Dynamic programming methodology, Elements of dynamicprogramming, Matrix-chain multiplication, Longest common subsequence, GreedyAlgorithms, Elements of Greedy strategy, Assembly-line scheduling, Activity selectionProblem, Fractional knapsack problem, Huffman codes).

UNIT – III: **(12 hours)**

Data structure for disjoint sets, Disjoint set operations, Linked list representation, B and B + tree, connected components and bi connected components. Breadth first search and depth-first search, Minimum Spanning Trees, Kruskal algorithm and Prim's algorithms, single- source shortest paths (Bellman-ford algorithm and Dijkstra'salgorithms), All-pairs shortest paths (Floyd – Warshall Algorithm).

UNIT – IV: **(12 hours)**

Back tracking, Branch and Bound, Eight Queen problem, Travelling sales person problem, 0/1 knapsack problem, NP - Completeness (Polynomial time, Polynomial time verification, NP -Completeness and reducibility, NP-Complete problems (without Proofs), Approximation algorithmscharacteristics, Traveling Salesman Problem.

TEXT BOOKS:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C.Stein : Introduction to Algorithms, 2nd Edition, PHI Learning Pvt. Ltd.
2. H. Bhasin: Algorithms, Design and Analysis, First Edition, Oxford Higher Education.

REFERENCE BOOKS:

1. Sanjay Dasgupta, UmeshVazirani: Algorithms, McGraw-Hill Education.
2. Horowitz &Sahani: Fundamentals of Algorithm, 2nd Edition, Universities Press.
3. Goodrich, Tamassia: Algorithm Design, Wiley India.

OPERATING SYSTEMS

Course Code **CSC 245** **L-P-T-Cr.:** **3 0 0 4** **Semester:** **IV**

Category: Programme core

Prerequisite: A course on "Computer Programming and Data Structures"
A course on "Computer Organization and Architecture"

Objective:

Provide an introduction to operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
Introduce the issues to be considered in the design and development of operating systemIntroduce basic Unix commands, system call interface for process management, interprocesscommunication and I/O in Unix

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of OPERATING SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION AND PROCESS MANAGEMENT (12 hours)

Operating System Overview: Introduction, The Need of Operating Systems, Evolution of Operating Systems, Types of Operating Systems, Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls, Virtual Machines, System Design and Implementation.
Process Management: Process concepts, Life cycle, PCB, Schedulers, Process Scheduling, Threads, Scheduling Levels, CPU Scheduling: Scheduling-Criteria, Algorithms, Algorithm Evaluation, interprocess communication.

UNIT – II: CONCURRENCY CONTROL AND MEMORY MANAGEMENT (12 hours)

Concurrency: Process synchronization, The Critical- Section Problem, Peterson's Solution, synchronization Hardware, Semaphores, Classic problems of synchronization, Monitors
Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual memory, Demand Paging, Page-Replacement, Algorithms, Allocation of frames, thrashing.

UNIT – III: DEAD LOCK, FILE SYSTEMS (12 hours)

Deadlocks: System Model, Deadlock Characterization, Deadlock Prevention, Deadlock Detection and Avoidance, Recovery from Deadlock.
File system Interface: Concept of a File, Access Methods, Directory structure, File System Mounting, File sharing, Protection.
File System Implementation: File -system structure, File- system Implementation, Directory Implementation, Allocation methods, Free-Space Management, Efficiency and Performance,

UNIT – IV: MASS STORAGE, PROTECTION, SECURITY (12 hours)

Secondary Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Formatting, Swap-Space Management, RAID structure.
Protection: Domain of Protection, Access Control, Access Matrix, Access Control Lists, Capability Lists.
Security: Security Objectives, Security Problems, Intruders, Inside System Attacks, Outside System Attacks, Cryptography as a Security Tool, Intrusion Detection System.

TEXT BOOKS:

1. Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Principles of Operating systems- Naresh Chauhan,Oxford Higher Education.

REFERENCE BOOKS:

1. Operating Systems – Internal and Design Principles Stallings, Fifth Edition–2005, Pearson education.
2. Operating System A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tanenbaum Pearson/PHI.

ANALYSIS AND DESIGN OF ALGORITHMS LAB.

Course Code	**ECL 246**	**L-P-T-Cr.:**	**0**	**3**	**0**	**1.5**	**Semester:**	**IV**

Category: Laboratory Course

Prerequisite: Data Structure

Objective: The student should be made to:

- Learn the algorithm analysis techniques.
- Become familiar with the different algorithm design techniques.
- Understand the limitations of Algorithm power.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ANALYSIS AND DESIGN OF ALGORITHMS LAB.
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF TOPICS FOR EXPERIMENTS

1. Apply the divide and Conquer technique to arrange a set of numbers using merge sort method.
2. Write programs to implement the following:
   a) Prim's algorithm.
   b) Kruskal's algorithm.
3. Write a program to find optimal ordering of matrix multiplication.

   (Note: Use Dynamic programming method).

   a) Perform graph traversals.
   b) Implement the 8-Queens Problem using backtracking.
   c) Implement Quick sort algorithm.
4. Write a program to implement dynamic programming algorithm to solve all pairsshortest path Problem.
5. Write a program to solve knapsack problem using the following:
   a) Greedy algorithm.
   b) Dynamic programming algorithm.
   c) Backtracking algorithm.
   d) Branch and bound algorithm.
6. Write a program that uses dynamic programming algorithm to solve the optimal binary search tree problem.
7. Write a program for solving traveling sales persons problem using the following:
   a) Dynamic programming algorithm.
   b) The back tracking algorithm.
   c) Branch and Bound.

MICROPROCESSOR & MICROCONTROLLER LAB

Course Code **CSL 247** **L-P-T-Cr.:** **0 3 0 1.5** **Semester:** **IV**

Category: Laboratory Course

Prerequisite: Digital Electronics

Objective:

- To provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM.
- To give the knowledge and practical exposure on connectivity and execute of interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MICROPROCESSOR & MICROCONTROLLER LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

INTRODUCTION TO 8085: ARCHITECTURE, ADDRESSING MODES, INSTRUCTION SET

a) Programming model of 8085 Microprocessor
b) Registers in 8085
c) Machine language/ Assembly Language
d) Assembly language commands/Instructions
e) Program format
f) Assembler introduction
g) Writing small data transfer programs

1. Find the 1's and 2's complement of an 8-bit number stored in Memory.
   a) 8-bit number
   b) 16-bit number
2. Addition of two 8-bit number stored in Memory:
   a) Result in 8-bit,
   b) Result in 16-bit
3. Subtraction of two 8-bit number stored in Memory
   a) Using SUB instruction
   b) Without using SUB instruction
4. Addition of two 16-bit number
   a) Using DAD instruction
   b) Without using DAD instruction
5. Decimal Addition of two number stored in memory location
   a) Decimal Addition of two 8-bit numbers Result 16 bit
   b) Decimal Addition of two 16-bit numbers Result 16 bit
6. Move a Block of data from one memory locations to another memory locations
7. Generation of Fibonacci Series of a specified length
8. Multiplication and Division of two 8-bit numbers
   a) Multiplication of two 8-bit number stored in memory location
   b) Division of two 8-bit number stored in memory location

9. Factorial of a number
    a) Result 8-bit
    b) Result 16-bit
10. Finding the largest and smallest number in a array of 8-bit number
    a) Largest number in the array of 8-bit number
    b) Smallest number in the array of 8-bit number
11. Arrange the array of 8bit numbers in ascending /descending order
    a) Arrangement in ascending order
    b) Arrangement in descending number
12. Hexadecimal to BCD conversion and vice-versa
    a) Binary Code (Hexadecimal) to BCD conversion of an 8-bit number
    b) BCD to Binary Code (Hexadecimal) conversion of an 8-bit number
13. Finding the Square of a number using look up table
14. 8051 programming
    a) Addition and subtraction of two 8-bit number stored in memory
    b) Multiplication and Division of two 8-bit number stored in memory

15. Speed control of DC motor.
16. (i) Square wave generator.
    (ii) Sawtooth wave generator.
17. Analog to digital conversions.

REFERENCE BOOKS:

1. Fundamentals of Microprocessors and Microcontrollers by B. Ram, Dhanpat Rai Publications [5.1, 5.2, Chapter-6, 9.9]
2. Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, Penram International Publishing [Chapter-2, 6, 7, 8.1, 8.4, 10.1, 10.2,

	Semester – V							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	MAC 351	Discrete Mathematics	FC (BS)	3	0	1	**3**	
2	CSC 352	Theory of Computation	PC(CE)	3	0	0	**3**	
3	CSC 353	Database Management Systems	PC(CE)	3	0	1	**3**	
4	CSC 354	Professional Elective-I	PE(CE)	3	0	0	**3**	
5	HSC 355	Engineering Economics	OE (OE)	3	0	1	**3**	
6	CSL 356	Database Management System Lab.	PC(CE)	0	3	0	**2**	
7	CSL 357	Web Technology Lab	PC(CE)	0	3	0	**2**	
8	MOC 358	Soft Skills and Personality Development(MOOCs-2)	MOOC	0	0	0	**3**	
						Total Credit:	**22**	

Professional Elective-I					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E01	Computer Graphics	4	0	0	3
CSE E02	Web Technology	4	0	0	3
CSE E03	Real Time Systems	4	0	0	3
CSE E04	Advanced Operating Systems	4	0	0	3
CSE E05	Advanced Data Structures	4	0	0	3

DISCRETE MATHEMATICS

Course Code **MAC 351** **L-P-T-Cr.:** **3 0 1 3** **Semester:** **V**

Category: Foundation Course

Prerequisite: Basics of set theory and combinatory

Objective:

- The objective is to introduce Logic, Graphs and Algebraic structures.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DISCRETE MATHEMATICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: LOGIC **(12 hours)**

Mathematical reasoning; propositions; negation disjunction and conjunction; implication and equivalence; normal form; truth tables; predicates; quantifiers; natural deduction; rules of Inference; methods of proofs; resolution principle; Automatic theorem proving, Fuzzy logic: fuzzy relation,, pattern classification, fuzzy analysis, distance between fuzzy sets, area perimeter, height, width of fuzzy subsets.

UNIT – II: SETS, RELATION & FUNCTIONS **(12 hours)**

Set theory; Paradoxes in set theory; inductive definition of sets and proof by induction; Peono postulates; Relations; representation of relations by graphs, Warshall's algorithm; properties of relations; equivalence relations and partitions; Partial orderings; Posets; Linear and well-ordered sets; Functions; mappings; injection and surjections; composition of functions; inverse functions; special functions; pigeonhole principle.

UNIT – III: GRAPH THEORY **(12 hours)**

Graph Theory; elements of graph theory, Graph Isomorphism, connected graph, Euler graph, Hamiltonian path, Grinberg's theorem, trees, tree traversals, spanning trees, BFS & DFS; minimal spanning tree, Kruskal's algorithm, Prim's algorithm, planar graph, dual of a graph, Euler formula

UNIT – IV: ALGEBRAIC STRUCTURES & COMBINATORIES **(12 hours)**

Definition and elementary properties of groups, semigroups, monoids, rings, fields, vector spaces and lattices; Elementary combinatory; counting techniques; recurrence relation; generating functions

TEXT BOOKS:

1. *C. L. Liu*, Elements of Discrete Mathematics, McGraw-Hill.
2. *K. H. Rosen*, Discrete Mathematics and applications, TataMcGraw Hill

REFERENCE BOOKS:

1. *J .L. Mott, A. Kandel, T.P .Baker*, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, Prentice Hall of India.
2. *R. Grimaldi and B V Ramana*, Discrete and combinatorial mathematics: An applied introduction, Pearson education

THEORY OF COMPUTATION

Course Code **CSC 352** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **V**

Category: Foundation Course

Prerequisite: Fundamental of computer science and mathematics

Objective:

- To introduce concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships.
- To design grammars and recognizers for different formal languages

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of THEORY OF COMPUTATION
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION **(12 hours)**

Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

UNIT – II: REGULAR EXPRESSION **(12 hours)**

Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages,

UNIT – III: CONTEXT FREE GRAMMAR **(12 hours)**

Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs

Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, PDA with two stacks.

UNIT – IV: TURING MACHINES **(12 hours)**

Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani and Jeffery D. Ullman, Automata Theory, Languages, and Computation (3rd. Edition), Pearson Education, 2008.
2. Peter Linz ,An Introduction to Formal Languages and Automata, Paperback – 2011

REFERENCE BOOKS:

1. K. L. P. Mishra and N. Chandrashekaran, Theory of Computer Science: Automata, Languages and Computation, Indian3rd Edition 2006.
2. H.R.Lewis and C.H.Papadimitriou, Elements of The theory of Computation, Second Edition, Pearson Education/PHI, 2003
3. Michael Sipser, Introduction to the Theory of Computation, Books/Cole Thomson Learning, 2001.

DATABASE MANAGEMENT SYSTEMS

Course Code **CSC 353** **L-P-T-Cr.:** **3 0 1 3** **Semester:** **V**

Category: Programme Core Course

Prerequisite: Basic Knowledge of Computer Programming and data structures

Objective:

- Classify modern and futuristic database applications based on size and complexity; design a database from understanding an Universe of Discourse, using ER diagrams; map ER model into Relational model and to normalize the relations;
- create a physical database from a design using DDL statements with appropriate key, domain and referential integrity constraints; analyze different ways of writing a query and justify which is the effective and efficient way; and compare and contrast various indexing strategies in different database systems and list key challenges in advanced database systems and to critique how they differ from traditional database systems.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DATABASE MANAGEMENT SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION TO DATABASE SYSTEMS (10 hours)

Data - Database Applications - Evolution of DB & DBMS - Need for data management – Data models & Database Schema Architecture - components of DBMS - Key issues and challenges in Database Systems.
E/R Model - Conceptual data modeling -E/R diagram notation, ER Diagrams - Relational Model - ER to Relational Mapping - Constraints - Keys - Dependenciesexamples.

UNIT – II: DATABASE LANGUAGE AND DATABASE DESIGN (10 hours)

Introduction to Database Languages: Relational Algebra, Relational Calculus, SQL - Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses, embedded SQL.
Database Design: Introduction to Functional Dependency and Normalization – Concept of functional dependency, First, Second, Third & Fourth Normal Forms - BCNF – Join Dependencies-other Normal forms

UNIT – III: TRANSACTIONS & CONCURRENCY AND PHYSICAL DATABASE DESIGN (10 hours)

Introduction to Transactions: Transaction Systems - ACID Properties - System & Media Recovery - Two Phase Commit Protocol - Recovery with SQL - Need for Concurrency Locking Protocols - Deadlocks & Managing Deadlocks - SQL Support for Concurrency.
Storage Strategies: Indices, B-Trees, Hashing, Indexing.

UNIT – IV: QUERY PROCESSING AND ADVANCES IN DATABASES (10 hours)

Query Processing and Optimization: Query Tree, Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Optimization Algorithms.
Introduction to Special Topics : Spatial & Temporal Databases – Data Mining & Warehousing - Data Visualization - Mobile Databases - OODB & XML Databases - Multimedia & Web Databases.

TEXT BOOKS:

1. Elmaski & Navathe -Fundamentals of Database Systems, 4th Edition, Pearson Education

REFERENCE BOOKS:

1. Database Systems, Thomas Connolly, Carolyn Begg
2. C.J. Date - An introduction to Database Systems, Pearson Education
3. Avi Silberschatz, Henry F. Korth , S. Sudarshan,Database System Concepts
4. Bipin Desai -An introduction to Database System, Galgotia Publication.
5. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2002.

WEB REFERENCES

1. http://cs.stanford.edu/people/widom/cs346/ioannidis.pdf
2. http://nptel.ac.in/courses/106106093/

Professional Elective-I

COMPUTER GRAPHICS

Course Code **CSE E01** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **V**

Category: Programme Elective Course

Prerequisite: Knowledge on C programming and mathematics

Objective:

- To identify and understand the core concepts of computer graphics
- To apply graphics programming techniques to design and create computer graphics scenes.
- To learn about the 2D and 3D transformations including translation,scaling,rotation and reflection .
- To understand principle of clipping,basic line-clipping algorithms
- To learn about application of curves in computer graphics

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPUTER GRAPHICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Graphics Hardware: Display devices, input devices, Raster Graphics.
Line and Circle drawing algorithms: DDA, Bresenham's line drawing algorithm, midpoint circledrawing algorithm.

UNIT – II: **(14 hours)**

Windowing and Clipping: Viewing and Window coordinate System, Viewport, Window, Zoom-inZoom-out, Cohen Sutherland, Cyrus beck line clipping algorithms
2D and 3D Geometrical Transformations: Homogeneous Coordinate system, Basic transformations: Translation, Scaling, Rotation and Reflection.

UNIT – III: **(12 hours)**

Viewing Transformation: Parallel Projection: Orthographic, Axonometric, Cavalier and Cabinet. **Perspective Projection:** one point, two point, three point perspective projection, vanishing point.

UNIT – IV: **(12 hours)**

Curve and Surfaces: Properties of curves, Blending functions: Cubic Bezier and B-Spline curves.
Parametric Surfaces: Surface of revolution Sweep surfaces, Fractal curves and surfaces,
Hidden line/surface removal: Object space and Image space methods, Inside- outside test, Back
Face detection: Z-buffer, A-Buffer Methods.Introduction to computer animation.

TEXT BOOKS:

1. Hearn D. and P. Baker, Computer Graphics C version, Prentice-Hall. (Major Reading)

REFERENCE BOOKS:

1. David F. Rozers, Procedural Elements for Computer Grapihics, TMH.
2. David F. Rozers, Mathematical Elements for Computer graphics, TMH.
3. Foley, J.D. A. Van Dam, Computer Graphics: Principles and Practice, Addison- Wesley.

Other References: (Web)

REAL TIME SYSTEMS

Course Code **CSE E03** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **V**

Category: Programme Elective Course

Prerequisite: Data Structure and Algorithm, Linear Algebra, Basics of Web programming

Objective:

- Basics of Real time systems
- Real time memory and design considerations
- Integration of Hardware and software in real time applications

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of REAL TIME SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (8 hours)

Basic real time concepts - Introduction, Real-time Versus Conventional Software, Computer Hardware for Monitoring and Control, Software Engineering Issues.

UNIT – II: DESIGN TECHNIQUES AND MEMORY MANAGEMENT (10 hours)

Real time specification and design techniques – structure of an RTOS - real time kernels – inter task communication and synchronization.Real time memory management. System performance analysis and optimization.

UNIT – III: QUEUING MODELS AND FAULT TOLERANT ARCHITECTURES (9 hours)

Queuing models – Reliability,testing and fault tolerance, HW/SW faults, diagnosis, functional testing . Faulttolerant architectures: TMR systems - multiprocessing systems.

UNIT – IV: REAL-TIME DATABASES AND COMMUNICATION, APPLICATIONS (13 hours)

Introduction – Main Memory Databases – Transaction Priorities – Concurrency Control Issues – Disk Scheduling Algorithms – Databases for Hard Real-Time Systems – Fault-Tolerant Routing
Hardware/Software integration, real time applications- case studies.

TEXT BOOKS:

1. LaplantePhilip.A, “Real-time systems design and analysis: An engineer’s handbook”,2nd Edition,
2. PHI.,1994.C.M.Krishna, Kang G.Shin, “Real-time systems” – McGraw Hill, 1997.

REFERENCE BOOKS:

1. Alan C. Shaw , “Real – Time Systems and software “,John Wiley & Sons Inc,2001
2. Buhr R J and Bailey D L, “An Introduction to Real-Time Systems”, Prentice-Hall 1999.
3. Burns, A and Wellings, A, “Real Time Systems and Programming Languages: Ada 95, Real-Time Java and Real-Time C/POSIX”, Addison-Wesley. ISBN.,2001
4. Levi S.T. and Agarwal A.K., “Real time System Design”, McGraw Hill International Edition, 1990. Rajibmall “Realtime systems, Theory & Practice “ , Pearson Education 2007.

WEB REFERENCES

1. www.eventhelix.com/realtimemantra/basics
2. www.unix.ecs.umass.edu/~krishna
3. http://infoweb.vub.ac.be/infoef/ulbarch/
4. www.augustana.ab.ca/~mohrj/courses/2005.winter/cs380/slides.7e

WEB TECHNOLOGY

Course Code **CSE E02** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Programme Core Course

Prerequisite: Fundamentals of Programming and Networking

Objective:

- Describe the concepts of WWW including browser and HTTP protocol.
- List the various HTML tags and use them to develop the user friendly web pages.
- Define the CSS with its types and use them to provide the styles to the web pages at various levels.
- Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
- Use the JavaScript to develop the dynamic web pages.
- Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
- Develop the modern Web applications using the client and server side technologies and the web design fundamentals.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of WEB TECHNOLOGY
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION **(8 hours)**

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0.

Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

UNIT – II: HTML and CSS **(12 hours)**

HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5.

Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3.

UNIT – III: JAVA SCRIPT and XML **(10 hours)**

JavaScript: Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, **DHTML :** Combining HTML, CSS and Javascript, Events and buttons.

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT

UNIT – IV: PHP and MYSQL (10 hours)

PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.

PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

TEXT BOOKS:

1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India.
2. Web Technologies, Black Book, dreamtech Press HTML 5, Black Book, dreamtech Press

REFERENCE BOOKS:

1. Web Design, Joel Sklar, Cengage Learning
2. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson

WEB REFERENCES

1. www.w3schools.com

ADVANCED OPERATING SYSTEMS

Course Code **CSE E04** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **V**

Category: Programme Elective Course

Prerequisite: Operating systems, Basics of Computer Architecture, Computer Networks

Objective: The main objective of studying this course is to understand concept distributed systems; clock synchronization issues, mutual exclusion, deadlock, resource management, system failure and fault tolerance, system protection model in distributed system.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED OPERATING SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (10 hours)

Introduction: Overview - Functions of an Operating System – Design Approaches – Types of Advanced Operating System - Synchronization Mechanisms – Concept of a Process, Concurrent Processes– TheCritical Section Problem, Other Synchronization Problems – Language Mechanisms for Synchronization –Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries – Models of Deadlocks, Resources,System State – Necessary and Sufficient conditions for a Deadlock – Systems with Single-Unit Requests,consumable Resources, Reusable Resources.

UNIT – II: DISTRIBUTED OPERATING SYSTEMS (10 hours)

Distributed operating systems: Introduction – Issues – Communication Primitives – Inherent Limitations - Lamport's Logical Clock;Vector Clock;Causal Ordering;Global State;Cuts;Termination Detection.Distributed Mutual Exclusion – Non-Token Based Algorithms – Lamport's Algorithm - Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm – Distributed Deadlock Detection – Issues – Centralized Deadlock-Detection Algorithms - Distributed Deadlock-Detection Algorithms. Agreement Protocols – Classification - Solutions – Applications.

UNIT – III: DISTRIBUTED RESOURCE MANAGEMENT (10 hours)

Distributed resource management: Distributed File systems – Architecture – Mechanisms – Design Issues – Distributed Shared Memory – Architecture – Algorithm – Protocols - Design Issues. Distributed Scheduling – Issues – Components – Algorithms.

Failure recovery and fault tolerance: Basic Concepts-Classification of Failures – Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Check pointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols;

UNIT – IV: (10 hours)

Multiprocessor and database operating systems: Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory Management – Reliability / Fault Tolerance; Database Operating Systems – Introduction – Concurrency Control – Distributed Database Systems – Concurrency Control Algorithms.

TEXT BOOKS:

1. Singhal, Mukesh& N.G. Shivaratri, Advanced Concepts in Operating Systems, TMH.

REFERENCE BOOKS:

1. P. K. Sinha, "Distributed Operating Systems" PHI, 1998.
2. A.S. Tanenbaum, Modern Operating Systems, PHI
3. G. Coluris, Distributed Systems-Concepts and Design.
4. Chow, Johnson, Distributed Operating Systems, Addison-Wesley

Other References: (Web)

ADVANCED DATA STRUCTURES

Course Code **CSE E05** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **V**

Category: Programme Elective Course

Prerequisite: Data Structure Basic

Objective: Design and analyze programming problem statements.
Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
Understand the necessary mathematical abstraction to solve problems.
Come up with analysis of efficiency and proofs of correctness
Comprehend and select algorithm design approaches in a problem specific manner.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED DATA STRUCTURES
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (10 hours)

Review of Data Prilinary Structures: Stack, Queue, Linked lists, binary tree and graph.
Time complexity, Asymtotic analysis: complexity-notations, Omega notation and Theta notation, Big O notation, Divide and conquer: Binary search, Quick sort, Merge sort. Master method for recurrence relation, Hashing, B and B + tree, AVL tree.

UNIT – II: GREEDY METHOD AND DYNAMIC PROGRAMMING (10 hours)

Greedy method: Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Single source shortest path problem.
Dynamic Programming: General method, applications-Strassen's Matrix chain multiplication, sum of subsets problem.

UNIT – III: BRANCH & BOUND AND ONLINE ALGORITHM (10 hours)

Branch and Bound: General method (Backtracking), N-queen problem, graph coloring, travelling salesman problem.Online Algorithm: Competitive Analysis, Deterministic Algorithms, Randomized Algorithms, Optimum Offline Algorithms, Case Studies – Ski Rental Problem, List Update Problem.

UNIT – IV: APPROXIMATION ALGORITHM AND NP CLASS PROBLEM (10 hours)

Approximation Algorithms: Basic Concepts, Bounds, Polynomial Time Approximation.
Schemes ,Bin Packing Problem. NP-Hard and NP-Complete classes, Cook's theorem. Introduction to Beyond NP-Class.

TEXT BOOKS:

IntroductiontoAlgorithms,2nd Edition,T.H.Cormen,C.E.Leiserson,R.L.Rivest,andC.Stein,PHIPvt.Ltd.Pearson Education.

REFERENCE BOOKS:

1 Design and Analysis of algorithms, Aho,UllmanandHopcroft, Pearson Education.
2 Computer Algorithms, E.Horowitz, S.Sahani and S.Rajasekharan, Galgotia Publishers pvt.Limited.

3 Algorithms, Robert Sedgewick, Addison- Wesley
4 Data structure using Java, Sahani
5 Online Computation and Competitive Analysis - A. Borodin and R. El-Yaniv, Cambridge Univ. Press,1998.
6 Approximation Algorithms - Vijay V. Vazirani, Springer Verlag, 2003.

ENGINEERING ECONOMICS

Course Code **HSC 355** **L-P-T-Cr.:** **3 0 1 3** **Semester:** **V**

Category: Foundation Course

Prerequisite: Na

Objective:

- The objective of this course is to acquaint the students with concepts and techniques in Economic Theory and to enable them to apply this knowledge in decision-making.
- Emphasis is given to changes in the nature of business firms in the globalization along with financial management idea and Cost management techniques in an organization.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ENGINEERING ECONOMICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Engineering Economics : Nature and scope, General concepts on micro & macroeconomics. The Theory of demand, Demand function, Law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply, Cost concept, Theory of production, Law of variable proportion, Law of returns to scale.

UNIT – II: **(10 hours)**

Time value of money : Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal and infinite lives, comparison of deferred investments, Future worth comparison, payback period comparison.

UNIT– III: **(10 hours)**

Capital Budgeting Decision and Techniques, Benefit/ Cost analysis, quantification of project cost and benefits, benefit/ cost applications, Cost –effectiveness analysis

UNIT – IV: **(10 hours)**

Analysis of public Projects: Fixed and variable cost, Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction techniques.

TEXT BOOKS:

1. Horn green, C.T., Cost Accounting, Prentice Hall of India
2. Riggs, J.L ., Dedworth, Bedworth, D.B, Randhawa, S.U. Engineering Economics, McGrawHill International Edition, 1996
3. Financial Management, Van Horne, Prentice Hall
4. Financial Management, Prasanna Chandra, Tata McGraw Hill

REFERENCE BOOKS:

DATABASE MANAGEMENT SYSTEMS LAB

Course Code **CSL 356** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **V**

Category: Laboratory Course

Prerequisite: RDBMS and computer programming language.

Objective:

- Understand basic concepts of how a database stores information via tables.
- Understanding of SQL syntax used with MySQL.
- Learn how to retrieve and manipulate data from one or more tables.
- Know how to filter data based upon multiple conditions.
- Updating and inserting data into existing tables.
- Learning how the relationships between tables will affect the SQL.
- The advantages of store procedures with storing data using variables and functions.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DATABASE MANAGEMENT SYSTEMS LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF TOPICS FOR EXPERIMENTS:

PART A : SQL :

1. DDL Statements (Create, Alter, Drop)
2. DML Statements (Insert, Update, Delete)
3. SELECT Statement : Information retrieval
4. Use of In-built functions (e.g. aggregate functions like Min, Max, Average… etc, time date functions…)
5. TCL statements (COMMIT, ROLL BACK, CHECK POINT)
6. Views, Sequence, Types (ORDBMS)
7. Security Management Commands (like GRANT and REVOKE)

PART B : PL/ SQL:

1. Un-named block
2. Named Blocks (FUNCTIONS, PROCEDURES)
3. Active Database Concepts (TRIGGERS)
4. PACKAGES

REFERENCE BOOKS:

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

WEB TECHNOLOGY LAB

Course Code **CSL 357** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **V**

Category: Laboratory Course

Prerequisite: Fundamentals of Programming and Networking

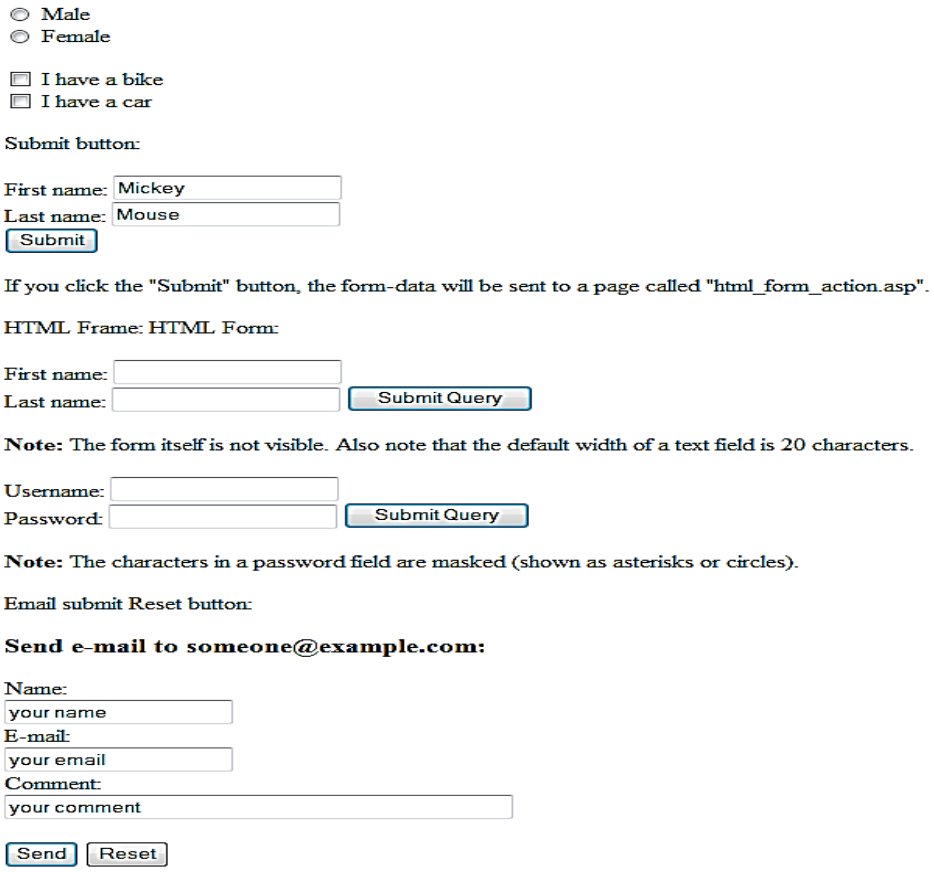
Objective:

- Describe the concepts of WWW including browser and HTTP protocol.
- List the various HTML tags and use them to develop the user friendly web pages.
- Define the CSS with its types and use them to provide the styles to the web pages at various levels.
- Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
- Use the JavaScript to develop the dynamic web pages.
- Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
- Develop the modern Web applications using the client and server side technologies and the web design fundamentals.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of WEB TECHNOLOGY LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

1. Design the following static web pages required for an online book store web site.
    a) HOME PAGE: The static home page must contain three frames.
    b) LOGIN PAGE
    c) CATOLOGUE PAGE:The catalogue page should contain the details of all the books available in the web site in a table.
    d) CART PAGE: The cart page contains the details about the books which are added to the cart.
    e) REGISTRATION PAGE
2. Write JavaScript to validate the fields of the above page. Write JavaScript to validate the fields of the Login page.
3. Design a web page using CSS which includes the following:
    a) Use different font, styles:
    b) Set a background image for both the page and single elements on the page.
    c) Control the repetition of the image with the background-repeat property.
    d) Define styles for links
    e) Working with layers
    f) Add a customized cursor
4. Write an XML file which will display the Book information. Write a Document Type Definition (DTD) to validate the above XML file. Display the XML file in a table. Use XML schemas XSL and CSS for the above purpose.
5. Create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click. The color should also be changed if we change the color in the “property window “.
6. Design the following Web page.



1. 1) Install TOMCAT web server and APACHE. 2) Access the above developed static web pages for books web site, using these servers by putting the web pages developed in week-1 and week-2 in the document root.
2. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. 1. Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
3. Install a database (Mysql). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a PHP program to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
4. Write a PHP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database.

	Semester – VI							
S.No.	**Corse Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	CSC 361	Computer Networks	PC(CE)	4	0	0	**3**	
2	CSC 362	Software Engineering	PC(CE)	3	0	1	**3**	
3	CSC 363	Professional Elective-II	PE (CE)	3	0	1	**3**	
4	XXX XXX	Professional Elective-III	PE (CE)	4	0	0	**3**	
5	XXX XXX	Open Elective-I	IE (IE)	4	0	0	**3**	
6	CSL 364	Computer Network Lab	PC(CE)	0	3	0	**2**	
7	CSL 365	Software Engineering Lab	PC(CE)	0	3	0	**2**	
8	MOC 366	Python for Data Science (MOOCs-3)	MOOC	0	0	0	**2**	
						Total Credit:	**21**	

PROFESSIONAL ELECTIVES					
Professional Elective-II					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E06	Advanced Computer Architecture	4	0	0	3
CSE E07	Human Computer Interaction	4	0	0	**3**
CSE E08	Parallel Computing	4	0	0	3
CSE E09	Wireless Communications	4	0	0	3
CSE E10	Distributed Database Systems	4	0	0	3
Professional Elective-III					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E11	Artificial Intelligence	4	0	0	3
CSE E12	Grid Computing	4	0	0	3
CSE E13	Semantic Web	4	0	0	3
CSE E14	Advanced Software Engineering	4	0	0	3
CSE E15	Storage Area Networks	4	0	0	3

OPEN ELECTIVES					
Open Elective-I					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E01	Embedded Systems	4	0	0	3
OPE E02	Optimization Techniques	4	0	0	3
OPE E03	Management Information Systems	4	0	0	3
OPE E04	Digital Signal Processing	4	0	0	3
OPE E05	Middleware Technologies	4	0	0	3

COMPUTER NETWORKS

Course Code **CSC 361** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Program Core Course

Prerequisite: Basic Computer Science

Objective:

- To produce a core knowledge of networking concepts and techniques to design simple networks.
- Provide in depth knowledge about the various communication technologies

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPUTER NETWORKS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction: Uses of computer networks, Reference models: OSI reference model, TCP/IP reference model, network standardization. Examples of data communication Services; X.25, networks, Frame relay and ATM . Medium access control: channel allocation problems, multiple access protocols: ALOHA, CSMA, collision frees protocols.

UNIT – II: **(10 hours)**

IEEE standards 802.3,Ethernet: Ethernet physical layer, Ethernet MAC sub layer protocol, Ethernet performance, switched Ethernet, fast Ethernet, gigabit Ethernet, IEEE802.4,IEEE802.5.

Data link layer switching: Uses of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

UNIT – III: **(10 hours)**

Network Layer: Network layer design issues, routing algorithms, optimality principle, shortest path, flooding, distance vector routing, count-to-infinity problem, link state algorithm, hierarchical routing, congestion control algorithms-General principles of congestion prevention policies.

Quality of service: Introduction, traffic shaping. The Network layer in the Internet: IPv4, IP Addresses, IPv6 Protocol, CIDR, Internet Control Protocols: ICMP, ARP, RARP and DHCP.

UNIT – IV: **(10 Hours)**

Transport Layer: The transport service: Services provided to the upper layers, transport service primitives, Berkeley Sockets, elements of transport protocols.The Internet Transport Protocols: UDP, TCP, the TCP service model, the TCP protocol, the TCP segment header, TCP connection establishment, TCP connection release.

Application Layer: The Domain Name System, electronic mail, World Wide Web: Architectural over view.

TEXT BOOKS:

1. Andrew S. Tannenbaum and David J. Wetherall, Computer Networks, 5/e, Pearson Education, 2010.

REFERENCE BOOKS:

1 Behrouz A. Forouzan and FirouzMosharraf, Computer Networks: A Top-Down Approach, McGraw Hill, 2011.
2 S.Keshav, Engineering Approach to Computer Networks, 2/e, Pearson Education, 1997.
3 Larry L.Peterson and Bruce S.Davi, Computer Networks: A Systems Approach, 4/e, Elsevier Publication, 2003.

SOFTWARE ENGINEERING

Course Code **CSC 362** **L-P-T-Cr.:** **3 0 1** **Semester:** **VI**

Category: Program Core Course

Prerequisite: Knowledge on programming and data structure

Objective:

- To understand common cycle process life processes.
- To understand the basic concepts in Requirement engineering,software design, coding, testing and maintenance.
- To learn about the role of project management including scheduling,planning,risk management etc.
- To have a basic knowledge about software quality,how to ensure good quality software.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SOFTWARE ENGINEERING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction to software and software engineering, various software process modules, capability, maturity, module and KPAs.Project planning, project introduction, team organization, scheduling and management, constructive cost model. Software measures, indicators and metrics, software risk analysis and management.

UNIT – II: **(10 hours)**

Software requirement analysis and specifications, applicability to small, medium, and large-scale systems.Software design, technical design, objectives of design, design metrics, modularity, module coupling and cohesion, relation between cohesion and coupling; Design strategies: Bottom up design, top down design, functional oriented design, object oriented design; IEEE recommended practice for software design description

UNIT – III: **(10 hours)**

Software testing, testability, testing process, structural testing, unit testing and integrated testing, debugging, testing tools, software maintenance, maintenance process, maintenance cost, reverse engineering and reengineering.

UNIT – IV: **(10 hours)**

Configuration management, Software Quality:Evolution of software quality,assessing and controlling software quality.softwarereliability:Hardwarevs Software reliability,Reliability metrics. CASE tools and workbenches.

TEXT BOOKS:

1. Pressman R., “Software Engineering”, McGraw-Hill.

REFERENCE BOOKS:

1. Sommerville, I., “Software Engineering”, Pearson Education.
2. Dfleeger, S. L., “Software Engineering”, Pearson Education. Rajib Mall, Software Engineering

Programme Elective-II

ADVANCED COMPUTER ARCHITECTURE

Course Code	**CSE E06**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VI**

Category: Professional elective course

Prerequisite: Compute Architecture and Organisation

Objective:

- To identify the key components of a computing system .
- To model the parallel programming paradigm

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED COMPUTER ARCHITECTURE
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION TO PARALLEL PROCESSING (10 hours)

Trends towards parallel processing, parallel processing mechanisms. Multicomputer and multiprocessor system, Flynn's classification. Parallel Computer Structures: Pipeline computers, Shared Memory Architecture: UMA, NUMA, loosely coupled multiprocessors, tightly coupled multiprocessors, PRAM model.

UNIT – II: PIPELINING AND SUPERSCALAR TECHNIQUE (10 hours)

Pipelining: Basic Concepts of pipelining, data hazards, control hazards and structural hazards.Techniques for overcoming or reducing the effects of various hazards, Speedup, efficiency, throughput.Scheduling-Static scheduling-loop unrolling, Dynamic Scheduling- Scoreboard and Tomasulo's Approach

UNIT – III: INSTRUCTION-LEVEL PARALLELISM (10 hours)

Concepts of instruction-level parallelism (ILP), techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures, array processor, vector processor, symbolic processors, Associative Processor, Systolic architecture. Amdahl's Law, Scalability-Isoefficiency function, Rule of Thumb.

UNIT – IV: INTERCONNECTION NETWORKS AND CACHE ORGINISATION (10 hours)

Definition of Network Topologies, Classification - Static Networks, , Dynamic Networks. Bus, Mesh, Shuffle-Exchange, Omega, Cube, Hypercube.Factors affecting performance of interconnection network. Cache memory organization- Principle of locality, cache mapping, types of cache miss. Techniques to

reduce cache misses. multilevel cache, cache coherence and synchronization mechanism. Cache write policy.

TEXT BOOKS:

1. Kai Hwang and Faye A. Briggs, Computer Architecture and Parallel Processing, 1990.
2. John L. Hennessey and David A. Patterson, Computer Architecture: A Quantitative Approach, 3/e, Morgan Kaufmann, 2003.

REFERENCE BOOKS:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design, Elsevier.
2. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.
3. Computer Architecture: Parhami, Oxford University Press

Human Computer Interaction

Course Code **CSE E07** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional elective course

Prerequisite: Basics of Computer, Programming, WEB

Objective:

- Software process and Design rules.Implementation and user support.Different models for cognition and collaboration.Introduction to Ubiquitous computing

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Human Computer Interaction
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (08 hours)

The Human – Input-output channels – Human Memory – Thinking – emotions – Psychology & design of interactive systems; Computer – Text entry devices- Positioning, Pointing & drawing – Display devices for Virtual reality, 3D; Interaction – models – Frameworks & HCI, Ergonomics – Interaction styles – WIMP Interfaces – context; paradigms for Interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories

UNIT – II: SOFTWARE PROCESS & DESIGN RULES,IMPLEMENTATION & USER SUPPORT (12 hours)

Interaction design basics – user focus – scenarios – navigation – screen design & layout; HCI in software process – life cycle – Usability engineering – Interactive design & prototyping ; Design rules – Principles for usability – standards – guidelines – golden rules – HCI patterns
Implementation support – Windowing system elements – using tool kits – user interface management ; Evaluation techniques – goals – expert analysis – choosing a method; universal design principles – multimodal interaction; user support – requirements – Approaches – adaptive help systems – designing user support systems.

UNIT – III: COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS (10 hours)

Cognitive models – Goal & task hierarchies – Linguistic models – Physical & device models – architectures ; communication & collaboration models – Face-to-face communication – conversation – text based – group working; Task analysis – difference between other techniques – task decomposition – Knowledge based analysis – ER based techniques –uses

UNIT – IV: UBIQUITOUS COMPUTING, HYPERTEXT, WWW (10 hours)

Ubiquitous computing application research – virtual & augmented reality – information & data visualization ; understanding hypertext – finding things – Web Technology & issues – Static Web content – Dynamic Web content; Groupware systems – Computer mediated communication – DSS – Frameworks for groupware.

TEXT BOOKS:

1. Human Computer Interaction by Alan Dix, Janet Finlay , ISBN :9788131717035, Pearson Education (2004)
2. Designing the User Interface - Strategies for Effective Human Computer Interaction", by Ben ShneidermanISBN : 9788131732557, Pearson Education (2010).

REFERENCE BOOKS:

1. Usability Engineering: Scenario-Based Development of Human-Computer Interaction , by Rosson, M. and Carroll, J. (2002)
2. The Essentials of Interaction Design, by Cooper, et al. , Wiley Publishing(2007)
3. Usability Engineering, by Nielsen, J. Morgan Kaufmann, San Francisco, 1993. ISBN 0-12-518406-9
4. The Resonant Interface: HCI Foundations for Interaction Design , by Heim, S. , Addison-Wesley. (2007)
5. Usability engineering: scenario-based development of human-computer interaction, By Rosson, M.B & Carroll, J.M. , Morgan Kaufman.(2002)
6. Human Computer Interaction in the New Millenium, John M.Carrol, Pearson Education, 2002

WEB REFERENCES:

1. www.scis.nova.edu/nova/hci/notes.html
2. http://courses.iicm.tugraz.at/hci/hci.pdf
3. www.ida.liu.se/~miker/hci/course.html

PARALLEL COMPUTING

Course Code **CSE E08** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional elective course

Prerequisite: Computer Organization and System Architecture, Data Structures, Operating Systems

Objective:

- The objective is to familiarize students with the fundamental concepts, techniques and tools of parallel computing.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PARALLEL COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: FOUNDATION OF PARALLEL COMPUTING (10 hours)

Theory of Parallelism: Concept of Parallel Processing, Evolution(Four Decades of Computing), Challenges, Applications of Parallel Processing, Flynn's Classification, The State of Computing, SIMD Architecture, MIMD Architecture: Shared Memory and Message Passing Organization, Multiprocessors and Multicomputer.

UNIT – II: PARALLEL COMPUTING ARCHITECTURE (10 hours)

Interconnection Networks: Classification criteria, Introduction to different Multiprocessors Interconnection Networks, Conditions of Parallelism, Performance Issues of Interconnection Networks, Routing in Interconnection Networks, Amdahl's law, Gustafson-Barsis's Law.

UNIT – III: SHARED-MEMORY ARCHITECTURE (10 hours)

Shared memory Architecture- Classification of Shared Memory Systems, Bus-Based Symmetric Multiprocessors, Basic Cache Coherency methods, Snooping Protocols for Cache Memory, Message Passing Architecture

UNIT – IV: PROGRAMMING TECHNIQUES (10 hours)

Abstract Models, Introduction to Message Passing Interface (MPI) and OpenMPI, Parallel Programming in the Parallel Virtual Machines, Granularity of Tasks

TEXT BOOKS:

1. Hesham El-Rewini and MostafaAbd-El-Barr, "Advanced Computer Architecture and Parallel Processing", Wiley
2. Kai Hwang and NareshJotwani, "Advanced Computer Architecture", 2nd Edition, McGrawHill.

REFERENCE BOOKS:

1. Kai Hwang and Faye A. Briggs, "Computer Architecture And Parallel Processing

WIRELESS COMMUNICATION

Course Code **CSE E09** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional elective course

Prerequisite: Concepts of Computer Network

Objective:

- Introduce Wireless Communication.This course focuses to learn WLL, LMDS, WLAN, PAN.This course focuses to learn FDMA, TDMA, CDMA, capacity of cellular system

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of WIRELESS COMMUNICATION
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Evolution of mobile radio communication, mobile radio telephony in entire world, examples of wireless communication system, 2G cellular networks, 3G wireless networks, WLL, LMDS, WLAN, PAN

UNIT – II: **(10 hours)**

Frequency reuse, channel assignment strategies, hand off strategy, interference & system capacity, trunking& grade of service, improving coverage & capacity in cellular system, introduction to radio wave propagation, three basic propagation mechanisms, reflection, ground reflection model (two ray), Okumura model, Hata model.

UNIT – III: **(10 hours)**

Small scale multipath propagation, Types of small scale fading, Rayleigh & Rician Distribution, AM, FM, PM, linear modulation techniques, constant envelope modulation, hybrid modulation, spread spectrum modulation.

UNIT – IV: **(10 hours)**

Equalization, training an adaptive equalizer, diversity technique, Rake receiver, multiple access, FDMA, TDMA, CDMA, capacity of cellular system.

TEXT BOOKS:

1. Wireless Communication, T. S. Rappaport, PHI

DISTRIBUTED DATABASE SYSTEMS

Course Code **CSE E10** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional elective course

Prerequisite: A course on "Database Management Systems"

Objective:

- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented databases.To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and its applications.Equip students with principles and knowledge of parallel and object oriented databases.
- Topics include distributed DBMS architecture and design; query processing and optimization; distributed transaction management and reliability; parallel and object database management systems.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DISTRIBUTED DATABASE SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(08 hours)**

Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design

UNIT – II: **(12 hours)**

Translation of Global Queries to Fragment Queries, Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General QueriesThe Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – III: **(08 hours)**

Reliability, Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency,Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management inDistributed Databases, Authorization and Protection

UNIT – IV: **(12 hours)**

Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed ObjectStorage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues,Query Execution, Transaction Management, Transaction Management in Object DBMSs,Transactions as ObjectsDatabase Integration, Scheme Translation, Scheme Integration, Query Processing Query ProcessingLayers in Distributed Multi-DBMSs, Query Optimization Issues Transaction Management Transactionand Computation Model, Multidatabase Concurrency Control, Multidatabase Recovery, ObjectOrientation and Interoperability, Object Management Architecture CORBA and Databaseinteroperability, Distributed Component Object Model, COM/OLE and Database Interoperability,PUSH-Based Technologies

TEXT BOOKS:

1. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, TMH.
2. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez ,Pearson Education, 2nd Edition.

REFERENCE BOOKS:

1. Distributed Database Systems, Chanda Ray, Pearson.
2. Distributed Database Management Systems, S. K. Rahimi and Frank. S. Haug, Wiley

Professional Elective-III

ARTIFICIAL INTELLIGENCE

Course Code **CSE E11** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional Elective Course

Prerequisite: Fundamental of computer science and mathematics

Objective:

- To learn the difference between optimal reasoning Vs. human like reasoning.
- To understand the notions of state space representation and heuristic search.
- To learn different knowledge representation techniques.
- To understand the applications of AI: namely Game playing, Theorem Proving. Expert systems , machine learning and Natural language Processing.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ARTIFICIAL INTELLIGENCE
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION TO AI AND PRODUCTION SYSTEM (12 hours)

Introduction to Artificial Intelligence, AI Problems, AI Techniques,Problems ,Problem Space and Search, Defining the problem as a state space search, Production system, Problem characteristics, Heuristic search Technologies**:** Generate and Test, Hill Climbing, Best First Search, Problem Reduction, means-end-analysis, optimal and A*,AND-OR Graphs, AO* Algorithms.

UNIT – II: KNOWLEDGE REPRESENTATION (12 hours)

Representation Knowledge using Predicate Logic, Representing simple facts in logic, Representing Instance and ISA relationships, Computable functions and Predicates, Resolution, Representing Knowledge using Rules, Forward Vs Backward Reasoning, Matching , Control Knowledge, , Weak slot and Filter structures, Semantic nets, Frames.

UNIT – III: REASONING TECHNIQUES (12 hours)

Strong slot and Filter structures, Conceptual Dependencies, Scripts. Introduction to Non monotonic reasoning ,Logics for Non monotonic reasoning, Implementation : Depth First Search, Dependency-Directed Back Tracking, Justification based Truth Maintenance Logic based Truth Maintenance systems,Statistical Reasoning, Probability and Bayes Theorem,Certainty factors, Rule based Systems, Beyesian Networks, Dempster-Shaffer Theory

UNIT – IV: GAME PLAYING AND LEARNING (12 Hours)

Minmax search, alpha-beta cutoffs, Planning system, Goal stack planning, Hierarchical Planning, Natural Language Processing., Syntactic Analysis, Semantic Analysis, Discuses and Pragmatic Processing. Introduction and Fundamentals of Artificial Neural Networks, Biological Prototype, Artificial Neuron,

Single Layer Artificial Neural Networks, Multilayer Artificial Neural Networks, Training of Artificial Neural Networks

TEXT BOOKS:

1. Elaine Rich, Kevin Knight and ShivashankarB . Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008.
2. Neural Computing: Theory and practice- Waserman.

REFERENCES:

1. Artificial Intelligence Structures and Strategies complex problem solving-George F. Lugar Pearson Education
2. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education, 2010.
3. Dan W. Patterson, Artificial Intelligence and Expert Systems, PHI.
4. Neural Networks: A Comprehensive Foundation 2/e- Symen Pearson Education.

GRID COMPUTING

Course Code	**CSE E12**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VI**

Category: Professional Elective Course

Prerequisite: Operating Systems, Data Structures, and Distributed Computing, Design and Analysis of Algorithms

Objective:

- The objective is to learn emerging techniques in Cluster and Grid computing and its applications, fault tolerance and security in Grids.
- Learn different Resource Allocation Schemes, Task scheduling algorithms, High-Throughput Computing, and knowledge about GridSim, Gridlet, and Grid Secuirty.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of GRID COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: BASICS OF DISTRIBUTED SYSTEMS (10 hours)

Introduction-Different form of computing,Strengths and Weakness of distributed computing, operating system concepts, Relevant to distributed computing, The architecture of distributed Applications, paradigm for distributed applications, choosing a paradigm for an application(Trade-Off).

UNIT – II: PARALLEL AND CLUSTER COMPUTING (10 hours)

Parallel computing overview, Parallel Programming Models andParadigms.Introduction to Cluster Computing, Scalable Parallel Computer Architectures, Cluster Computer and its Architecture, Classifications, Components for Clusters, Cluster Middleware and Single System Image.

UNIT – III: INTRODUCTION TO GRID COMPUTING (10 hours)

Introduction to Grid Computing, Grid computing anatomy- Architecture, Applications of Grid Computing, Types of grids: Computational, Data, Desktop, Enterprise and Utility Grids, relationship to other distributed technologies, grid computing roadmap.

UNIT – IV: GRID SERVICE ARCHITECTURE (10 hours)

Merging Grid service architecture with the web service architecture. Open grid service architecture: Introduction Atchitecture and goal, Simple use cases: Commercial data centers, National Fusion collaboratory, online media and entertainment, OGSA Platform components, infrastructure.

TEXT BOOKS:

1. Distrbuted Computing, principles and applications, M.L.Liu,Pearson Education, 2004.
2. (Edited By) I. Foster and C. Kesselman, The Grid: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, Elsevier, 2004.
3. Raj KumarBuyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education, 2008.
4. Grid Computing, Joshy,Joseph and Craig fellenstein, Pearson Education 2004.

REFERENCE BOOKS:

1. Chakrabarti, Grid Computing Security, Springer, 2007.
2. Wilkinson, Grid Computing: Techniques and Applications, CRC Press, 2009.
3. S. R. Prabhu, Grid and Cluster Computing, PHI, 2008.

4. Janakiram, Grid Computing, Tata McGraw-Hill, 2005

SEMANTIC WEB

Course Code	CSE E13	L-P-T-Cr.:	4	0	0	3	Semester:	VI

Category: Professional Elective Course

Prerequisite: Basic Computer science

Objective:

- To identify Web Intelligence.
- To know Knowledge Representation for the Semantic Web.
- Understanding Semantic Web Applications, Services and Technology

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SEMANTIC WEB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Web Intelligence: Thinking and intelligent web applications, theinformation age ,the world wide web, limitations of today's web, the next generation web, machine intelligence, artificial intelligence, ontology,inference engines, software agents, berners-lee www, semantic road map,logic on the semantic web. Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, ontologies languages for the semantic web -Resource Description Framework(RDF) / RDF schema, Ontology Web Language(OWL),UML,XML/XML schema.

UNIT – II: **(08 hours)**

Ontology Engineering: Ontology engineering, constructing ontology, ontology development tools, ontology methods, ontology sharing and merging, ontology libraries and ontology mapping, logic, rule and inference engines.

UNIT – III: **(10 hours)**

Semantic Web Applications, Services and Technology: Semantic web applications and services, semantic search, e-learning, semantic bioinformatics, knowledge base, XML based web services,creating an OWL-S ontology for web services, semantic search technology, web search agents and semantic methods.

UNIT – IV: **(10 hours)**

Social Network Analysis and semantic web: What is social networksanalysis? Development of the social networks analysis, electronic sources for network analysis, electronic discussion networks, blogs and online communities, web based networks, building semantic web applications with social network features.

TEXT BOOKS:

1. Berners Lee, Godel and Turing, Thinking on the Web, Wiley inter science, 2008.
2. Peter Mika, Social Networks and the Semantic Web, Springer, 2007.

REFERENCE BOOKS:

1. Davies, R.Studer, P.Warren, Semantic Web Technologies, Trends and Research in Ontology Based Systems, J John Wiley and Sons, 2007.
2. Liyang Lu Chapman and Hall, Semantic Web and Semantic Web Services,CRC Publishers , 2007.

3. Heiner Stuckenschmidt, Frank Van Harmelen, Information Sharing on thesemantic Web, Springer Publications, 2004.
4. T.Segaran, C.Evans, J.Taylor, Programming the Semantic Web, O'Reilly, 2009.

ADVANCED SOFTWARE ENGINEERING

Course Code **CSE E14** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional Elective Course

Prerequisite: Software Engineering,

Objective:

- To learn unified software development process.
- To learn Architecture Description Languages and UML

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED SOFTWARE ENGINEERING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Embedded software and systems engineering: overview, examples and industrial realities Project Management - Project Planning and Scheduling Standards, e.g. PSS-05; Case studies

UNIT – II: **(10 hours)**

Unified Software Development Process Software Process Improvement Software Economics Software QualitySoftware Metrics - Measurement, Estimation and Prediction Requirements Management Configuration Management Risk Management Testing and Inspection

UNIT – III: **(10 hours)**

Architecture Description Languages Pattern-Oriented Software Architecture Component-based Development Distributed Software Architectures using Middleware Enterprise Application Integration Architectures for Mobile and Pervasive Systems Model Driven Architecture

UNIT – IV: **(10 hours)**

UML Extension Mechanisms Object Constraint Language Model Checking

TEXT BOOKS:

1. Jacobson, J. Rumbaugh, G. Booch: The Unified Software Development Process. Addison Wesley. 1999
2. F. Buschmann, R. Meunier, H. Rohnert, P. Sommerlad, M. Stal: Pattern-Oriented Software Architecture. John Wiley. 1996
3. G. Booch, I. Jacobson, J. Rumbaugh: The Unified Modeling Language User Guide. Addison Wesley. 1999

REFERENCE BOOKS:

1. H.B. Warmer, A. G. Kleppe: The Object Constraint Language: Precise Modeling With UML Addison Wesley. 1997
2. E. M. Clarke, O. Grumberg, D. Peled: Model Checking. MIT Press. 2000
3. A. Finkelstein (ed): The Future of Software Engineering. ACM Press. 2000
4. W. Emmerich: Distributed Component Technologies and their Software Engineering Implications. Proc. of the 24th Int. Conference on Software Engineering, Orlando,nFlorida. pp. 537-546.ACMPress.2002.Alsoavailablefrom http://www.cs.ucl.ac.uk/staff/w.emmerich/publications/ICSE2002/SOA/
5. R. Hubert, D.A. Taylor: Convergent Architecture: Building Model Driven J2EE Systems with UML. Wiley 2002.
6. W. A. Ruh, F. X. Maginnis, W. J. Brown: Enterprise Application Integration. Wiley 2000
7. C. Mascolo, L. Capra and W. Emmerich: Middleware for Mobile Computing. In E. Gregori, G. Anastasi, S. Basagni (eds): Networking 2002 Tutorial Papers. Lecture Notes in Computer Science 2497. Springer Verlag 2002.
8. http://www.cs.ucl.ac.uk/staff/w.emmerich/publications/Networking2002 W. Emmerich, E. Ellmer and H. Fieglein: TIGRA: An Architectural Style for Enterprise Application Integration. Proc. of 23rd Int. Conference on

STORAGE AREA NETWORKS

Course Code **CSE E15** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Programme Elective Course

Prerequisite: Knowledge of Computer Networks and DBMS

Objective:

- To learn H/W and S/W architecture, various features of Storage area Network (SAN) as well as its applications

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of STORAGE AREA NETWORKS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION AND INTELLIGENT DISK SUBSYSTEMS (10 hours)

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks .The Data Storage and Data Access problem; The Battle for size and Access

Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems

UNIT – II: I/O TECHNIQUES, NETWORK ATTACHED STORAGE AND FILE SYSTEM AND NAS (10 hours)

I/O Techniques : The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage

Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

File System and NAS: File System and NAS:Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

UNIT – III: STORAGE VIRTUALIZATION AND SAN ARCHITECTURE & HARDWARE DEVICES (10 hours)

Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric Storage virtualization in the Network SAN Architecture and Hardware devices : Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective

UNIT – IV: SOFTWARE COMPONENTS OF SAN AND MANAGEMENT (10 hours)

Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations

TEXT BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks, Wiley India, 2007
Robert Spalding: Storage Networks The Complete Reference, Tata McGraw-Hill, 2003.

REFERENCE BOOKS:

1. Richard Barker and Paul Massiglia: Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs, John Wiley India, 2002

Open Elective -I

EMBEDDED SYSTEMS

Course Code **OPE E01** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Open Elective Course

Prerequisite: Digital Electronics, Microprocessor and Microcontroller and Basic Computer Network

Objective:

- **A**bility to understand the design concept of embedded systems, real time interfacing of sensors, actuators to microcontrollers.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of EMBEDDED SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Overview of Embedded Systems: Embedded System, Categories and Requirements of Embedded Systems, Challenges and Issues in Embedded System Development, Applications of Embedded Systems in various domains.

UNIT – II: **(10 hours)**

Embedded Design cycle:Embedded Hardware & Software Design & Development Process & Environment: Hardware Architecture, Interfacing Processor, Memories, I/O and Communication Interface Standards, Embedded Operating systems, Types of Embedded Operating systems.

UNIT – III: **(10 hours)**

Microcontroller: 8/16/32 Bit (8051/ AVR/PIC/ARM/MSP 430) Microcontrollers and an overview of their Architecture, Instruction set, Interface & Applications. Programming Concepts and Embedded Programming in C for Device Drivers for interfacing LCD, ADC, sensors, stepper motor, key board, DAC, memory.Embedded System-on Programmable Chip (SOPC): FPGA based soft & hard processor, Embedded Software development on FPGA

UNIT – IV: **(10 hours)**

Embedded real time operating systems: Typical real time applications, Hard Vs Soft real-time systems, A reference model of Real Time Systems: Inter-process Communication and Synchronization of Processes, Tasks and Threads- Multiple Process in an Application, Problem of Sharing data by multiple tasks & routines, Scheduling, Commonly used Approaches to Real Time Scheduling Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective release time and Deadlines, Offline Vs Online Scheduling.Embedded systems case studies.

TEXT BOOKS:

1. Embedded Systems Architecture, Programming and Design, Second Edition, Raj Kamal, Tata Mc-Graw Hill
2. The 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi, Mazidi, McKinlay, Second Edition, Pearson Education.
3. PIC Microcontroller and Embedded Systems using assembly and C for PIC18, Mazidi, MCKINLAY, CAUSEY, Pearson Education.
4. ARM Systems Developers Guides- Design & Optimizing System Software - Andrew N.

Sloss, Dominic Symes, Chris Wright, 2004, Elsevier.
5. Jean J. Labrosse, “Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C”, The publisher, Paul Temme, 2003.

REFERENCE BOOKS:

1. Introduction to Embedded Systems, Shibu K V, Tata Mc-Graw Hill.
2. PIC Microcontroller by H.W Huang, Delmar CENGAGE Learning, 2007.
3. J B Peatman, Design with PIC Microcontrollers, Prentice Hall.
4. Dr.K.V.K.K.Prasad, 'Embedded/Real-Time Operating System',Dreamtech Press(for Units I,II & III).
5. Daniel W. Lewis, “Fundamentals of Embedded Software where C and Assembly meet”, PHI, 2002. 6. SteaveFurber, “ARM system – on – chip architecture” Addison Wesley, 2000.

OPTIMIZATION TECHNIQUES

Course Code **OPE E02** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Open Elective Course

Prerequisite: Basic Knowledge of Linear Algebra and Matrix Theory.

Objective:

- To introduce the fundamental concepts of Optimization Techniques.
- To make the learners aware of the importance of optimizations in real scenarios and modern application in computer science like AI, Machine learning, sensor network and routing protocol.Optimization methods using calculus have several limitations and thus not suitable for many practical applications.
- Most widely used optimization method is linear programming which is the main objective of this module.
- To provide the concepts of various classical and modern methods of for constrained and unconstrained problems in both single and multivariable.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of OPTIMIZATION TECHNIQUES
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: OPTIMIZATION & SIMPLEX METHOD (10 hours)

Introduction to Optimization, Classification of Optimization Problem, Classical Optimization Technique, Single –Variable Optimization, Multivariable optimization, Direct Solution, Constrained variation, Lagrange multiplier, linear programming, Standard form of linear programming, Simplex Algorithm, Two Phage of simplex Method, Big M-Method.

UNIT – II: DUALITY, ASSIGNMENT & TRANSPIRATION (10 hours)

Formation of dual problems, Important Result in Duality, Dual simplex Method, Mathematical formulation of Assignment problem, Hungarian Method, The travelling Salesman Problem, Transportation Problem, North West Corner Rule, Optimality Test, Difference of Assignment and Transportation problem.

UNIT – III: Integer Programming & Geometric Programming (10 hours)

Introduction, Importance of Integer Programming Problems, Application, Methods of Integer Programming Problem, Cutting, Search, Cutting Plane, Mixed Integer Programming, Unconstrained Geometric programming, Constrained Minimization, Mixed inequality.

UNIT – IV: Network Scheduling & Game Theory (10 hours)

Introduction, Rules of Network Construction, Time Analysis, Critical Path Method (CPM), Programme Evaluation and Review Techniques(PERT), Cost Consideration in PERT/CPM, Payoff, Types of Game, The Maxmin – Minimax Principle

TEXT BOOKS:

1. Engineering Optimization, Singiresu S. Rao, New Age International Publisher.
2. Operation Research, KantiSwarup, S Chand & Sons Publisher

REFERENCE BOOKS:

1. Operations Research,Dr. S.D.Sharma
2. Operations Research: An Introduction,H.A. Taha, PHI Pvt. Ltd.

Management Information Systems

Course Code **OPE E03** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Open Elective Course

Prerequisite: Basic Software Engineering.

Objective:

- The objective of the course is to develop the basic understanding of the decision support system of the artificialintelligence for business organization.Implication of emerging trends in technology.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Management Information Systems
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Management Information system: Introduction, objective, definition, benefits, characteristics of MIS, , information system level, types of information system, resistance to MIS, implementing MIS,features of MIS, components of MIS.

UNIT – II: **(10 hours)**

Managerial decision making: Decision making process, problem solving techniques, how decisions are being supported – decisions styles group, Simon Model of decision making, features of various CBIS. Decision support system overview - relevance, scope, characteristic and capabilities, components and classification of DSS Decision support System: Introduction, architecture, components, limitation, development.

UNIT – III: **(08 hours)**

Database management system: Objective, characteristics, components and use of DBMS, types of database, Role of DBA. Model base management system: types of models, certainty, uncertainty, risk

UNIT – IV: **(12 Hours)**

Information Security challenges in E-enterprise : Introduction, Security Threats and Vulnerability, Controlling Security Threat and Vulnerability, Management Security Threat in E-business, Disaster Management, MIS and Security Challenges,Software security: threats, method of safety, cryptography, digital signature.Introduction to Emerging trends technology, Expert System, knowledge management, A.I., data mining,data warehousing,

TEXT BOOKS

1. Keen, peter G.W.: Decision Support System an Organisational Perspective Addison-Wesley Pub.
2. Theierauff, Robert J. Decision Support System for effective planning – Prentice Hall – 1982.

REFERENCE BOOKS

1. Kroger, Donald W., and Hugh J. Watson Computer Based Information System New York, 1984.

2. Davis, Michael W. A management Approach – Macmillan Publishing company, Prentice Hall, New Jersey,1988.
3. Andrew P. Decision support System Engineering, Sage, John Wiley & Sons, New York

DIGITAL SIGNAL PROCESSING

Course Code **OPE E04** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Open Elective Course

Prerequisite: Linear algebra, complex numbers, trigonometry, calculus, signal and systems

Objective:

- This course aims to introduce the concepts of digital signal processing and thebasic analytical methods, and to show how they are applied to design filters for given applications.
- Study of key DSP operations such as convolution, filtering, and discrete Fourier transforms, Digital filter design and spectral analysis.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DIGITAL SIGNAL PROCESSING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: DISCRETE-TIME SIGNALS AND SYSTEMS (10 hours)

Discrete-Time Signals: Some Elementary Discrete-Time signals, Classification of Discrete Time Signals, Simple Manipulation;
Discrete-Time Systems: Input-Output Description, Block Diagram Representation, Classification,Interconnection; Analysis of Discrete-Time LTI Systems: Techniques, Response of LTI Systems, Discrete-Time Systems Described by Difference Equations; Implementation of Discrete-Time Systems;
Correlation of Discrete-Time Signals: Crosscorrelation and Autocorrelation Sequences.
The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain.

UNIT – II: DISCRETE FOURIER TRANSFORMS (10 hours)

Frequency Domain Sampling: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a LinearTransformation,Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering,Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT.

UNIT – III: IMPLEMENTATION OF DISCRETE-TIME SYSTEMS (10 hours)

Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure,Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures.Causality and Its Implications, Characteristics of Practical Frequency-Selective Filters; Design of FIR Filters:Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design ofLinear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance

UNIT – IV: FAST FOURIER TRANSFORMS (10 hours)

Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms:Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computationof the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications,J. G. Proakis and D. G. Manolakis,Pearson.

REFERENCE BOOKS:

1. Digital Signal Processing, by Oppenheim, Prentice Hall, 1988
2. Digital Signal Processing;S. K. Mitra: TMH,1998
3. Introduction to Digital Signal Processing; S.J.Orfanidis,Prentice-Hall,1996.
4. Digital Signal Processing, byP.Ramesh Babu, Scitech Pub., India.

MIDDLEWARE TECHNOLOGIES

Course Code **OPE E05** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Open Elective Course

Prerequisite: Knowledge of Computer software.

Objective:

- To learn EJB application.To learn CORBA and COM

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MIDDLEWARE TECHNOLOGIES
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Client / Server concepts: client-server, file server, database server, group server, object server, web server, middleware, general middleware, service specific middleware, client / server building blocks, RPC, messaging, peerto- peer.

UNIT – II: **(10 hours)**

EJB Architecture: EJB, EJB architecture, overview of EJB software architecture, view of EJB, conversation, building and deploying EJBs, rolesin EJB.

UNIT – III: **(08 hours)**

EJB Applications: EJB APPLICATIONS: EJB session beans, EJB entity beans, EJB clients, EJB deployment, building an application with EJB

UNIT – IV: **(12 hours)**

CORBA: CORBA, distributed systems, purpose, exploring CORBA alternatives, architecture overview, CORBA and networking model, CORBA object model, IDL, ORB, building an application with CORBA

COM:COM, data types, interfaces, proxy and stub, marshalling, implementing server/client, interface pointers, object creation, invocation, destruction, comparison COM and CORBA .Introduction to .NET, overview of .NET architecture, marshalling, remoting.

TEXT BOOKS:

1. Robert Orfali, Dan Harkey and Jeri Edwards, The Essential Client /Server Survival Guide, Galgotia Publications, 2002.
2. Tom Valesky, Enterprise Java Beans, Pearson Education, 2002.

REFERENCE BOOKS:

1. Mowbray, Inside CORBA, Pearson Education, 2002.

2. Jeremy Rosenberger, Teach Yourself CORBA in 14 days, TEC Media, 2000.
3. Jason Pritchard, COM and CORBA Side by Side, Addison Wesley, 2000.
4. Jesse Liberty, Programming C#, 2/e, O'Reilly Press, 2002

COMPUTER NETWORK LAB

Course Code **CSL 364** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **VI**

Category: Laboratory Course

Prerequisite: Basic Computer Science

Objective:

- To produce a core knowledge of networking concepts and techniques to design simple networks
- .Provide in depth knowledge about the various communication technologies

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPUTER NETWORK LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF TOPICS FOR EXPERIMENTS

1. Few interactive experiments related to router, cabling, H/W and software configuration for computer communication.
2. Some Network protocols simulation using NetSim, NS2, or any other protocol simulators for:
   a) Analyzing number of transmitting nodes vs. collision count, mean delay for Ethernet LAN .
   b) Analyzing bus vs. star-switch with respect to number of collisions (for a fixed number of transmitting nodes) for Ethernet LAN
   c) Analyzing performance of token ring with number of nodes vs. response time, mean delay.
   d) Comparing the throughput and normalized throughput for token ring and token bus for different transmitting nodes.
   e) Comparing the CSMA/CD vs. CSMA/CA protocols (for a fixed number of transmitting nodes).
   f) Analyzing thedifference between unicast and broadcast transmission (for a fixed number of transmitting nodes).
   g) Verification of stop-and-wait protocol, Go-back-N protocol, Selective repeat protocol, distance vector routing algorithm, state routing algorithm.
3. Socket programming.

WEB REFERENCES:

1. https://www.isi.edu/nsnam/ns/
2. https://www.javatpoint.com/socket-programming

SOFTWARE ENGINEERING LAB.

Course Code **CSL 365** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **VI**

Category: Program Core Course

Prerequisite: Knowledge on programming and data structure

Objective:

- The Software Engineering Lab has been developed by keeping in mind the following objectives:
- To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web.
- Present case studies to demonstrate practical applications of different concepts.
- Provide a scope to students where they can solve small, real life problems

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SOFTWARE ENGINEERING LAB.
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

List Of Experiments:

1. Develop requirements specification for a given problem (The requirements specification should include both functional and non-functional requirements. For a set of about 20 sample problems
2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required).
3. Develop Structured design for the DFD model developed.
4. Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)
5. Develop Sequence Diagrams
6. Develop Class diagrams.
7. Develop code for the developed class model using Java
8. Use testing tool such as Junit.
9. Use configuration management tool
10. Use any one project management tool such as Microsoft Project or Gantt Project, etc.

	Semester – VII							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	CSC 471	Data Warehousing and Data Mining	PC(CE)	3	0	0	**3**	
2	CSC 472	Compiler Design	PC(CE)	3	0	0	**3**	
3	XXX XXX	Professional Elective-IV	PE (CE)	3	0	0	**3**	
4	XXX XXX	ProfessionalElective-V	PE (CE)	3	0	0	**3**	
5	XXX XXX	OpenElective-II	OE (OE)	3	0	0	**3**	
6	CSP 473	Minor Project	PP (PW)	4	0	0	**4**	
7	CSS 474	Seminar	TS(PW)				**1**	
8	MOC 475	Software Testing (MOOCs-4)	MOOC	0	0	0	**4**	
						Total Credit:	**24**	

Professional Elective-IV					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E16	Wireless Sensor Networks	4	0	0	3
CSE E17	Distributed Systems	4	0	0	3
CSE E18	Software Design and Validations	4	0	0	3
CSE E19	High Performance Computing	4	0	0	3
CSE E20	Natural Language Processing	4	0	0	3
Professional Elective-V					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E21	Cryptography and Network Security	4	0	0	3
CSE E22	Ethical Hacking	4	0	0	3
CSE E23	Introduction to Bioinformatics	4	0	0	3
CSE E24	Game Programming	4	0	0	3

Open Elective-II					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E06	Internet of Things	3	0	0	3
OPE E07	Simulation and Modeling	3	0	0	3
OPE E08	Digital Image Processing	3	0	0	3
OPE E09	Soft Computing	3	0	0	3
OPE E10	Mobile Computing	3	0	0	3

DATA WAREHOUSING AND DATA MINING

Course Code **CSC 471** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VII**

Category: Programme Core Course

Prerequisite: Data Structure and Algorithm, Linear Algebra, Basics of Web programming

Objective:

- This course deals with evolving multidimensional intelligent model from a typical system, representation of multi dimensional data for a data warehouse, discovering the knowledge imbibed in the high dimensional system, fiding the hidden interesting patterns in data, and gives the idea to evaluate various mining techniques on complex data objects.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DATA WAREHOUSING AND DATA MINING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION TO DATA WAREHOUSING AND ARCHITECTURE **(08 hours)**

Evolution of Decision Support Systems- Data warehousing Components –Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflkes and Fact constellations

UNIT – II: DATA WAREHOUSE PROCESSAND ARCHITECTURE **(08 hours)**

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications

UNIT – III: INTRODUCTION TO DATA MINING AND CLASSIFICATIONS **(14 hours)**

Data mining-KDD versus datamining, Stages of the Data Mining Process-task premitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation.

Decision Tree Induction - Bayesian Classifiation – Rule Based Classifiation –Classifiation by Back propagation – Support Vector Machines – Associative Classifiation – Lazy Learners – Other Classifiation Methods

UNIT – IV: CLUSTERING,ADVANCES IN DATA MINING **(10 hours)**

Clustering techniques – , Partitioning methods- k-means Hierarchical Methods - distance-based agglomerative and divisible clustering,Mining complex data objects, Spatial databases, temporal databases, Multimedia databases, Time series and Sequence data; Text Mining –Graph mining-web mining-Application and trends in data mining.

TEXT BOOKS:

1. Jiawei Han and MichelineKamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition2011, ISBN: 1558604898.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMc Graw Hill Edition, Tenth Reprint 2007.
3. G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Easter EconomyEdition, Prentice Hall of India, 2006

REFERENCE BOOKS:

1. Mehmedkantardzic,"Dataminingconcepts,models,methods, and lgorithms", Wiley Interscience, 2003.
2. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.George M Marakas, Modern Data Warehousing, Mining and Visualization, Prentice Hall,2003.

WEB REFERENCES:

http://www.data-miners.com/

COMPILER DESIGN

Course Code **CSC 472** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VII**

Category: Programme Core Course

Prerequisite: Theory of Computation / Automata theory

Objective:

- To learn various stages of compilation, design phases of a compiler construction process.
- This course will also introduce open source tool Lex and Yaac.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPILER DESIGN
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION **(8 hours)**

Overview of Compilation: Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

UNIT – II: PARSING **(12 hours)**

Syntax Analysis: Role of a parser, context free grammars and context free languages, parse trees and derivations, ambiguous grammar.
Top Down Parsing: Recursive descent parsing, LL (1) grammars, non-recursive predictive parsing, error reporting and recovery.
Bottom Up Parsing: Handle pruning and shift reduces parsing, SLR parsers and construction of SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, parsing using ambiguous grammars, error reporting and recovery, parser generator

UNIT – III: SDT,SYMBOL TABLE AND INTERMEDIATE CODE GENERATION **(10 hours)**

Syntax Directed Translation: Syntax directed definitions (SDD), inherited and synthesized attributes, dependency graphs, evaluation orders for SDD, semantic rules, application of syntax directed translation.
Symbol Table: Structure and features of symbol tables, symbol attributes and scopes.
Intermediate Code Generation: Introduction, benefits and types of intermediate code generation, three address codes - quadruples and triples, DAG for expressions, types and declarations, translation of expressions, translation of Boolean expressions and control flow statements, back patching, intermediate code generation for procedures.

UNIT – IV: REAL-TIME DATABASES AND COMMUNICATION, APPLICATIONS **(10 hours)**

Run Time Environment: storage organizations, static and dynamic storage allocations, stack allocation, Activation of the procedure and the activation record.
Code Generations: Introduction, Major Issues of Code generation, registers allocation, simple code generation using basic blocks.

Elements of Code Optimization: Objective, peephole optimization, redundant and un-reachable codes, concepts of elimination of local common sub-expressions, basics of flow of control optimization.

TEXT BOOKS:

1. Principles of Compiler Design, A.V. Aho .J.D.Ullman; Pearson Education.
2. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.

REFERENCE BOOKS:

1. Lex&Yacc, John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Modern Compiler Design, Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
3. Engineering a Compiler, Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson

WEB REFERENCES

1http://nptel.ac.in/courses/106108113/

Professional Elective-IV

WIRELESS SENSOR NETWORKS

Course Code	**CSE E16**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VII**
Category:	Professional Elective Course								
Prerequisite:	Basic Computer Network								

Objective:

- The purpose of this course is to introduce students to Obtain a broad understanding about the network architecture of wireless sensor network.
- Understand all basic characteristics of wireless sensor networks and sensor nodes.
- The principles of data transmission, clustering algorithm and routing protocols. Design and development of new network architecture and MAC protocols.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of WIRELESS SENSOR NETWORKS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (10 hours)

Networked wireless sensor devices, Applications: Habitat Monitoring, Smart Transportation, Key design challenges. **Network deployment:** Structured versus randomized deployment, Network topology, Connectivity. Introduction to cloud system,Sensor Cloud Systems, Challenges in Sensor Cloud Systems.

UNIT – II: LOCALIZATION AND WIRELESS CHARACTERISTICS (10 hours)

Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization. Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.

UNIT – III: MEDIUM-ACCESS AND SLEEP SCHEDULING (10 hours)

Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques.Classification of Energy Management SchemesSleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage.

UNIT – IV: ROUTING AND INTEGRATION OF SENSOR & CLOUD SYSTEM (10 hours)

Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing. Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.

TEXT BOOKS:

1. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli, TaiebZnati , Wiley Inter Science.
2. Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press

REFERENCE BOOKS:

1. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati , Springer.
3. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and MilindTambe , Kluwer Publications.

4. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.

DISTRIBUTED SYSTEMS

Course Code **CSE E17** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Basic operating system

Objective:

- The main objective of studying this course is to understand concept distributed systems; clock synchronization issues, mutual exclusion, deadlock, resource management, system failure and fault tolerance, system protection model in distributed system.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DISTRIBUTED SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION, THEORITICAL FOUNDATION (10 hours)

Overview: Concepts, architecture, issues in distributed OS, communication model: message passing, RPC, Theoretical Foundations: Physical clocks, Logical clock, vector clock, happened before relation, major property of the clocks. Applications of clock synchronization: causal ordering of messages (Birman-Schiper-Stephenson, and Schiper-Eggli-Sandoz protocols) **Global state:** consistent global state, (chandy-lamport's global state recording algorithm), Cuts in distributed computation, Huang's termination detection algorithm.

UNIT – II: MUTUAL EXCLUSION, DEAD LOCK, AND AGREEMENT PROTOCOLS (10 hours)

Distributed Mutual Exclusion: What is it? Mutual Exclusion in uniprocess system/shared memory systemvs Distributed systems.System Model, requirements, performance metrics. Algorithms: Lamport's algorithm,Ricart-Agrawala algorithm,Maekawa's Quorum based algorithm, Suzuki-Kasami Broadcast Algorithm,Raymond's Tree-Based Algorithm, Singhal's heuristic algorithm.

Distributed Deadlock Detection: Preliminaries, handling strategies, control organizations, Algorithms : Centralized control (Completely centralized control, Ho-Ramamurthy algorithms), Distributed deadlock detection (Path pushing, Edge-chasing algorithms, diffusion computation based algorithms), Hierarchal deadlock detection (Ho-Ramamurthy algorithms).

Agreement Protocols : Introduction, System model, classifications (Byzantine, consensus, and interactive agreement protocols), Lamport's algorithm, Dolev et alia Algorithm. Applications of agreement protocols.

UNIT – III: DISTRIBUTED RESOURCE MANAGEMENT (10 hours)

Distributed File Systems: Architecture, Mechanism for building Distributes file system, Design issues, Case studies (SUN NFS, SPRITE).

Distributed Shared Memory: Architecture, advantages, Algorithms : Central server approach, Migration algorithm, Read replication algorithm, Full replication algorithms, Memory coherence (Introduction only).

Distributed Scheduling: Introduction, motivation, Issues in load distribution, components of load distribution, Load distributing algorithms (Sender-initiated, Receiver-initiated algorithm), Task Migration, issues in task migration

UNIT – IV: FAILURE RECOVERY, FAULT TOLERENCE, AND RESOURCE SECURITY AND PROTECTION **(10 hours)**

Failure Recovery: Types of failure, Backward and forward error recovery, Recovery in concurrent systems (Orphan message and the Domino effect, Lost messages, Livelocks). Checkpoints : consistent, and strongly consistent state of checkpoints. Fault Tolerance : Introduction, issues, two-phase commit protocols, non-blocking commit protocols, Voting protocols.Access and Flow Control: Introduction, The access matrix model, Safety in the access matrix model, Lattice model and information flow.

TEXT BOOKS:

1. Singhal, Mukesh& N.G. Shivaratri, Advanced Concepts in Operating Systems, TMH.

REFERENCE BOOKS:

1. P. K. Sinha, "Distributed Operating Systems" PHI, 1998.
2. A.S. Tanenbaum, Modern Operating Systems, PHI
3. G. Coluris, Distributed Systems-Concepts and Design.
4. Chow, Johnson, Distributed Operating Systems, Addison-Wesley

SOFTWARE DESIGN AND VALIDATION

Course Code **CSE E18** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Software Engineering

Objective:

- Understand the concepts and theory of advanced software design.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SOFTWARE DESIGN AND VALIDATION
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: CONCEPTS OF MODELS (10 hours)

System, Process and Product Engineering Hierarchies Requirement Engineering and its phases, Building the Analysis Models: Concepts, Data Flow Model, Control Flow Model, State Charts and Transition Models, Quality Function Deployment, Language and Tools, Requirements Validation Metrics.

UNIT – II: SOFTWARE DESIGN CONCEPTS (10 hours)

Software Design Concepts and Principles, Data Design, Software Architectural Styles, Analysis of Architectural Designs, Architectural Design Metrics, Design Structure Quality Index Estimation, User interface design models and process Interface Design Activities, Component Level Design and Notations, Component Level Design Metrics.

UNIT – III: CONCEPT OF SOFTWARE ARCHITECTURE AND OBJECT-ORIENTED DESIGN (10 hours)

Design quality, Design Concepts, The Design Model, Introduction to Pattern Based Software Design, Architecture styles: Main program with sub program style, Abstract data type style, Repository, Layered. Architectural Design: Software Architecture, Data Design and Architectural Design, User Interface Design: Rules, User Interface Analysis and Steps in Interface Design, Design Evaluation Design of Objects, Design and Factoring , Design of Software Objects ,Features and Methods, Cohesion of Objects , Coupling between Objects , Coupling and Visibility, Inheritance, Establishing The Object Model, Refining classes and associations, Analysis model vs. design model classes,

UNIT – IV: INTRODUCTION TO SOFTWARE VERIFICATION AND VALIDATION (10 hours)

An Introduction to Software Verification and Validation/Basic Concepts, Software Quality/Maturity Model/Project presentation, Verification &Validation Planning and Scoping, Requirements for Verification &Validation, Architecture and Design Verification & Validation, Testing of Verification & Validation

TEXTBOOKS:

1. Roger Pressman. S., Software Engineering : A Practitioner s Approach, (4th Edition), McGraw Hill, 1997.
2. Sommerville, Software Engineering, V Edition: Adison Wesley, 1996.
3. Pfleeger, Software Engineering, Prentice Hall, 1999.
4. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli Fundamentals of Software Engineering, Prentice Hall of India, 1991

REFERENCE BOOKS:

1. GradyBooch, James Rambaugh, Ivar Jacobson, "Unified Modeling Language User Guide", 2nd Edition, Addison- Wesley, ISBN – 0321267974.
2. JimArlow, IlaNeustadt, "UML 2 and Unified Process: Practical Object Oriented Analysis and Design.", 2nd Edition, Addison- Wesley, ISBN – 0321321278

HIGH PERFORMANCE COMPUTING

Course Code	**CSE E19**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VII**

Category: Professional Elective Course

Prerequisite: Computer Architecture, Advanced Computer Architeture, OS

Objective:

- The course highlights different features of High-Performance Computing, and how they can be implemented through the hardware (architecturalfeatures) and system software (operating systems, run-time systems).

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of HIGH PERFORMANCE COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: BASICS OF HIGH PERFORMANCE COMPUTING (10 hours)

RISC processors, Characteristics of RISC processors, RISC vs. CISC, Classification of instruction set architectures, Review of performance measurements, Basic parallel processing techniques: instruction level, thread level and process level.Need of high speed computing – increase the speed of computers – history of parallel computers and recent parallel computers; solving problems in parallel – temporal parallelism – data parallelism – comparison of temporal and data parallel processing – data parallel processing with specialized processors – inter-task dependency. The need for parallel computers - models of computation - analyzing algorithms – expressing algorithms.

UNIT – II: PIPELINING CONCEPTS (10 hours)

Principles of pipelining and vector processing - Linear pipelining - Classification of pipeline processors - General pipelines - Instruction and Arithmetic pipelines –Design of Pipelined instruction unit-Principles of Designing Pipeline Processors- Instruction prefetch and branch handling- Data Buffering and Busing Structure-Internal forwarding and register tagging, Hazard detection and Resolution, Dynamic pipelines and Reconfigurability

UNIT – III: INTRODUCTION TO DATAFLOW AND MULTI-PROCESSOR SYSTEMS (10 hours)

Dataflow computers - Data driven computing and Languages, Data flow computers architectures - Static data flow computer, Dynamic data flow computer, Data flow design alternatives.Multi-Processors: Centralized vs. distributed shared memory, Interconnection topologies, Multiprocessor architecture, Symmetric multiprocessors, Cache coherence problem, memory consistency, Multicore architecture

UNIT – IV: CONCEPTS OF MEMORIES AND PROCESS MANAGEMENT (14 hours)

Virtual memory: Use of memory by programs, Address translation, Paging, Cache memory: Organization, impact on programming.Operating systems: Processes and system calls, Process management, Program profiling, File systems: Disk management, Name management, Protection, Parallel architecture: Inter-process communication, Synchronization, Mutual exclusion, Basics of parallel architecture, Parallel programming with message passing using MPI.

TEXT BOOKS:

1. Hennessey and Patterson, “Computer Architecture: A Quantitative Approach”, Morgan Kaufman.2004.

REFERENCE BOOKS:

1. K. Hwang, F. A. Briggs, “Computer architecture and parallel processing”, McGraw-Hill.

NATURAL LANGUAGE PROCESSING

Course Code **CSE E20** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Artificial Intelligence

Objective:

- Teach students the leading trends and systems in natural language processing.
- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of NATURAL LANGUAGE PROCESSING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction: Basic Probability & Information Theory: Introduction to NLP, Main Issues, Basics on Probability Theory, Elements of Information Theory, Language Modeling in General and Noisy Channel Model, Smoothing and EM Algorithm.

UNIT – II: **(10 hours)**

Linguistics: Phonology and Morphology, Syntax (Phrase Structure vs. Dependency).
Words & Lexicon: Word Classes and Lexicography, Mutual Information, The t-score, The Chi-square Test, Word Classes for NLP Tasks, Parameter Estimation, Partitioning Algorithm, Complexity Issues of Word Classes, Programming Tricks &Tips.

UNIT – III: **(10 hours)**

Hidden Markov Models & Tagging: Markov Models, Hidden Markov Models (HMMs), Trellis Algorithm, Viterbi Algorithm. Estimating the Parameters of HMMs, The Forward-Backward Algorithm, Implementation Issues, Task of Tagging, Tag sets, Morphology, Lemmatization, Tagging Methods, Manually Designed Rules and Grammars, Statistical Methods, HMM Tagging (Supervised, Unsupervised), Evaluation Methodology (examples from tagging), Precision, Recall, Accuracy, Statistical Transformation Rule-Based Tagging, Maximum Entropy, Maximum Entropy Tagging, Feature Based Tagging, Results on Tagging, Various Natural Languages.

UNIT – IV: **(10 hours)**

Grammars & Parsing Algorithms: Introduction to Parsing, Generative Grammars, Properties of Regular and Context-free Grammars, Overview on Non-statistical Parsing Algorithms, Simple Top-Down Parser with Backtracking, Shift-Reduce Parser, Tree banks and Tree banking, Evaluation of Parsers, Probabilistic Parsing. PCFG: Best Parse, Probability of String.

Statistical Parsing & Machine Translation: Lexicalized PCFG, Statistical Machine Translation (MT), Alignment and Parameter Estimation for MT.

TEXT BOOKS:

1. Foundations of Statistical Natural Language Processing, Manning, C. D. and H. Schutze, TheMIT Press.

REFERENCE BOOKS:

1. Speech and Language Processing, Jurafsky, D. and J. H. Martin, Prentice-Hall.
2. Natural Language Understanding, Allen, J., TheBenajmins/Cummings Publishing CompanyInc.
3. Elements of Information Theory, Cover, T. M. and J. A. Thomas, Wiley.
4. Statistical Language Learning, Charniak, E., The MIT Press.
5. Statistical Methods for Speech Recognition, Jelinek, F., The MIT Press.

Professional Elective-V

CRYPTOGRAPHY AND NETWORK SECURITY

Course Code **CSE E21** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Fundamental of computer science and mathematics

Objective:

- Explain the objectives of information security.Explain the importance and application of each of confidentiality, integrity, authentication and availability.
- Understand various cryptographic algorithms.Understand the basic categories of threats to computers and networks.
- Describe public-key cryptosystem.
- Describe the enhancements made to lPv4 by IPSec.
- Understand Intrusions and intrusion detection.
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
- Discuss Web security and Firewalls

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of CRYPTOGRAPHY AND NETWORK SECURITY
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: CLASSICAL ENCRYPTION TECHNIQUES (12 hours)

Introduction: Cryptography, cryptanalysis, Security attacks, services & mechanisms, Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Cyber threats and their defense (Phishing Defensive measures), web based attacks, SQL injection & Defense techniques, Buffer overflow & format string vulnerabilities, TCP session hijacking (ARP attacks, route table modification) UDP hijacking(man-in-the-middle attacks).

UNIT – II: BLOCK CIPHERS , SYMMETRIC KEY CRYPTOGRAPHY & ASYMMETRIC KEY CRYPTOGRAPHY (12 hours)

Traditional Block Cipher Structure, DES,Triple DES, Block Cipher Design Principles, AES-Structure, Transformation functions, Key Expansion, Blowfish, IDEA, Block Cipher Modes of Operations. Public Key Cryptography: Principles, public key cryptography algorithms, RSA Algorithms, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT – III: CRYPTOGRAPHIC HASH FUNCTIONS & DIGITAL SIGNATURES (12 hours)

Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC, Digital Signatures, NIST Digital Signature Algorithm.Key management & distribution. User Authentication: Remote user authentication principles, Kerberos

UNIT – IV: User Authentication, Transport Layer Security & Email Security IP Security & Intrusion Detection Systems (12 hours)

Transport Level Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Shell(SSH) Electronic Mail Security: Pretty Good Privacy (PGP) and S/MIME. **IP Security:** IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. Firewalls:Need for Fire wall,Types of Firewall , Firewall Designing principle

TEXT BOOKS

1. Cryptography & Network Security: Principles and Practices, William Stallings, PEA, Sixth edition.
2. Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J.David Irwin, CRC press
3. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech.

REFERENCE BOOKS

1. Everyday Cryptography, Fundamental Principles & Applications, Keith Martin, Oxford
2. Network Security & Cryptography, Bernard Menezes, Cengage,2010

ETHICAL HACKING

Course Code **CSE E22** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: A course on "Operating Systems".A course on "Computer Networks".A course on "Network Security and Cryptography.

Objective:

- The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security.
- The course includes-Impacts of Hacking; Types of Hackers; Information Security Models; Information Security Program; Business Perspective; Planning a Controlled Attack;Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration)

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ETHICAL HACKING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction: Hacking Impacts, The HackerFramework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, IntegrationInformation Security Models: Computer Security, Network Security, Service Security, Application Security, Security ArchitectureInformation Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT – II: **(10 hours)**

The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement.

UNIT – III: **(08 hours)**

Preparing for a Hack: Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance.

UNIT – IV: **(12 hours)**

Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase Exploitation: Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern Deliverable: The Deliverable, The Document, Overal Structure, Aligning Findings, Presentation Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion.

TEXT BOOKS:

1. James S. Tiller, “The Ethical Hack: A Framework for Business Value Penetration Testing”, Auerbach Publications, CRC Press

REFERENCE BOOKS:

1. EC-Council, “Ethical Hacking and Countermeasures Attack Phases”, Cengage Learning
2. Michael Simpson, Kent Backman, James Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning

INTRODUCTION TO BIOINFORMATICS

Course Code **CSE E23** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Basics of Algorithm, Biology

Objective:

- To understand basic concepts of molecular biology and genetics, the concepts of computer science that relate to problems in biological sciences, computer as a tool for biomedical research, and important functional relationships from gene data.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of INTRODUCTION TO BIOINFORMATICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION **(08 hours)**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System.

UNIT – II: DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS **(08 hours)**

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics

UNIT – III: MODELING FOR BIOINFORMATICSAND PATTERN MATCHING **(14 hours)**

Hidden markov modeling for biological data analysis – Sequence identifiation –Sequence classifiation – multiple alignment generation – Comparative modeling –Protein modelling –genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks Molecular modeling – Computer programs for molecular modeling.Gene regulation – motif recognition – motif detection – strategies for motif detection –Visualization – Fractal analysis – DNA walk models – one dimension – two dimension –higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

UNIT – IV: MICROARRAY ANALYSIS **(10 hours)**

Microarray technology for genome expression study – image analysis for data extraction –preprocessing – segmentation – gridding – spot extraction – normalization, fitering – cluster analysis – gene network analysis – Compared Evaluation of Scientifi Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

TEXT BOOKS:

1. Yi-Ping Phoebe Chen (Ed), “BioInformatics Technologies”, First Indian Reprint, Springer Verlag, 2007.
2. Zoe lacroix and Terence Critchlow, “BioInformatics – Managing Scientifi data”, First Indian Reprint, Elsevier, 2004

REFERENCE BOOKS:

1. Zoe Lacroix and Terence Critchlow, “Bioinformatics – Managing Scientifi Data”, First Edition, Elsevier, 2004
2. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003. Arthur M Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005

GAME PROGRAMMING

Course Code **CSE E24** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Basic Computer science

Objective:

- To provide fundamentals knowledge of game programming.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of GAME PROGRAMMING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(08 hours)**

Introduction to game programming, suitable languages for developing games and reasons, animation framework, worms in windows and applets, full screen worms.

UNIT – II: **(12 hours)**

Introduction to java imaging, image loading, visual effects and animation. Loading and playing sounds, audio effects and synthesis, and sprites. Side scroller, isometric tile game, 3-D check board and checkers 3-D, loading and managing external models, lathe to make shapes, 3D- sprites

UNIT – III: **(10 hours)**

Networking basics, network chat, networked two-person game, networked virtual environment

UNIT – IV: **(10 hours)**

Game production and project management, game industry roles and economics, the publisher developer relationship, marketing, intellectual property content, law and practice, content regulation.

TEXT BOOKS:

1. Andrew Davison, Killer Game programming in Java, O'Reilly Publishers, 2005.
2. Steve Rabin, Introduction to Game Development, CENGAGE Technology, 2009.

REFERENCE BOOKS:

1. David Brackeen, Developing Games in Java, 2004.
2. David M Bourg & Glenn Seemann, AI for Game Developers, O'Reilly Publishers, 2004.

WEB RESOURCE:

1. http://www3.ntu.edu.sg/home/ehchua/programming/java/J8d_Game_Framework.html.

Open Elective-II

INTERNET OF THINGS

Course Code **OPE E06** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VII**

Category: Open Elective Course

Prerequisite: Basic Computer Network

Objective:

- To Understand the Architectural Overview of IoT.
- Understand the vision of IoT from a global context.
- Understand the application of IoT.Determine the Market perspective of IoT.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of INTERNET OF THINGS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION **(10 hours)**

The Internet of Things Today, 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, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT – II: IOT ARCHITECTURE **(10 hours)**

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoTarchitecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT – III: IOT LAYERS PROTOCOLS **(10 hours)**

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART,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

UNIT – IV: INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE **(10 hours)**

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

TEXT BOOKS:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1stEdition, Academic Press, 2014
2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014

REFERENCE BOOKS:

1. Peter Waher, “Learning Internet of Things”, PACKT publishing,BIRMINGHAM – MUMBAI
2. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet ofThings”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2,Springer

SIMULATION MODELING

Course Code **OPE E07** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VII**

Category: Open Elective Course

Prerequisite: Concepts of system and Programming languages

Objective:

- Introduce computer simulation technologies and techniques, provides the foundations for the student to libraries and programs.
- This course focuses what is needed to build simulation software environments and not just building simulations using preexisting packages.
- Understand computer simulation needs ,and to implement and test a variety of simulation and data analysis.
- Build tools to view and control simulations and their results.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SIMULATION MODELING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: SYSTEM MODEL **(10 hours)**

System definition and components, System Environment, Stochastic Activities, Continuous and Discrete Systems, System Modeling, Types of models, Static and Dynamic Physical Models, Static and Dynamic Mathematical Models, Principles used in Modelling, System Studies, Types of system study.

UNIT – II: SYSTEM SIMULATION **(10 hours)**

System simulation, why & when to simulate, nature and techniques of simulation, Monte Carlo Method, Comparison of simulation and analytical methods, Types of system simulation, Numerical Computation Technique for Continuous Models, Numerical Computation Technique for Discrete Models, Single-server queuing system, Distributed Lag models, Cobweb model, Progress of a Simulation study.

UNIT – III: CONTINUOUS SYSTEM SIMULATION AND PROBABILITY CONCEPTS **(10 hours)**

Continuous System Simulation, Analog vs. Digital Simulation, Hybrid Computers, Continuous System Simulation Languages (CSSLs), CSMP-III, Hybrid Simulation, water reservoir system, simulation of an autopilot, Real time Simulation. Discrete system simulation, fixed time-step , generation of random numbers, Simulation of a telephone System, Simulation Programming Tasks, test for randomness, Discrete simulation languages.

UNIT – IV: SYSTEM DYNAMICS, GPSS AND SIMSCRIPT **(10 hours)**

System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams. Introduction to GPSS, simulation of Manufacture Shop, Gathering Statistics,Data structure in GPPS, Evaluation of Simulation Algorithm in GPSS. Introduction to SIMSCRIPT:Program, system concepts, origination, and statements, defining the telephone system model, Data structure in SIMSCRIPT, Evaluation of Simulation Algorithm in SIMSCRIPT.

TEXT BOOKS:

1. Geoftrey Gordon, " System Simulation",2/e, PHI

REFERENCE BOOKS:

1. Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event System Simulation", Pearson Education.
2. NarsinghDeo, System Simulation with Digital Computer, PHI
3. V P Singh, "System Modeling and simulation", New Age International.
4. Averill M. Law, W. David Kelton, "System Modeling and simulation and Analysis", TMH

DIGITAL IMAGE PROCESSING

Course Code **OPE E08** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VII**

Category: Open Elective Course

Prerequisite: A fundamental study on matrix convention, probability theory and statistical principles are needed to be learned

Objective:

- The objective of the course is to understand a digital image and different processing techniques for the better analysis of an image.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DIGITAL IMAGE PROCESSING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS

Elements of visual perception: Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Image sampling and quantization Basic relationship between pixels: Basic geometric transformations-

Introduction to Fourier Transform and DFT : Properties of 2D Fourier Transform , FFT, Separable Image Transforms ,Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loevetransforms.Perspective Projection, Spatial Domain Filtering, sampling and quantization.

UNIT – II: IMAGE ENHANCEMENT TECHNIQUES

Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging,

Spatial filtering: Smoothing, sharpening filters,Laplacian filters, Frequency domain filters : Smoothing, Sharpening filters,Homomorphic filtering

UNIT – III: IMAGE RESTORATIONAND IMAGE COMPRESSION

Model of Image Degradation/restoration process: Noise models, Inverse filtering, Least mean square filtering, Constrained least mean square filtering, Blind image restoration, Pseudo inverse, Singular value decomposition.

Lossless compression: Variable length coding: LZW coding, Bit plane coding- predictive coding, DPCM.

Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization

UNIT – IV: IMAGE SEGMENTATION AND REPRESENTATION

Edge detection: Thresholding, Region Based segmentation,

Boundary representation: chair codes, Polygonal approximation,

Boundary segments: boundary descriptors: Simple descriptors, Fourier descriptors, Regional descriptors, Simple descriptors, Texture

TEXT BOOKS:

1. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing, By Anil K Jain
2. Digital Image Processing, By William K Pratt, John Willey (2001)
3. Image Processing Analysis and Machine Vision, By MillmanSonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniy (1999).
4. Digital Image Processing and Applications, By, B. Chanda, D. DuttaMagundar, Prentice Hall of India, 2000

SOFT COMPUTING

Course Code	**OPE E09**	**L-P-T-Cr.:**	**3**	**0**	**0**	**3**	**Semester:**	**VII**

Category: Open Elective Course

Prerequisite: Probability and Statistics, Vectors, C++/Java/ Matlab programming

Objective:

- To study the techniques of soft computing, especially evolutionary computation, fuzzy logic, GA and neural networks.
- Applying hybrid of multiple techniques and choosing the appropriate technique for the problems that one want to solve.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SOFT COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION AND ARTIFICIAL NEURAL NETWORK (12 hours)

Introduction to Soft Computing: Historical Development, Definitions, advantages and disadvantages, solution of complex real life problems.

Artificial Neural Network: Introduction, basic models, Hebb's learning, Adaline, Perceptron, Multilayer feed forward network, Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Deep Neural Network, Applications.

UNIT – II: FUZZY LOGIC (12 hours)

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of ClassicalSets, Membership Function,Fuzzy rule generation. Operations on Fuzzy Sets: Compliment,Intersections, Unions, Combinations of Operations, Aggregation Operations.

FuzzyArithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals &Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT – III: GENETIC ALGORITHMS (12 hours)

Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of GA, analysis of selection operations, Hypothesis of building blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications.

UNIT – IV: HYBRID SYSTEMS (12 hours)

Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

TEXT BOOKS:

1. Jang, “Neuro-Fuzzy and Soft computing”, Sun, Mizutani, Pearson
2. Haykin, “Neural networks: a comprehensive foundation”,
3. Goldberg, “Genetic Algorithms”,
4. G.J. Klir& B. Yuan, “FuzzySets& Fuzzy Logic”, PHI.

REFERENCE BOOKS:

1. Anderson J.A., “An Introduction to Neural Networks”, PHI, 1999
2. Hertz J. Krogh, R.G. Palmer, “Introduction to the Theory of Neural Computation”, Addison-Wesley, California,
3. Melanie Mitchell, “An Introduction to Genetic Algorithm”, PHI, 1998.
4. “Neural Networks-A Comprehensive Foundations”, Prentice-Hall International, New Jersey, 1999.
5. Freeman J.A. & D.M. Skapura, “Neural Networks: Algorithms, Applications and Programming Techniques”, Addison Wesley, Reading, Mass, (1992).

MOBILE COMPUTING

Course Code **OPE E10** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VII**

Category: Open Elective Course

Prerequisite: Data communication and Computer Networks

Objective:

- The objective is to learn emerging techniques in GSM, wireless MAC.Learn mobile network and transport layer.
- Learn mobile database, data disseminationand MANAT protocols

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MOBILE COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION, GSM, WIRELESS MAC (10 hours)

Introduction to Mobile Communications and Computing: Mobile Computing (MC):Introduction to MC, novel applications, limitations, and architecture.

GSM: Mobile services, System architecture, Radio interface, Protocols, Localization andcalling, Handover, Security, and New data services.

Wireless Medium Access Control : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

UNIT – II: MOBILE NETWORK AND TRANSPORT LAYER (10 hours)

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packetdelivery, agent advertisement and discovery, registration, tunneling and encapsulation, Optimizations), Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT – III: MOBILE DATABASE AND DATA DISSEMINATION (10 hours)

Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

UNIT – IV: MANAT, PROTOCOLS (10 hours)

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Protocols and Tools: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

TEXT BOOKS :

1. Jochen Schiller,"Mobile Communications",Addison-Wesley.
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing"

REFERENCES:

1. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press.
2. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional.
3. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer.
4. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech.

MINOR PROJECT

Student may choose any research or application based topic for the minor project. The minor project can be done by individual or maximum of four persons. Student has to submit a report.

SEMINAR

Student has to select a topic of his/her interest in consultation with the faculty incharge of seminar. He/She can collect information from the books, journals, internet and prepare a report. Prepare a power point presentation on the topics and present to a committee to evaluate the seminar. Seminar is separate for each student.

	Semester – VIII							
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**P**	**T**	**Credits**	**Remarks**
1	XXX XX	Professional Elective-VI	PC(CE)	4	0	0	**3**	
2	XXXXXX	Open Elective-III	OE(OE)	3	0	0	**3**	
3	XXXXXX	Open Elective-IV	OE(OE)	3	0	0	**3**	
4	CSP 482	Major Project	PP (PW)	0	0	0	**10**	
5	CSV 483	Comprehensive Viva-voce	PP (CV)	0	0	0	**2**	
						Total Credit:	**21**	

PROFESSIONAL ELECTIVES					
Professional Elective-VI					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
CSE E25	Cloud Computing	4	0	0	3
CSE E26	Big Data Analytics	4	0	0	3
CSE E27	Object Oriented Analysis and Design	4	0	0	3
CSE E28	Advanced Database Systems	4	0	0	3

OPEN ELECTIVES					
Open Elective-III					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E11	Information Theory and Coding	3	0	0	3
OPE E12	Pattern Recognition	3	0	0	3
HSC 483	Entrepreneurship Management	3	0	0	3
OPE E14	Computer Oriented Numerical Methods	3	0	0	3
Open Elective-IV					
Code	**Course Title**	**L**	**P**	**T**	**Credits**
OPE E15	Machine Learning	3	0	0	3
OPE E16	Software Project Management	3	0	0	3
OPE E17	Remote Sensing and Geographic Information Systems	3	0	0	3
OPE E18	Personal Development	3	0	0	3
OPE E19	E-Commerce	3	0	0	3

Professional Elective-VI

CLOUD COMPUTING

Course Code	**CSE E25**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VIII**

Category: Professional Elective Course

Prerequisite: Basic Computer Network

Objective:

- To develop the understanding of fundamentals and technological aspects of Cloud Computing. Management of cloud services.
- Virtualization along with various terminologies and the keywords used in Cloud Computing and virtualization. Storage network design and optimization

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of CLOUD COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: CLOUD COMPUTING FUNDAMENTALS **(10 hours)**

Introduction: Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas.Cloud Computing definition, private,public and hybrid cloud.
Cloud types: IaaS,PaaS, SaaS. Benefits and challenges of cloud computing, public vs privateclouds, role of virtualization in enabling the cloud; Business Agility: Benefits andChallenges to Cloud architecture. Application availability, performance, securityand disaster recovery

UNIT – II: MANAGEMENT OF CLOUD SERVICES **(08 hours)**

Reliability, availability and security of services deployed from the cloud.Performance and scalability of services, tools and technologies used to managecloud services deployment; Cloud Economics: Cloud Computing infrastructuresavailable for implementing cloud based services.

UNIT – III: VIRTUALIZED DATA CENTER ARCHITECTURE & INFORMATION STORAGE SECURITY & DESIGN **(12 hours)**

Cloud infrastructures; public, private, hybrid. Service provider interfaces; Saas,Paas, Iaas. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures. Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloud environments.

UNIT – IV: STORAGE NETWORK DESIGN & OPTIMIZATION OF CLOUD STORAGE **(10 hours)**

Architecture of storage, analysis and planning. Storage network designconsiderations; NAS and FC SANs, hybrid storage networking technologies(iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, hostsystem design considerations.Global storage management locations, scalability, operational efficiency. Globalstorage distribution; terabytes to petabytes and greater

TEXT BOOKS:

1. Greg Schulz, “Cloud and Virtual Data Storage Networking”, AuerbachPublications [ISBN:978-1439851739], 2011.
2. GautamShroff, “Enterprise Cloud Computing Technology ArchitectureApplications”, Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.

REFERENCE BOOKS:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A PracticalApproach” McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009.
2. Dimitris N. Chorafas, “Cloud Computing Strategies” CRC Press; 1 edition[ISBN: 1439834539],2010.
3. EMC, “Information Storage and Management” Wiley; 2 edition [ISBN: 9780470294215],2012.

BIG DATA ANALYTICS

Course Code **CSE E26** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VIII**

Category: Professional elective course

Prerequisite: Basic Computer Network, Cloud Computing and Database system.

Objective:

- Fundamentals of Big data. Fundamental of Mapreduce. Information Management and Data Privacy and Ethics

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of BIG DATA ANALYTICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(08 hours)**

Introduction: Big data and its importance, a flood of mythic "start up"proportions, big data is more than merely big why now? aconvergenceof key trends, a wider variety of data, the expanding universe of unstructureddata, industry examples of big data: Digital marketing and the online world,the right approach, cross channel lifecycle marketing.

UNIT – II: **(12 hours)**

Big Data Technology: The elephant in the room: Hadoop's parallel world, old vs. new approaches. Data discovery: Work the way people's minds work, open source technology for big data analytics, the cloud and big data, predictive analytics moves into the limelight, a brief history of hadoop, apache hadoop and the hadoop ecosystem.

MapReduce: Analyzing the data with hadoop, map and reduce, java mapreduce, scaling out, data flow, combiner functions, running a distributedmapreduce job, hadoop streaming, the hadoop distributed file system, thedesign of HDFS, HDFS concepts, blocks, name nodes and data nodes, HDFS federation, HDFS high, availability, the command, line interface, basic file system operations, hadoop file systems

UNIT – III: **(12 hours)**

Information Management: The big data foundation, big data computingplatforms, big data computation, more on big data storage, big datacomputational limitations, big data emerging technologies.

Business analytics : The last mile in data analysis, geospatial intelligence will make your life better, consumption of analytics, from creation to consumption.

Visualizing: How to make it consumable? organizations are using data visualization as a way to take immediate action.

UNIT – IV: **(10 hours)**

Data Privacy and Ethics : The privacy landscape, the great data grabisn't new, preferencess, personalization, and relationships, rights andresponsibility, playing in a global sandbox , conscientious and conscious responsibility, privacy may be the wrong focus can data be anonymized?balancing for counter intelligence.

TEXT BOOKS:

1. MichaelMinelli, Michele Chambers, Big Data,Big Analytics, Wiley Publications, 2013
2. Tom White, Hadoop: The Definitive Guide, 3/e, O'Reilly Publications, 2012.

REFERENCE BOOKS:

1. Bill Franks Taming, The Big Data Tidal Wave, 1/e, Wiley, 2012.
2. Frank J. Ohlhorst, Big Data Analytics, 1/e, Wiley, 2012

Other References: (Web)

1. https://onlinecourses.nptel.ac.in/noc15_mg05/preview
2. https://wr.informatik.uni-hamburg.de/_media/teaching/wintersemester_2015_2016/bd-1516-einfuehrung.pdf

OBJECT ORIENTED ANALYSIS AND DESIGN

Course Code **CSE E27** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VIII**

Category: Professional elective course

Prerequisite: Software Engineering

Objective:

- To train students on object modeling.
- To apply unified process phases.
- To apply unified modeling language for software design of any applications.
- To study case studies for OOAD

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of OBJECT ORIENTED ANALYSIS AND DESIGN
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction to UML: Importance of modeling, principles of modeling, Object oriented modeling, Conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT – II: **(10 hours)**

Basic BehavioralModeling: Interactions, Use cases, Use case Diagrams, Interaction diagrams, Activity Diagrams

UNIT – III: **(08 hours)**

Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams., Class diagrams

UNIT – IV: **(12 hours)**

Advanced Behavioral Modeling: Events and signals, State machines, Processes and Threads, Time and space, State chart diagrams. Advanced Structural Modeling Advanced classes, Advanced Relationships, Interfaces,Types and Roles, Packages,Instances Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Case Study: The Unified Library application.

TEXT BOOKS:

1. The Unified Modeling Language User Guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.
2. UML 2 ToolkitHans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, WILEY-Dreamtech India Pvt. Ltd.

REFERENCE BOOKS:

1. Fundamentals of Object Oriented Design in UML Meilir Page-Jones,Pearson Education.

2. Modeling Software Systems Using UML2, Pascal Roques:, Wiley- Dreamtech India Pvt. Ltd.
3. Object Oriented Analysis &Design,AtulKahate:, The McGraw Hill Companies.
4. Practical Object-Oriented Design with UML Mark Priestley:,TATA McGraw Hill.
5. Appling UML and Patterns: An introduction to Object–Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

ADVANCED DATABASE SYSTEMS

Course Code **CSE E28** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VIII**

Category: Professional elective course

Prerequisite: DBMS, Computer Networks

Objective:

- To know advanced concepts of database in large scale analytics, derive data maintenance, change schema, database update and Benchmark Object Databases, deals with uncertainties in advanced concepts of database, and open issues in database technologies.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED DATABASE SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: PARALLEL AND DISTRIBUTED DATABASES (08 hours)

Inter and Intra Query Parallelism – Architecture – Query evaluation – Optimization – Distributed Architecture – Storage – Catalog Management – Query Processing - Transactions – Recovery - Large-scale Data Analytics in the Internet Context – Map Reduce Paradigm - run-time system for supporting scalable and fault-tolerant execution - paradigms: PigLatin and Hive and parallel databases versus Map Reduce

UNIT – II: ACTIVE DATABASES, TEMPORAL AND OBJECT DATABASES (10 hours)

Syntax and Sematics (Starburst, Oracle, DB2) – Taxonomy – Applications – Integrity Management – Workflw Management – Business Rules – Design Principles – Properties – Rule Modularization – Rule Debugging – IDEA methodology – Open Problems.
Overview – Data types – Associating Facts – Temporal Query Language – TSQL2 – Time Ontology – Language Constructs – Architecture – Temporal Support – Object Database and Change Management – Change of Schema – Implementing Database Updates in O2 – Benchmark Database Updates – Performance Evaluation.

UNIT – III: SPATIAL, TEXT AND MULTIMEDIA DATABASES (10 hours)

Traditional Indexing Methods (Secondary Keys, Spatial Access Methods) – Text Retrieval – Multimedia Indexing – 1D Time Series – 2d Color images – Sub pattern Matching – Open Issues – Uncertainties

UNIT – IV: COMPLEX QUERIES AND REASONING (10 hours)

Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Data log – Fix point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – Open issues.
Introduction to Big data analytics and No-SQL

TEXT / REFERENCE BOOKS:

1. Ramakrishnan, Gehrke, "Database Management System", Tata McGraw Hill Publications, Third Edition.
2. Carlo Zaniolo, Stefano Ceri "Advanced Database Systems", Morgan Kauffmann Publishers.
3. VLDB Journal.
4. Elmaski&Navathe -Fundamentals of Database Systems, 4th Edition, Pearson Education
5. Database Systems, Thomas Connolly, Carolyn Begg
6. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2002.

WEB REFERENCES

1. http://video.google.com
2. http://www.blinkvid.com/video
3. http://www.learnerstv.com/course.php?cat=Computers
4. http://www.crazyengineers.com/forum

Open Elective-III

INFORMATION THEORY AND CODING

Course Code **OPE E11** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basics of probability theory

Objective:

- To impart the knowledge of various error detection and correction coding techniques used in signal transmission.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of INFORMATION THEORY AND CODING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INFORMATION THEORY AND SOURCE CODING (10 hours)

Introduction to Information Theory, Uncertainty and Information, Mutual Information and Entropy,Source Coding, Huffman Coding, Shannon-Fano-Elias Coding, Arithmetic Coding, Lempel-ZivAlgorithm, Run Length Encoding, Channel Capacity, Channel Coding, Information Capacity Theorem,The Shannon Limit.

UNIT – II: ERROR CONTROL CODING (CHANNEL CODING) (10 hours)

Error Correcting Codes, Matrix Description of Linear Block Codes, Equivalent Codes, Parity CheckMatrix, Syndrome Decoding, Perfect codes, Hamming Codes, Cyclic Codes, Brust Error Correction,Fire Codes, Golay Codes

UNIT – III: BCH, CONVOLUTION AND TRELLIS (10 hours)

Bose-ChaudhriHocquenghem (BCH) codes, Decoding of BCH codes, Reed-Solomon Codes,Convolution Codes, Polynomial description , Turbo Codes , Turbo Decoding, Introduction to TCM,Performance Evaluation forAEGN Channel.

UNIT – IV: COMPRESSION TECHNIQUES, AUDIO AND VIDEO CODING **(10 hours)**

Principle of Data Compression, Text Compression, Image Compression (GIF, TIFF,JPEG), Image AudioCoders, Videp Compression, MPEG Video Standards (MPEG 1,2,3 and MP-3 Standrad Sounds.

TEXT BOOKS

1. Information Theory, Coding and Cryptography, Ranjan Bose 2nd Edition, The McGraw-Hill.

REFERENCE BOOKS:

1. Information theory and Coding, Norman Abramson, McGraw-Hill electronic Seriesr.
2. Information Coding Techniques, Dr. J. S. Chitode, Technical Publication.

PATTERN RECOGNITION

Course Code **OPE E12** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basic of Algorithm, Linear Algebra, Vector Space, Probability and Statistics

Objective:

- To know about supervised and unsupervised Learning.
- To study about feature extraction and structural pattern recognition.
- To explore different classification models.
- To learn about fuzzy pattern classifiers and perception.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PATTERN RECOGNITION
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION AND STASTICAL PATTERN RECOGNITION **(10 hours)**

Introduction and mathematical preliminaries - What is pattern recognition? Clustering vs. Classification; Applications; Linear Algebra, vector spaces, probability theory, estimation techniques.
Classification: Bayes decision rule, Error probability, Error rate, Minimum distance classifier, Mahalanobis distance; K-NN Classifier, Linear discriminant functions and Non-linear decision boundaries.

UNIT – II: **(10 hours)**

Fisher's LDA, Single and Multilayer perceptron, training set and test sets, standardization and normalization.Clustering: Different distance functions and similarity measures, Sum of Squared Error Technique, Minimum within cluster distance criterion, K-means clustering, single linkage and complete linkage clustering, , existence of unique clusters or no clusters

UNIT – III: **(12 hours)**

Feature selection: Problem statement and Uses, Probabilistic reparability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, (l,r) algorithm.Feature Extraction: PCA, Kernel PCA.

UNIT – IV: **(08 hours)**

Recent advances in PR: Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy

TEXT BOOKS:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, JohnWiley, 2001.
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

REFERENCE BOOKS:

1. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.
2. M. Narasimha Murthy and V.Susheela Devi, ―Pattern Recognition‖, Springer 2011.
3. Robert J.Schalkoff, ―Pattern Recognition Statistical, Structural and Neural Approaches‖, John Wiley & Sons Inc., New York, 1992.
4. C.M.Bishop,―Pattern Recognition and Machine Learning‖, Springer, 2006.
5. Andrew Webb, ―Stastical Pattern Recognition‖, Arnold publishers, London, 1999.

WEB REFERENCES:

1. http://www.ph.tn.tudelft.nl/PRInfo/
2. http://kdd.ics.uci.edu/
3. http://morden.csee.usf.edu/nnc/index1.html
4. http://www.iapr.org/

ENTREPRENEURSHIP MANAGEMENT

Course Code **HSC 483** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Na

Objective:

- This is a program geared toward entrepreneurial-minded individuals.
- It focuses on business and management topics to help students build future enterprises.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ENTREPRENEURSHIP MANAGEMENT
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Entrepreneurial traits, types and significance; definitions, characteristics of entrepreneurial types, qualities and functions of entrepreneurs, role and importance of entrepreneur in economic growth; search for business idea, sources of ideas processing.

UNIT – II: **(10 hours)**

Competing theories of entrepreneurship; entrepreneurial development programme in India: history, support, objectives, stages of performances; planning and EDP - objectives, target group, selection of center, pre-training work, entrepreneurial input; entrepreneurial behaviours and entrepreneurial motivation

UNIT – III: **(10 hours)**

Govt. Policy towards SSI's; Entrepreneurial success in rural area, innovation and entrepreneur; establishing entrepreneurs systems,

UNIT – IV: **(10 hours)**

Input requirements: sources and criteria of financing, fixed and working capital assessment; technical assistance, marketing assistance; Sickness of units and remedial assistance; preparation of feasibility reports and legal formalities and documentation.

SUGGESTED READINGS:

Cliffton, Davis S and Fyfie, David E. "Project feasibility Analysis", 1977, John Wiley, New York.
Desai, AN. "Entrepreneur and Environment", 1990, Ashish, New Delhi.
Drucker, Peter, "Innovation and Entrepreneurship", 1985, Heinemann, London.
Jain Rajiv, "Planning a Small Industry: A Guide to Entrepreneurs", 1984, S.S. Books, Delhi.
Kumar, S.A. "entrepreneurship in Small Industry", 1990, Discovery, New Delhi.

COMPUTER ORIENTED NUMERICAL METHODS

Course Code **OPE E14** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Interdisciplinary Elective Course

Objective:

- To Understand integration & differentiation .
- Understand the differential equation and root finding.
- Understand the solution of system of linear equation.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPUTER ORIENTED NUMERICAL METHODS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: ERROR **(10 hours)**

Calculation and handling of error in programming. Interpolation: Newton's. Lagrange's, Gauss. Stirling's and Bessel's interpolation formulae and their accuracy, Inverse interpolation. Interpolation with two independent variables (elementary idea only).

UNIT – II: INTEGRATION & DIFFERENTIATION **(08 hours)**

Trapezoidal, Simpson, Weddle's and Gaussian Quadrature methods and their accuracy. Numerical derivative (1st and 2nd order) based on Newton's Forward and Stirling's interpolation.

UNIT – III: DIFFERENTIAL EQUATION AND ROOT FINDING **(12 hours)**

Euler's method, Runge-Kutta Method (4th order algorithm), Finite difference method, J.C. Adam and Successive approximation method. Bisection, False Position, Newton-Raphson and Iteration Method. Simultaneous Equation for Several unknown: Newton-Raphson and Iteration Method.Solution for Multiple roots: Graeffe's Root Squaring method.
Least square fitting of a set of points: Line. Quadratic and Cubic Interpolation: Linear, Quadratic and Cubic Spline methods.

UNIT – IV: SOLUTION OF SYSTEM OF LINEAR EQUATION **(10 hours)**

Matrix inversion method, Gaussian elimination method, LU decomposition method, Pivoting. Eigen value and Eigenvector of Symmetric Matrix: Jacobi Transformations, Gaussian elimination method.

TEXT BOOKS:

1. J.B. Scarborough: Numerical Mathematical Analysis (Oxford and IBH)

REFERENCES:

1. E. Balgurusamy: Numerical Methods (TMH)
2. V. Rajaraman: Computer Oriented Numerical Methods
3. George W. Collins, II: Fundamental Numerical Methods and Data Analysis – Free Internet resource available at httP.7/ads.harvard.edu/books/1990fnmd.book

Open Elective-IV

MACHINE LEARNING

Course Code **OPE E15** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Fundamental of computer science and mathematics

Objective:

- To introduce concepts of learning.
- To know decision tree learning and various learning methods.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MACHINE LEARNING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

General Introduction: Learning Problems, Choosing Training experience/Target Function, Representation of the target function, issues in machine learning.

Concept Learning: Concept learning task-Inductive Learning, Concept Learning as search, FIND-S algorithm, version spaces, The List then Eliminate algorithm, Representation of version spaces, The Candidate Elimination algorithm, Inductive bias.

UNIT – II: **(12 hours)**

Decision Tree Learning: Decision tree representation, ID3 Learning algorithm, Entropy, Information gain, over fitting, reduced error pruning, Rule-post pruning.
Bayesian Learning: Bayes' Theorem and concept Learning, Bayes optimal classifier, Bayesian Belief Network.

UNIT – III: **(12 hours)**

Instance based Learning: Introduction, k-Nearest Neighbour Learning algorithm, distance weighted nearest neighbour learning algorithm, case based reasoning, lazy learner and eager learner.
Learning Set of Rules: Sequential covering algorithm, First Order Inductive Learning (FOIL), Induction as inverted deduction, Inverting resolution (First order resolution), Generalisation, theta-subsumption and entailment, PROGOL.

UNIT – IV: **(12 hours)**

Analytical Learning: Inductive vs Analytical Learning, Prolog-EBG, Combining inductive and analytical learning.

TEXT BOOKS

1. Tom M. Mitchell, Machine Learning, Mac Graw Hill

REFERENCE BOOKS:

1. Christopher M. Bishop, Machine Learning and Pattern Recognition, Springer

SOFTWARE PROJECT MANAGEMENT

Course Code **OPE E16** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basic Software Engineering.

Objective:

- To know Project Evaluation and Planning.
- To introduce the concept of Project Sequencing and Scheduling.
- To know Quality Management and People Management.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SOFTWARE PROJECT MANAGEMENT
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4 •	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: PROJECT EVALUATION AND PLANNING **(10 hours)**

Activities in Software Project Management, Overview Of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb.

UNIT – II: PROJECT SEQUENCING AND SCHEDULING (10 hours)

Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

UNIT – III: MONITORING AND CONTROL (10 hours)

Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types of Contracts, Stages in Contract Placement, Typical Terms of a Contract, Contract Management and Acceptance.

UNIT – IV: QUALITY MANAGEMENT AND PEOPLE MANAGEMENT (10 hours)

Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety. ISO and CMMI models, Testing, and Software reliability, test automation, Overview of project management tools.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Fifth Edition, Tata McGraw Hill, 2011.

REFERENCE BOOKS :

1. Royce, "Software Project Management", Pearson Education, 1999.
2. Robert K. Wysocki, Effective Software Project Management, Wiley, 2009.

REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

Course Code **OPE E17** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basic knowledge geography and computer science.

Objective:

- To Understand Geographic information system.
- Understand remote sensing.
- Understand natural resources management

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Fundamentals of Remote Sensing: Introduction, electromagnetic radiation, electromagnetic spectrum, energy interactions with earth's surface materials and atmosphere, sensors and platforms, false colour composite (FCC) image, image interpretation techniques, satellite remote sensing - Indian context.

UNIT – II: **(12 hours)**

Fundamentals of GIS: Introduction, elements of GIS, vectorization, rasterization, geo-referencing, map projections, digitization process, data base handling, types of data structures, overlay analysis, surface terrain models - digital elevation model (DEM), triangulated irregular network (TIN), and slope models.RS and GIS Techniques for Natural Resources Management: Land use/ land cover classification systems, forest cover, agriculture and wasteland management. water resources management.

UNIT – III: **(08 hours)**

RS and GIS Techniques for Infrastructure Planning and Management: Urban utilities, cadastral mapping and transport network. GPS Navigationsystem for various applications.

UNIT – IV: **(10 hours)**

RS and GIS Techniques for Natural Disasters Management: Earthquakes, landslides, cyclones and floods - hazard zonation, riskassessment, relief and rehabilitation measures.

TEXT BOOKS:

1. P.K. Guha, Remote Sensing for the Beginner, EWP Ltd., 2013.
2. M. Anjireddy, Text Book of Remote Sensing and Geographical Information Systems, BSP Publishers, 2012.

REFERENCE BOOKS:

1. T.M. Lillesand and Kiefer, Remote Sensing and Image Interpretation, R.W. John Wiley & Sons Publishers, 2008.

PERSONAL DEVELOPMENT

Course Code	**OPE E18**	**L-P-T-Cr.:**	**3**	**0**	**0**	**3**	**Semester:**	**VIII**	

Category: Open Elective Course

Prerequisite: Basic knowledge about business communication and language.

Objective:

- A person's personality is defined by their characteristics, behaviors, thoughts, and feelings.
- These aspects start developing during childhood, and are strengthened and molded as the person grows.

- This study nurtures the student and grooms their personality

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PERSONAL DEVELOPMENT
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Self Awareness: Know yourself, have a snapshot of yourself, assess your personal traits, discover natural potential. Activities and Tasks: Class discussion, questionnaires, Johari Window, SWOC analysis (strengths, weaknesses, opportunities and challenges).

UNIT – II: **(10 hours)**

Self Discipline: Importance of self-discipline, characteristics of a self-disciplined achiever, self-discipline in personal life and career. Activities and Tasks: Viewing short videos followed by discussion and analysis, brainstorming in small groups, creating an action plan to realize academic and career goals.

UNIT – III: **(10 hours)**

Motivating Oneself: Self-motivation, confidence building, goal setting, decision making. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires, Handling emotions, time management, stress management, change management. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

UNIT – IV: **(10 hours)**

Interpersonal Behaviour: Attitude towards persons and situations, teamwork, leadership skills, problem solving skills, interpersonal adaptability, cultural adaptability. Importance of Corporate communication - Introduction to and definition of corporates – Communication, process, patterns and channels of communication- Barriers to communication and strategies to overcome them- Evolution of corporate culture- Role and contribution of individual group and organization - Role of psychology in communication.

TEXT BOOKS:

1. Personality Development and Soft Skills – Oxford University Press by Barun K. Mitra

REFERENCE BOOK:

1. Personality Development – Goodwill Publishing House by Harsh Kumar

E-COMMERCE

Course Code **OPE E19** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basic Software Engineering.

Objective:

- To know Project Evaluation and Planning.

- To introduce the concept of Project Sequencing and Scheduling.
- To know Quality Management and People Management.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of E-COMMERCE
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Electronic Commerce: Frame work, anatomy of e-commerce applications, e-commerce consumer applications, e-commerce organization applications, consumer oriented electronic commerce, mercantile process models. Electronic payment systems: Digital token based, smart cards, credit cards, risks in electronic payment systems.

Inter Organizational Commerce: EDI, EDI implementation, value added networks.

UNIT – II: **(12 hours)**

Intra Organizational Commerce: Work flow, automation customization and internal commerce, supply chain management. Corporate Digital Library: Document library, digital document types, corporate data warehouses, advertising and marketing, information based marketing, advertising on internet, online marketing process, market research.

UNIT – III: **(08 hours)**

Consumer Search and Resource Discovery: Information search and retrieval, commerce catalogues, information filtering.

UNIT – IV: **(08 hours)**

Multimedia: Key multimedia concepts, digital video and electronic commerce, desktop video processing, desktop video conferencing.

TEXT BOOKS:

1. Ravi Kalakota and Andrew B. Whinston, Frontiers of electronic commerce, Pearson, 1996.

REFERENCE BOOKS:

1. Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, Ecommerce fundamentals and applications, John Wiley, 2008.
2. S. Jaiswal, E-Commerce, Galgotia Publications, 2003.