B.TECH COURSE IN COMPUTER SCIENCE AND ENGINEERING

(FOR THE STUDENTS ADMITTED IN 2019-20)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES

ANDHRA PRADESH

Rajiv Gandhi University of Knowledge Technologies - Nuzvid/RKV/Srikakulam/Ongole

CONTENTS

		Web Technologies
		Computer Organization & Architecture Lab
		Database Management Systems Lab
		Web Technologies Lab
		Compiler Design
		Computer Networks
		Software Engineering
		Operating Systems
		Computer Networks Lab
		Software Engineering Lab
		Operating System Lab
		Artificial Intelligence
		Mobile Application Development
		Mobile Application Development-Lab
	(vi)	**Professional Elective Courses**
		Elective group-1
		Data Mining
		Advanced Java
		Distributed Computing
		Advanced Computer Architecture
		Elective group-2
		Machine Learning
		Object Oriented Analysis and Design
		Distributed Systems
		Real time Operating System
		Embeded Systems
		Digital Image Processing
		Mobile Application Development
		Elective Group-3
		Information Retrieval
		Software Testing
		Mobile Computing
		Data Compression
		Computer Graphics
		Elective Group-4
		Data Science
		Unix Shell Programming
		VLSI
		Soft Computing
		File Structures
		Elective Group-5
		Big Data Analytics
		Design Patterns
		Cloud Computing

		Information Security
		Computer Vision
		Optimization Techniques
		Artificial Intelligence
		Elective Group-6
		Deep Learning
		Software Reliability Engineering
		Ad-hoc Sensor Networks
		Biometric Security
		Human Computer Interaction
		Elective Group-7
		Service Oriented Architecture
		Internet of Things
		Cyber Security
		Robotics
		Computer Forensics
		Open Elective Courses
		OOPs through Java
		Database Management Systems
		Computer Graphics
		Distributed Computing
		Digital Image Processing
		List of additional Open Electives
		Soft Skills and Interpersonal Communication
		Economic Policies in India
		Indian Music System
		Intellectual Property Rights (IPR)
	(vii)	**Seminars/Mini Projects/Projects**
		Mini Project – 1
		Summer Internship
		Project-I
		Project-II & Dissertation

Chapter-1

General, Course structure, Theme and semester-wise credit distribution

A. Definition of Credit:

1 Hour Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
3 Hours Practical (Lab)/week	1.5 credits

B. Total number of credits: 160

C. Minimum number of contact hours/weeks per semester: 15 weeks of teaching

1. For 1 credit course: 15 contact hours per semester
2. For 2 credit course: 30 contact hours per semester
3. For 3 credit course: 45 contact hours per semester
4. For 4 credit course: 60 contact hours per semester

D. Course code and definition, Abbreviations

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
EC	Core Courses
ECEL	Program Electives
ECP1	Project Stage-I
ECP2	Project Stage-II
ECMP1	Mini Project Stage-I
ECMP2	Mini Project Stage-II
ECSI	Summer Internship
BS	Basic Science
ES	General Engineering Courses
HS	Humanities and Social Sciences including Management Science
OE	Open Electives
MC	Mandatory Courses
PCC	Program Core Course
PEC	Program Elective Course
OEC	Open Elective Course
BSC	Basic Science Course
HSC	Humanities and Social Sciences including Management Science Course
PROJ	Mini project/Project

E. Structure of Program

S.No	Category	Credits
1	Basic Science Courses	17.5
2	Engineering Science Courses	22
3	Humanities and Social Sciences including Management courses	12.5
4	Program core courses	54
5	Program Elective courses	24
6	Open Elective courses	12
7	Project work, Miniproject work, Summer internships project	18
8	Mandatory courses - 03 [Indian Constitution, Environmental Studies, Career Development Course]	(non-credit)
	Total	**160**

F. Semester-wise Credits Distribution

Year & Semester	BSC	HSMC	ESC	PCC	PEC	OEC	PROJ	TOTAL
E1S1	4	1.5	14	0	0	0	0	19.5
E1S2	9.5	0	2.5	9	0	0	0	21
E2S1	4	3	4.5	10	0	0	0	21.5
E2S2	0	4.5	0	16.5	0	0	0	21
E3S1	0	1.5	0	16.5	3	0	0	21
E3S2	0	0	0	3	12	3	3	21
Summer Internship							3	3
E4S1	0	0	0	0	6	3	6	15
E4S2	0	2	0	0	3	6	6	17
Total	**17.5**	**12.5**	**21**	**55**	**24**	**12**	**18**	**160**

Total number of Mandatory Courses (MC): 03 (Indian Constitution, Environmental Science, Career Development Course)

Notations:

E1-S1: Engineering first year first semester
E1-S2: Engineering first year second semester
E2-S1: Engineering second year first semester
E2-S2: Engineering second year first semester
E3-S1: Engineering third year first semester
E3-S2: Engineering third year second semester
E4-S1: Engineering fourth year first semester
E4-S2: Engineering fourth year second semester
SUM INTERN: Summer Internship program

CHAPTER – 2
SEMESTER-WISE STRUCTURE OF CURRICULUM

Mandatory Induction Program

3 Weeks Duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent people • Visit to local areas • Familiarization of Dept./Branch Innovations

ENGINEERING FIRST YEAR: SEMESTER-1							
Sl. No.	**Course Type**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	BSC	MA1102	Engineering Mathematics-1 (Calculus & Linear Algebra)	3	1	0	4
2	ESC	EC1109	Basic Electrical and Electronics Engg.	3	1	0	4
3	ESC	CS1101	Problem Solving and Programming Through C	3	1	0	4
4	ESC	CS1102	IT Workshop	2	0	2	3
5	HSMC	EG1181	English-Lab-I	0	0	3	1.5
6	ESC	EC1189	Basic Electrical and Electronics Engg. Lab	0	0	3	1.5
7	ESC	CS1181	Programming Lab	0	0	3	1.5
8	HSMC	HS1101	Indian Constitution	1	0	0	0
Total				**12**	**3**	**11**	**19.5**

ENGINEERING FIRST YEAR:SEMESTER-2							
Sl. No.	**Course Type**	**Course Code**	**Course Title**	**Hours per week**			Credits
				L	**T**	**P**	
1	BSC	MA1202	Discrete Mathematics	3	1	0	4
2	BSC	PY1201	Engineering Physics	3	1	0	4
3	ESC	ME1214	Engineering Graphics & Computer Drafting	1	0	3	2.5
4	PCC	CS1201	Programming through C++	3	0	0	3
	PCC	CS1202	Data Structures	3	0	0	3
5	BSC	PY1281	Physics Lab	0	0	3	1.5
6	PCC	CS1281	C++ Lab	0	0	3	1.5
7	PCC	CS1282	Data Structures Lab	0	0	3	1.5
8	HSMC	BE3101	Environmental Sciences	1	0	0	0
Total				**14**	**2**	**12**	**21**

ENGINEERING SECOND YEAR: SEMESTER-1							
Sl. No.	**Course Type**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	BSC	MA2102	Mathematics-2(Probability and Statistics)	3	1	0	4
2	HSMC	MG2101	Managerial Economics and Finance Accounting	3	0	0	3
3	ESC	EC2109	Digital Logic Design	3	0	0	3
4	PCC	CS2101	Design & Analysis of Algorithms	3	1	0	4
5	PCC	CS2102	Object Oriented Programming Through JAVA	3	0	0	3
6	PCC	CS2181	Design & Analysis of Algorithms Lab	0	0	3	1.5
7	ESC	EC2189	Digital Logic Design Lab	0	0	3	1.5
8	PCC	CS2182	Object Oriented Programming Through JAVA Lab	0	0	3	1.5
Total				**15**	**2**	**9**	**21.5**

ENGINEERING SECOND YEAR:SEMESTER-2

Sl. No.	Course Type	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	HSMC	MG2202	Operational Research	3	0	0	3
2	PCC	CS2201	Computer Organization & Architecture	3	0	0	3
3	PCC	CS2202	Database Management Systems	3	0	0	3
4	PCC	CS2203	Formal Languages & Automata Theory	3	0	0	3
5	PCC	CS2204	Web Technologies	3	0	0	3
6	HSMC	EG2283	English Lab-II	0	0	3	1.5
7	PCC	CS2281	Computer Organization & Architecture Lab	0	0	3	1.5
8	PCC	CS2282	Database Management Systems Lab	0	0	3	1.5
9	PCC	CS2283	Web Technologies Lab	0	0	3	1.5
Total				**15**	**0**	**12**	**21**

ENGINEERING THIRD YEAR:SEMESTER-1

Sl. No.	Course Type	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PCC	CS3101	Compiler Design	3	0	0	3
2	PCC	CS3102	Computer Networks	3	0	0	3
3	PCC	CS3103	Software Engineering	3	0	0	3
4	PCC	CS3104	Operating Systems	3	0	0	3
5	PEC	CS31XX	Elective - I	3	0	0	3
6	PCC	CS3181	Computer Networks Lab	0	0	3	1.5
7	PCC	CS3182	Software Engineering Lab	0	0	3	1.5
8	PCC	CS3183	Operating System Lab	0	0	3	1.5
9	HSMC	EG3184	English Lab III	0	0	3	1.5
Total				**15**	**0**	**12**	**21**

ENGINEERING THIRD YEAR:SEMESTER-2

Sl. No.	Course Type	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PCC	CS3201	Cryptography and Networks Security	3	0	0	3
2	PEC	CS32XX	Elective-II	3	0	2	4
3	PEC	CS32XX	Elective - III	3	0	2	4
4	PEC	CS32XX	Elective - IV	3	0	2	4
5	OEC	CS32XX	Open Elective-I	3	0	0	3
6	PR	CS3291	Mini Project	0	0	6	3
7	MC	HS3204	Career Development Course	1	0	0	0
Total				**16**	**0**	**12**	**21**

ENGINEERING THIRD YEAR:SUMMER SEMESTER

Course Code	Course Title	Hours per week			Credits
		L	T	P	
CS3292	Summer Internship	0	0	6	3

ENGINEERING FOURTH YEAR:SEMESTER-1

Sl. No.	Course Type	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PEC	CS41XX	Elective-V	3	0	0	3
2	PEC	CS41XX	Elective-VI	3	0	0	3
3	OEC	CS41XX	Open Elective - II	3	0	0	3
4	PR	CS4193	Project-I	0	0	12	6
Total				**9**	**0**	**15**	**15**

ENGINEERING FOURTH YEAR:SEMESTER-2

Sl. No.	Course Type	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PEC	CS42XX	Elective-VII	3	0	0	3
2	OEC	CS42XX	Open Elective-III	3	0	0	3
3	OEC	CS42XX	Open Elective-IV	3	0	0	3
4	PR	CS4294	Project-II	0	0	12	6
5	HSMC	CS4299	Community Service	0	0	4	2
Total				**9**	**0**	**16**	**17**

** All Program Electives and Open-Electives can be done through MOOCs duly following Institute norms.

****

ENGINEERING FIRST YEAR: SEMESTER-I

Course Code	Course Name	Course Category	L-T-P	Credits
MA1102	**Engineering Mathematics-I**	**BSC**	**3-1-0**	**4**

Course Learning Objectives:

1. Discuss the Solutions of first order differential equations
2. Understand Continuity and differentiability of multi-variable functions and its applications to discuss maximum and minimum
3. Discuss the convergence Improper integrals and apply Leibnitz rule
4. Discuss the linear transformation and its Eigen values and Eigen vectors.
5. Discuss numerical methods to find the roots of polynomial and transcendental equations Interpolating and Fitting the curves for data points.
6. Evaluate integrals by using numerical methods and solving IVP

Course Content:

Unit – I **(8 Contact hours)**

Differential equations of first order and first degree:

Basic concepts, Variable Separable method, homogeneous differential equations, Exact differential equations, Integrating factor, Differentiable equations Reducible to exact, Linear differential equations, Bernoulli differential equations

Unit - II **(16 Contact hours)**

Functions of several variables:

Limit, Continuity and Differentiability of functions of several variables, Partial derivatives and their geometrical interpretation, Differentials, Derivatives of Composite and Implicit functions, Chain rule, Jacobians, Derivatives of higher order, Homogeneous functions, Euler's theorem, and Harmonic functions, Taylor's expansion of functions of several variables, Maxima and Minima of functions of several variables - Lagrange's method of multipliers.

Unit - III **(8 Contact hours)**

Beta and Gamma Functions:

Convergence of improper integrals, tests of convergence, Beta and Gamma functions - elementary properties, differentiation under integral sign, and differentiation of integrals with variable limits - Leibnitz rule.

Unit - IV **(11 Contact hours)**

Linear Algebra:

Vector Spaces, Linear Combinations of Vectors, Linear dependence and Independence, System of Linear Equations, Rank of a Matrix, Inverse of a matrix, Eigen values and Eigen Vectors. Properties for various type of matrices (i.e Symmetric, skew-symmetric, Hermitian, Skew - Hermitian, Orthogonal, Unitary matrices and Idempotent matrix).

Unit - V **(9 Contact hours)**

Numerical solution of transcendental equations, Interpolation and Curve fitting:

Roots of polynomial and transcendental equations – bisection method, Regula-falsi method and Newton-Raphson method, Finite differences, Newton's forward and backward interpolation formulae, Gauss central difference Interpolation formulae, Curve fitting by Least square method [(i) straight line (ii) Parabola].

Unit – VI **(8 Contact hours)**

Numerical integration and numerical solution of IVP:

Lagrange interpolation, Divided differences, Trapezoidal rule, Simpson's 1/3rd rule rule for numerical integration, Solution of IVP by Euler and Runga-Kutta method.

Learning resources

Text book:

1. ERWIN KREYSZIG**, '***Advanced Engineering Mathematics'*, Wiley-India, 9th Edition.

Reference Books:

1. TOM M. APOSTAL**,***' Calculus, Volume II'*, Wiley-India, Second Edition,
2. R. K. JAIN AND S. R. K. IYENGAR,' *Advanced Engineering Mathematics'*, Narosa Publishers, 3rd Edition.
3. B.S.GREWAL**, '***Higher Engineering Mathematics'*, Khanna Publishers, 42nd Edition.

Web resources:

1. NPTEL, IIT- Madras, 08-June-2017, Introduction to ordinary differential equations URL: https://nptel.ac.in/courses/111106100/12
2. NPTEL, IIT- Kanpur, 15-March-2016, Differential Calculus of Several Variables URL: https://nptel.ac.in/courses/111104092/11
3. RGUKT Course Content.

Course outcomes: At the end of the course, the student will be able to

CO 1	Solve first order differential equations.
CO 2	Explain limits and continuity, differentiability and partial derivatives of functions of multivariable and solve the extremum problems subjected to constraints.
CO 3	Apply Leibnitz rule and beta gamma functions to evaluate improper integrals.
CO 4	Finding Eigen values and Eigen vector for a linear transformation.
CO 5	Approximate the roots of polynomial and transcendental equations.
CO 6	Approximate the value at a point by using given discrete data. Solve IVP numerically.

For Theory courses only:

Course Nature	**Theory**

Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Rajiv Gandhi University of Knowledge Technologies - Nuzvid/RKV/Srikakulam/Ongole

Course Code	Course Name	Course Category	L-T-P	Credits
EC1109	Basic Electrical and Electronics Engineering	ESC	3-0-0	3

Course Learning Objectives

1. Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology.
2. Provide knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
3. To explain the working principle, construction, applications of DC machines, AC machines.
4. Realize the importance of electronic devices in the present technology.

Course Content:

Unit-I **(13 Contact hours)**

DC Circuits: Parallel circuits, Star-delta and delta-star transformations, equivalent resistance calculation, Mesh and Nodal analysis, superposition theorem, thevenin's theorem and maximum power transfer theorem. Introduction, Basic definitions, Types of elements, Ohm's Law, Kirchhoff's Laws, Series.

Unit-II (**7 Contact hours)**

AC Circuits

Single-phase: Inductive circuits, capacitive circuits, series RL, RC and RLC circuits, resonance

Three-phase: star connection and delta connection.

Unit-III **(9 Contact hours)**

DC Machines

Generator: Principle of operation of DC Generator, EMF equation, types, applications
Motor: DC motor types, torque equation, applications, three point starter.

UNIT-IV **(9 Contact hours)**

AC Machines

Transformers: Principle of operation of single phase transformers, EMF equation, losses, efficiency and regulation.

Induction Machine: Principle of operation of induction motor, slip-torque characteristics, applications.

UNIT-V **(9 Contact hours)**

Semiconductor Devices

Diode: types of semiconductors, P-N junction diode, V-I Characteristics, zener diode, Diode Applications. **Rectifiers:** Half wave, Full wave and Bridge rectifiers.

UNIT-VI **(7 Contact hours)**

Transistors

PNP and NPN Junction transistor, Transistor configurations, Transistor as an amplifier

Learning Resources

Text books:

Basic Electrical and Electronics Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.

Reference Books:

Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand & Co.

Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.

Web Resources:

1. Prof T S Natarajan, NPTEL-IIT Madras, 'Basic Electronics'
   URL: https://nptel.ac.in/courses/122106025/
2. Prof U Umanand, IISC Bangalore, 'Basic Electrical Technology'.
   URL: http://nptel.ac.in/courses/108108076/
3. Prof S Aniruddhan, IIT Madras, 'Basic Electrical Circuits'.
   URL: https://onlinecourses.nptel.ac.in/noc16_ee03

Course Outcomes:

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

CO 1	Predict the behaviour of any electrical and magnetic circuits.
CO 2	Formulate and solve complex AC, DC circuits
CO 3	Identify the type of electrical machine used for that particular application
CO 4	Realize the requirement of transformers in transmission and distribution of electric power and other applications
CO 5	Utilize the semiconductor devices like diodes and transistors
CO 6	Internlink Knowledge of electrical and electronic circuits to general problems

Assessment Method:

Assessment Tool	Weekly tests/Assignments (In semester)	Monthly tests (In semester)	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Rajiv Gandhi University of Knowledge Technologies -

Nuzvid/RKV/Srikakulam/Ongole

Course Code	Course Name	Course Category	L-T-P	Credits
CS1101	**Problem Solving and Programming Through C**	**ESC**	**3-1-0**	**4**

Course Learning Objectives:

1. To understand the various steps in Program development.
2. To understand the basic concepts in C Programming Language.
3. To learn about arrays and character arrays
4. To learn how to write modular and readable C Programs
5. To understand the basic concepts of Pointers and Dynamic memory allocation.
6. To understand the usage of Structure and Unions and about file operations

Course Content:

UNIT – I **(10 Contact hours)**

Introduction to Computer Programming: Computing Environments, Computer Languages, Creating and Running Programs. Algorithms and Flow charts :

Definition of Algorithms and examples, Introduction to C Language - Background, C Identifiers, Data Types, Operators, Variables, Constants, Input / Output, Expressions, C Programs, Precedence and Associativity, Evaluating Expressions, Type Conversion, Statements, Bitwise Operators.

UNIT-II **(10 Contact hours)**

Conditional Statements and Loops: if-else, switch Statements, Standard Functions. Repetition: loops, while, for, do-while statements, Loop examples, break, continue and GOTO statements.

UNIT-III **(8 Contact hours)**

Arrays: Array Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays;

Strings: Declaring, Initializing, Printing and reading strings, string manipulation functions, String input and output functions, array of strings,

UNIT – IV **(12 Contact hours)**

Functions: Designing Structured Programs, Function Basics, User Defined Functions, Inter Function Communication, Standard Functions, Recursion- Recursive Functions, Preprocessor Commands. Strings - Concepts, C Strings, String Input / Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – V **(10 Contact hours)**

Pointers: Introduction, Pointers to Pointers, Compatibility, void Pointers, Arrays and Pointers, Pointer constants, Pointers and Strings, Pointers to Functions, Pointers to Constant Objects, Constant Pointers, Pointer Arithmetic. Call-by-reference: Pointers for Inter-Function Communication, Passing Arrays to a Function.

Dynamic Memory Allocation: Memory Allocation Functions, Programming Applications, Command-line Arguments.

UNIT – VI **(10 Contact hours)**

The Type Definition (type def), Enumerated Types .

Structure& Union: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, definition and Initialization of Union, Accessing of Union.

Files: Input and Output: Files, Streams, Standard library Input Output Functions, Character Input Output Functions.

Learning resources

Text book:

1. Reema Thareja, " Programming in C", Oxford Publications, 2nd Edition

Reference Books:

1. E. BalaguruSwamy, " Programming in ANSI C", Mc Graw Hill, 7th Edition
2. Brian W. Kernighan, Dennis M. Ritchie, " The C Programming Language", Prentice Hall, 2nd Edition

Web resources:

Indian Institute of Technology, Kharagpur, "Problem Solving through Programming in C", https://nptel.ac.in/courses/106105171/

Course outcomes: At the end of the course, the student will be able to

CO 1	Develop flowcharts, algorithms for given complex problems.
CO 2	Analyze basic programming constructs.
CO 3	Write C programs for real world problems. Implement C programming by using various control structures.
CO 4	Able to write rite modular and readable C Programs
CO 5	Able to use pointers in C programming
CO 6	Appreciate coding standards and best practices for program development.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS1102	IT Workshop	ESC	2-0-0	2

Course Objectives:

1. The IT Workshop is a training lab course to get training on PC Hardware, Internet & World Wide Web, and Productivity tools for documentation, Spreadsheet computations, and Presentation.
2. To introduce to a personal computer and its basic peripherals, the process of assembling a personal computer,
3. Installation of system software like MS Windows, Linux and the required device drivers, hardware and software level troubleshooting process.
4. To introduce connecting the PC on to the internet from home and workplace and effectively usage of the internet, Usage of web browsers, email, newsgroups and discussion forums.
5. To get knowledge in awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber-attacks.
6. To introduce the usage of Productivity tools in crafting professional word documents, excel spreadsheets and powerpoint presentations using open office tools and Latex

Course Content:

UNIT I **(5 Hours)**

Hardware: Working PC to disassemble and assemble to working condition; Identifying the peripherals of a computer, components in a CPU and its functions; Installing operating system from Linux Family and Windows on the same PC with dual boot; Hardware Troubleshooting; Software Troubleshooting.

UNIT II **(5 Hours)**

Internet & World Wide Web: Introduction to Internet & World Wide Web; Connecting to Internet – IP Configuration, Proxy Settings, Gateways, DNS Server; Accessing Websites & Emails; Web Browsers and various plug ins; Search Engine and Netiquette;

UNIT III **(4 Hours)**

Cyber Awareness – Cyber Hygiene, Awareness of Cyber Crimes, Financial Loss due to Cyber Crimes, Data Loss & Data Theft due to Cyber Crimes, Psychological Harm due to Cyber Crimes.

UNIT IV **(5 Hours)**

Productivity Tools: Latex and Word: An overview of Latex and Microsoft (MS) office / equivalent (FOSS)tool word should be learned: Importance of Latex and MS office / equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that should be covered in Seach, using Latex and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

UNIT V **(5 Hours)**

Productivity Tool : Spreadsheet : Accessing, overview of toolbars, saving spreadsheet files, Using help and resources, Gridlines, Format Cells, Summation, auto fill, Formatting Text.

UNIT VI

Presentation Tools: Power Point and Flash (6 Hours)

Basic Power Presentation, PPT orientation, Slide Layouts, Inserting & Formatting Text, Inserting Images & Videos, Tables & Charts, Slide Transitions & Animations.

REFERENCE BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. Latex Companion – Leslie Lamppost, PHI/Pearson.
3. Comdex Information Technology course tool kit Visas Gupta, WILEY Dramatic
4. IT Essentials PC Hardware and Software Companion Guide Third Edition by David.
5. Anfinsen and Ken Quamme. – CISCO Press, Pearson Education.
6. PC Hardware and A+ Handbook – Kate J. Chase PHI (Microsoft)
7. https://www.eckovation.com/course/cyber-awareness-foundation-course#curriculum.

Course Outcomes:

CO 1	Apply knowledge for computer assembling and software installation.
CO 2	Ability how to solve the trouble shooting problems.
CO 3	Apply the tools for preparation of PPT, Documentation and budget sheet etc.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course code	Course Name	Course Category	L-T-P	Credits
CS1102	**IT Workshop Laboratory**	**PCC**	**0-0-4**	**2**

Experiments in IT Workshop:

1. Every student should Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor. Every student should disassemble and assemble the PC back to working condition.
2. Every student should individually install operating system like Linux or MS windows on the personal computer. The system should be configured as dual boot with both windows and Linux.
3. Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition.
4. Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.
5. Cyber Hygiene: Students should learn about viruses on the internet and install antivirus software. Student should learn to customize the browsers to block pop ups, block active x downloads to avoid viruses and/or worms.
6. Develop home page: Student should learn to develop his/her home page using HTML consisting of his/her photo, name, address and education details as a table and his/her skill set as a list.

Using LaTeX and Word to create project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs in word.

Spreadsheet Orientation: Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. **Creating a Scheduler**:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in spreadsheet – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, Sorting, Conditional formatting, Managing workbooks and analyzing the data, using functions & tables.

Creating Power Point: Student should work on basic power point utilities and tools in Latex and Ms Office/equivalent (FOSS) which help them create basic power point presentation. PPT orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting Images & videos, Tables and Charts, Slide Transitions and animations.

For Lab courses only:

Course Nature		**Practical**		
Assessment Method				
Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

****

EG1281	**English Language Laboratory**	**HSC**	**L : T 1: P1.5**	**2.5 credits**

Objectives:

- The sole aim of the course is to make students effective communicators.
- The focus of this course is on communication skills which cover the four major language skills, namely, reading, listening, speaking and writing besides Functional English grammar.
- It will improve the language proficiency of the students in English with emphasis on LSRW skills
- It will develop the communication skills of the students in both formal and informal situations.

Unit 1

THEORY – 1 CREDITS - (1.5HRS CONTACT PERIOD IN A WEEK)

1. “Human Resources” - English For Engineers And Technologists – Theory – 1credit

LABORATORY / PRACTICALS 1.5 CREDITS - (3HRS CONTACT PERIOD IN A WEEK)

Total contact hours = 13.5 hrs

2. **LISTENING**
   2.1 Podcasts – 5

3. **SPEAKING**
   3.1 British Council – A1 –level – Modules 1-5
   3.2 ESL conversations – 5

4. **READING**
   4.1Introduction to Reading Comprehension Passages
   4.2Types of RC passages
   4.3Tactics to tackle RC questions

5. **WRITING**
   5.1Rearrangement of Jumbled Words and Sentences
   5.2Format of the Questions

6. **Essential English Grammar**
   6.1 I have to (33)
   6.2 Do this/Don't do that!/ Let's do this (35)

7. **Oxford Interactive laboratory – LSRW software – Compulsory Practice**

Unit 2

THEORY – 1 CREDITS - (1.5HRS CONTACT PERIOD IN A WEEK)

1. "An Ideal Family" -Panorama: A Course on Reading– Theory – 1credit

LABORATORY / PRACTICALS 1.5 CREDITS - (3HRS CONTACT PERIOD IN A WEEK)

Total contact hours = 13.5 hrs

2. **LISTENING**
   2.1Podcasts – 5 – LISTENING SKILLS

3. **SPEAKING**
   3.1 British Council – A1 –level – Modules 6-10
   3.2 ESL conversations - 5

4. **READING**
   4.1. Types of RC passages
   4.2. Time saving tactics

5. **WRITING**
   5.1Rearrangement of Jumbled Words and Sentences
   5.2Format of the Questions

6. **Essential English Grammar**

6.1 I used to (36)
6.2 There and it (37-39)

7. **Oxford Interactive laboratory – LSRW software – Compulsory Practice**

Unit 3

THEORY – 1 CREDITS - (1.5HRS CONTACT PERIOD IN A WEEK)

1. "Transport: Problems and Solutions"– English for Engineers and Technologists -Theory – 1credit

LABORATORY / PRACTICALS 1.5 CREDITS - (3HRS CONTACT PERIOD IN A WEEK)

Total contact hours = 13.5 hrs

2. **LISTENING**
   2.1Podcasts – 5

3. **SPEAKING**
   3.1British Council – A1 –level – Modules 11-15
   3.2 ESL conversations - 5

4. **READING -**
   4.1. RC Practice Tests – 5

5. **WRITING**
   5.1Accuracy Building Zone – Exercises 1 – 5

6. **Essential English Grammar**
   6.1. I do – Do you? – So do I – I don't (40 -43)
   6.2. Is it…? – Have you …? – Do they ….? (44-48)

7. **Oxford Interactive laboratory – LSRW software – Compulsory Practice**

Unit 4

THEORY – 1 CREDITS - (1.5HRS CONTACT PERIOD IN A WEEK)

1. " War "– Panorama: A course on Reading-Theory – 1credit

LABORATORY / PRACTICALS 1.5 CREDITS - (3HRS CONTACT PERIOD IN A WEEK)

Total contact hours = 13.5 hrs

2. **LISTENING**
   2.1Podcasts – 5 – LISTENING SKILLS

3. **SPEAKING**
   3.1British Council – A1 –level – Modules 16-20
   3.2 ESL conversations - 5

4. **READING -**
   4.1. RC Practice Tests – 6-10

5. **WRITING**
   5.1Accuracy Building Zone – Exercises 6 – 10

6. **Essential English Grammar**
   6.1 Do you know where ….? (49)
   6.2 She said that … He told me that …. (50)

7. **Oxford Interactive laboratory – LSRW software – Compulsory Practice**

Unit 5

THEORY – 1 CREDITS - (1.5HRS CONTACT PERIOD IN A WEEK)

1. “ Evaluating Technology ”– English for Engineers and Technologists -Theory – 1credit

   LABORATORY / PRACTICALS 1.5 CREDITS - (3HRS CONTACT PERIOD IN A WEEK)

2. **LISTENING**
   2.1Podcasts – 5

3. **SPEAKING**
   3.1British Council – A2 –level – Modules 1-5
   3.2 ESL conversations - 5

4. **READING -**
   4.1. RC Practice Tests – 1-5

5. **WRITING**
   5.1 Accuracy Building Zone – Exercises 11 – 15

6. **Essential English Grammar**
   6.1 Doing – do - to do – (51-55)
   6.2 Do – make – have – (57 - 58)

7. **Oxford Interactive laboratory – LSRW software – Compulsory Practice**

Course outcomes

After the completion of this Laboratory course, the students will be able to

CO 1	Critically analyze a text and be more efficient in comprehensions and vocabulary.
CO 2	Learn writing effectively.
CO 3	Speak confidently and spontaneously.
CO 4	Present the presentations effectively overcoming stress, fear and anxiety.
CO 5	Build a strong ethical personality.
CO 6	Implementing practically the four skills of English besides competency in functional English.

References
Textual

1. **British Council Face 2 Face Instruction Material**
2. **Objective English by Edgar Thorpe and Showick Thorpe**
3. **Oxford Interactive Lab Course**
4. **English For Engineers And Technologists, published by Orient Blackswan Pvt Ltd**
5. **Non-Detailed Text Book: Panorama – A Course On Reading, published by Oxford University Press India**
6. **Raymond Murphy: Essential English Grammar: A Self-Study Reference and Practice Book (CUP)**

Web Resources

1. **www.Eslfast .com**
2. **www.British council.org**

Assessment Method

Weightage (%)	Internal Marks	External Marks	Total Marks
	40%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
EC1189	Basic Electrical and Electronics Engineering Laboratory	**ESC**	**0-0-3**	**1.5**

Course Learning Objective:

1. To make student get familiarized with the electrical and electronic measuring equipments.
2. To make understand the student the concepts of characteristics of Resistors, Capacitors and Inductors.
3. To understand the behavior of electrical equipments.
4. To understand the concepts of diodes, transistors and amplification.

List of Experiments:

Familiarization with DSO, Function generators, RPS, FPS, Multimeters and other lab equipments

Section A: Electrical Engineering Laboratory:

1. Verification of ohm’s law, series and parallel circuits
2. Verification of Kirchhoff’s Laws
3. Verification of Voltage division and Current division principles
4. Verification of circuit theorems
5. V-I characteristics of Incandescent and CFL lamp
6. V-I characteristics of Fluorescent lamp
7. A.C analysis of series R-L circuit and R-C circuit
8. Calibration of Energy meter
9. Open circuit characteristics of D.C Generator
10. Speed control of D.C shunt Motor
11. Three phase power measurement
12. Lab project

Section B: Electronics Engineering Laboratory:

1. Familiarization with any CAD tools like multisim/Pspice/ngspice for doing basic experiments .
2. V-I characteristics of a P-N junction diode and zener diode
3. Half wave and center tapped full wave rectifier
4. Full wave bridge Rectifier with and without filters.
5. Design of a simple amplifier using BJT
6. Experiment on simple analog-modulation scheme
7. Simple experiment on Arduino kit and interfacing with sensors

8. Lab project

Course outcome

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

CO 1	Design basic circuits using P-N junction diode and Zener diode
CO 2	Design rectifier circuits considering the practical aspects into consideration
CO 3	Design simple amplifier with required gain
CO 4	Use circuit knowledge in analyzing Arduino boards
CO 5	Designing simple experiments using Arduino board and sensors interfacing
CO 6	Experimental verification of basic circuit laws and circuit theorems
CO 7	Experimental analysis of V-I characteristics of different electrical and electronic equipments
CO 8	Experimental analysis of electrical machines likes motors, generators etc
CO 9	Design of a simple prototype project

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS1181	Programming Lab	ESC	0-0-3	1.5

Course Learning Objective:

1. Identify situations where computational methods and computers would be useful.
2. Given a computational problem, identify and abstractthe programming task involved.
3. Approach the programming tasks using techniques learned and write pseudo-code.
4. To understand the concepts of Programming language
5. To learn the basics of C declarations, operators and expressions
6. To learn on the manipulation of strings, functions and pointers
7. To apply concepts and techniques for implementation

List of Programming Assignments for Laboratory:

Statements, Expressions & Conditionals

1. Write a program to print the memory allocation required for all the datatype in C Language.
2. Write a program to check whether the given number is even number or odd number.
3. Write a menu based program to take of input of two values followed input of choice and accordingly perform arithmetic operations like Addition, Subtraction, Multiplication, Modulus, Division, Power(Using Switch Statement)
4. Write a program to swap two given numbers with and without using extra variable.
5. Write a program to find out the whether the given number is a perfect square or not.
6. Write a program to find out whether the given number is positive, negative or zero value.

Iterative Constructs - I: For Loop, While Loop &Do. While

1. Write a program print all the factors of a given number
2. Write a program to find the factorial of a given number
3. Write a program to find whether a given number is Palindrome or not.
4. Write a program to find whether a given number is Prime or not.
5. Write a program to print the Fibonacci series upto given ‘n’ number of terms.

Iterative Constructs – II: Nested Loops

1. Write a program to print the first ‘n’ prime numbers and prime numbers upto ‘n’ value.
2. Write a program to print the Pascal Triangle for given ‘n’ value
3. Write a program to print the first ‘n’ perfect number for a given ‘n’ value.
4. Write a program to print the following pattern for given ‘n’ value.

5. For Eg. If n = 3, the output would be

```
                    *
              *     *     *
        *     *     *     *     *
              *     *     *
                    *
```

6. Write a program to print the following pattern for given 'n' value
   For Eg. If n = 4, the output would be

```
                    2
              3     5
        7     11    13
  17    19    23    29
```

Single Dimensional Arrays: Basic Operations and Problems

1. Write a program to take an input array of 'n' numbers and find out the sum of all the elements, product of all the elements and mean of the array.
2. Write a program to take an input array of 'n' numbers and print the second smallest and second largest element of all elements in the array.

Two Dimensional Arrays –Matrices& its operations

1. Write a program to find the addition and subtraction for the given two matrices of sizes 'M x N' and 'P x Q' respectively
2. Write a program to find the multiplication of the given two matrices of sizes 'M x N' and 'P x Q' respectively.
3. Write a program to find transpose of a matrix.

Strings – Dealing with non-numerical data

1. Write a program to convert the Lower Case letters to Upper Case Letters and Upper Case Letters to Lower Case Letters in a given input string.
2. Write a program to the print out the number of vowels, consonants, and digits (0-9) present in the given input string.
3. Write a program to check whether the given input string is palindrome string or not
4. Write a program to sort the given string of characters.

Array of Strings

1. Write a program to find the strings starting with "c" and "a" for the given n input strings..
2. Write a program to print the words of given input string in reverse order For

Eg. If input string is “I am an Indian”, the output would be “Indian an am I”

3. Write a program to arrange the given ‘n’ strings in Dictionary Order.

Functions

4. Write a program to implement the string operations like Length of String, String Copying, String Concatenation, Conversion to Uppercase and String Comparison.(Define own Function for each of the operation. Header file “string.h” is not allowed)
5. Write a C program to implement Multiplication and Division Operations without using operators “*” and “\” respectively. Define function “mul” for multiplication and “div” for integer division.

Recursion

1. Write a program to print the integers from 1 to N and then N to 1 for the given input number ‘N’ without using any loops.
2. Write a program to find the X power N($X^{N)}$ using the user defined recursive function “pow(X,N)” without using any predefined function from the library.
3. Write a program to find the GCD of two numbers ‘a’ and ‘b’ by defining a recursive function GCD(a,b).

Structures

1. Write a program to take the information of ‘n’ Students (REGID, Name, CGPA, Address – Village, District, Phone NO) and print the topper among the n students.
2. Write a program to take the information of ‘n’ Students (REGID, Name, CGPA, Address – Village, District, Phone NO) and print the students in the ascending order of Regn ID.
3. Write a program to take the information of ‘n’ Students (REGID, Name, CGPA, Address – Village, District, Phone NO)and print the list of Phone Number for the students who are the above average of CGPA.

File Handling – Create, Read and Write operations on File

1. Write a program to print the number of lines and words in a given input file name.
2. Write a program to copy from the given file to another file.
3. Write a program to append one file at the end of another file.
4. Write a program to search for a word in a given text file.

Course outcomes

At the end of the course, the student will be able

CO 1	To formulate the algorithms for simple problems
CO 2	To translate the given algorithms to a working and correct program
CO 3	To identify and correct logical errors encountered at run time
CO 4	To write iterative as well as recursive programs

CO 5	To represent Data in arrays, strings, Structures and manipulate them through a program
CO 6	To decompose a problem into functions and synthesize a complete program
CO 7	To be able to create, read and write to and from text files

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course code	Course name	Course Category	L-T-P	Credits
MG1101	Indian Constitution	MC	1-0-0	0

Course Learning Objectives:

1. The basic objective of the course is to provide knowledge about institutions
2. It help to understands the processes to governing the society in a systematic way.
3. It helps to establish social Justice, Liberty, Equity and Fraternity.
4. The course will introduce the idea of political system in general
5. It provides idea about working process of constitutional institutions.
6. To create awareness about the functioning of the judicial system in India.

Course Contents

UNIT-I **(5 Contact hours)**

Introduction-Constitution' meaning of the term, Indian constitution sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and duties, Directive Principles of State Policy.

UNIT-II **(5Contact hours)**

Union Government and its Administration-Structure of the Indian Union: Federalism, centre-state relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Loksabha, Rajyasabha.

UNIT-III **(5 Contact hours)**

Election commission-Election commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

UNIT-IV **(3 Contact hours)**

State Government and its Administration- Governor: Role and position, CM and Council of ministers, state secretariat: Organization, structure and functions.

UNIT-V **(7 Contact hours)**

Local Administration-District's Administration head: Role and importance, Municipalities: Introduction, Mayor and role of Elected Representatives, CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role, Block level: Organizational Hierarchy (different departments), Village level: Role of elected and appointed officials, Importance of grass root democracy.

UNIT-VI **(5 Contact hours)**

Union Judiciary-Establishment and constitution of Supreme court, Appointment of Judges, Establishment of State High court, Establishment of common High court for 2 or more states, WRITS, PIL(Public Interest Litigation).

Learning resources

Text book:

1. Durga Das Basu,*Constitutions of India*, 23rded, LexisNexis Publication.

Reference Books:

1.'Indian Polity' by Laxmikanth
2.'Indian Administration' by SubhashKashyap
3.'Indian Administration' by Avasti and Avasti
4.'Government and Politics of India' by W.H.Mrrison Jones
5.'Constitution of India' by J.C.Johari

Course outcomes: At the end of the course, the student will be able to

CO 1	The students will understand their fundamental rules and duties.
CO 2	The students will learn the political system and the system of elections in India.
CO 3	It is to provide the students the institutions and processes to govern themselves in the manner they prefer.
CO 4	Students can also be able to utilize the laws and facilities provided by constution
CO 5	It will provide over all idea about our legal system.
CO 6	It will enable students more strong in terms of law and practice in day to day life.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	0	0	0	0

****

Rajiv Gandhi University of Knowledge Technologies -

Nuzvid/RKV/Srikakulam/Ongole

ENGINEERING FIRST YEAR: SEMESTER-2

Course code	Course Name	Course Category	L-T-P	Credits
MA1202	**Discrete Mathematics**	**BSC**	**3-1-0**	**4**

Course learning objectives:

1. Develop mathematical maturity of students to build the ability to understand and create mathematical arguments and to teach them how to think logically and mathematically.
2. Prove theorems and Mathematical arguments by using different methods. provide the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security and operating systems.
3. Learn the basic properties of sets and how to work with discrete structures, which are abstract mathematical structures used to represent discrete objects and relationship between these objects.
4. Introduce basic techniques of counting so that they develop the ability to enumerate..
5. Learn the concepts of graphs and its properties, solving real world problems by using graph concepts.
6. Learn the concept of algebraic structures such as semi groups, monoids, groups and concept of homomorphism.

Course Content:

Unit – I **(10 Contact hours)**

Propositional logic:

Syntax, semantics, valid, satisfiable and unsatisfiable formulas, encoding and examining the validity of some logical arguments.

Unit - II **(6 Contact hours)**

Proof techniques:

Forward proof, proof by contradiction, contra positive proofs, proof of necessity and sufficiency.

Unit - III **(12 Contact hours)**

Sets, relations and functions:

Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations, principles of mathematical induction, Finite and infinite sets, countable and uncountable sets, Cantor's diagonal argument and the power set theorem.

Unit - IV **(10 Contact hours)**

Introduction to counting:

Basic counting techniques, inclusion and exclusion,pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating function.

Unit - V **(12 Contact hours)**

Graph Theory:

Graphs and their basic properties, degree, path, cycle, sub graphs, isomorphism, Eulerian and Hamiltonian walks, graph colouring, planar graphs, trees.

Unit – VI **(10 Contact hours)**

Algebraic structures:

Algebraic structures with one binary operation and semi groups, monoids and groups, homomorphism, congruence relation and quotient structures. Free and cyclic monoids and groups, permutation groups, substructures, normal subgroups.

Learning resources:

TEXT BOOKS:

1. Kenneth H. Rosen,'*Discrete Mathematics and its Applications*', Tata McGraw-Hill. Seventh edition

REFERENCE BOOKS:

1. Trembley and Manohar, '*Discrete Mathematical Structures to Computer Science*', by Mc - Graw Hill (1997).
2. Kolman, Busby and Ross, '*Discrete Mathematical Structures*' PHI (2009), Sixth Edition.
3. Thomas Koshy, '*Discrete Mathematics with Applications*', Elsevier Academic press.

Web resources:

1. 1. NPTEL Lectures by Prof. Kamala Krithivasan, Dept of CSE,IIT Madras
2. **link:** https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20
3. MIT open course ware: Mathematics for Computer Science, Fall 2010. Instructor: Tom Leighton https://www.youtube.com/watch?v=L3LMbpZIKhQ&list=PLB7540DEDD482705B
4. Also visit: http://ocw.mit.edu/6-042JF10
5. Discrete Mathematics for GATE. IIT lecture:
6. https://www.youtube.com/watch?v=E6uhC0pT9J8&list=PLEJxKK7AcSEGD7ty8DB1aU0xVG_P_hs_0
7. 4.RGUKT Course Content

Course outcomes: At the end of the course, the student will be able to

CO 1	Read, comprehend and construct mathematical argument
CO 2	Prove theorems and mathematical statements in different techniques.
CO 3	Deal with set, relation, countability and functions.
CO 4	Apply permutation, combination, pigeon hole principle, recurrence relation and generating functions to enumerate objects.
CO 5	Understand and apply concepts of graph in many computer science courses.
CO 6	Solve problems on group.

Assessment method for Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Rajiv Gandhi University of Knowledge Technologies -

Nuzvid/RKV/Srikakulam/Ongole

Course code	Course name	Course Category	L-T-P	Credits
PY1201	E1 Engineering Physics-CSE	BSC	3-1-3	5.5

Course Learning Objectives:

1. To learn different optical phenomena shown by light waves related to interference, diffraction, polarization and their application.
2. To learn about working of LASERS and its applications. To learn about introduction of optical fibers, their applications in our lives and some interesting facts associated with optical fibers. Student also learn light wave communication systems, and holography and for sensing physical parameters.
3. Student will learn fundamentals of quantum mechanics like wave function, particle in 1D box and its applications in real life. Student also learns the basics of Quantum computing.
4. Students will get knowledge about the band theory of solids and qualitative treatment of Kronig-Penny model. To acquire the knowledge about semiconductors and the characteristics of basic electronics devices
5. Understand the nature and characterization of acoustic design and applications
6. Understand the theory, preparations and applications of functional materials and nano materials.

Course Content:

Unit – I: Wave Optics (14 Hours)

Interference**:** Superposition principle, Division of amplitude and wave front division, Interferometers (Michelson), Applications; Diffraction: Fraunhoffer diffraction (single, double & multiple slits), Rayleigh criterion for resolving power, Dispersive power, Applications. Polarization: Production & detection of polarized light, wave plates, optical acivity, Laurents Half-shade polarimeter, photo-elasticity and applications

Unit – II: LASERS AND Optical fibers (16 Hours)

Basic principles of Lasers, Theory of Lasers, Types of Lasers, He-Ne, Nd-YAG and semiconductors lasers, applications of lasers, Basic principles of Holography, types of holograms, holographic NDT. Light propagation in Optical fibers, Basic principles in optical fibers, types of optical fibers, optical fibers for communication and sensing.

Unit – III: Acoustics (12 Hours)

Introduction, Reverberation and reverberation time, growth and decay of energy, Sabine's formula, absorption coefficient and its measurement, factors affecting architectural acoustics, production, detection and applications of Ultrasound.

Unit IV: Quantum Mechanics (15 Hours)

Failure of classical physics**,** De Broglie waves & Uncertainty Principle, Wave function, Schrodinger Equation & probability interpretation, Operators, expectation values, Time independent Schrodinger Equation and its Applications, Particle in a box (1-D). Introduction to Quantum computing -difference between classical computing and quantum computing, data representation-classical bits & quantum bits –qubits.

Unit V: Semiconductor Physics (15 Hours)

Electron in periodic structures, Band theory of solids, Kronig-Penny model (qualitative treatment), E-K curve, effective mass, Density of states, Fermi levels. Intrinsic and extrinsic semiconductors, dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, Hall effect- Hall sensors- Hall effect switches and, Physics of p-n junction, Metal-semiconductor junction (Ohmic and Schottky)

Unit – VI: Functional materials: **(15 Hours)**

Fiber reinforced plastics, fiber reinforced metals, surface acoustic wave materials, biomaterials, high temperature materials, smart materials and their applications, Introduction to Nano materials and applications.

Text Books:

1. Hitendra K. Malik and A. K. Singh, '*Engineering Physics*' Tata McGraw Hill, 2nd Edition, 2017
2. Dr. M.N Avadhanulu, Dr. P.G Kishore sagar, '*A Textbook of Engineering Physics'* S.chand, 2014
3. Gaur and Gupta "*Engineering Physics*, Dhanpathrai Publications, 6th edition

References:

1. Ajoy Ghatak '*Optics*' Tata McGraw Hill, 6th Edition
2. M. Armugam, Anuradha '*Engineering Physics*', Agencies publishers, 2003
3. David McMahon, '*Quantum Computing Explained'*, Wiley, 2016

Course outcomes: At the end of the course, the student will be able to

CO1.Student will be able to understand the phenomena of interference, diffraction and polarization exhibited by light waves.

CO2. Student will be able to understand the working and construction of LASERS and its applications in various fields. Student will get knowledge about optical fibers and their applications.

CO3. Student will be able to construct a quantum mechanical model to explain the behavior of a system at microscopic level and solve engineering problems using the laws of quantum mechanics.

CO4. Student will able to understand the properties of semiconductors and basic electronic devices

CO5. Student will able to understand the nature and characterization of acoustic design and ultra-sonic waves applications

CO6. Students will get knowledge about new emerging materials and its applications and use in various fields.

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
ME1214	Engineering Graphics & Computer Drafting	ESC	1-0-3	2.5

Course Learning Objectives:

1. To know about emergence of Engineering Graphics as a refined communication tool and to be aware of International and national standards of practice for uniform presentation of drawings.
2. To adopt the projection of three-dimensional object orthogonally on a set of vertical and horizontal planes and obtain the views of the frontal and the top surfaces.
3. To describe the position of a point and position of the line with respect to all the planes of projection and obtain its views.
4. To learn orthographic projections of various simple plane surfaces in simple and inclined positions.
5. To know about orthographic projections of right and regular solids in simple positions, when their axes are perpendicular to one reference plane and parallel to the other.
6. To learn about types of cutting planes and to obtain views of simple solids.
7. To learn about different methodologies to be used for obtaining the two dimensional layout of the lateral surfaces of uncut solids.
8. To learn about computer aided drafting techniques and to be familiarize with one of the most powerful software 'AutoCAD'.

Course Content:

Unit - I **(6 Contact hours)**

Introduction to Engineering drawing – Tools and Standards, Geometric Constructions, Scales, Conics and Special Curves - ellipse, parabola, hyperbola, cycloids, Involutes.

Unit - II **(6 Contact hours)**

Introduction to Orthographic Projections,Projections of Points, Projection of Lines.

Unit - III **(7 Contact hours)**

Projection of Planes, Projections of Solids cube, prism, pyramid, cylinder, cone and sphere.

Unit - IV **(5 Contact hours)**

Sections of Solids - cube, prism, pyramid, cylinder, cone and sphere. Development of Surfaces – Parallel line method and Radial line method.

Unit - V **(6 Contact hours)**

Computer Aided Design – Introduction to AutoCAD, Co-ordinate System (UCS) and their Commands, Basic Commands of Drawing and Editing, Dimensioning and Text.

Unit – VI **(6Contact hours)**

Drawing practice with AutoCAD – Creating 2D Drawings of Objects from Isometric views, Creating Isometric views form Orthographic views and . Introductions to 3D drawings.

Learning Resources

Text Book:

1. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publications

Reference Books:

1. K. Venugopal , "Engineering drawing"
2. N.S. Parthasarathy and Vela Murali , "Engineering Drawing"

Course outcomes: At the end of the course, the student will be able to

CO 1	Student will be aware of International and national standards of practice.
CO 2	Student will be familiar with obtaining the views of the frontal and the top surfaces of an object.
CO 3	Student will be aware of orthographic projections of right and regular solids in simple positions, when their axes are perpendicular to one reference plane and parallel to the other.
CO 4	Student will know about computer aided drafting techniques and will be familiar with one of the most powerful software 'AutoCAD'.

For Theory Courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS1201	Programming through C++	PCC	3-0-0	3

Course Learning Objectives:

1. To understand the various steps in Program development.
2. To understand the basic concepts in C++ Programming Language.
3. To learn about functions and Object oriented concepts in C++
4. To learn how to write programs using OOPS concepts
5. To understand the basic concepts of Constructor and Destructors.
6. To understand the usage of inheritance, polymorphism, templates and exception handling .

Course Content:

UNIT – I **(7 Contact hours)**

Introduction : Differences Between C And C++, The Object Oriented Technology , Disadvantage of Conventional Programming, Concepts of Object Oriented Programming, Advantages of OOP Structure of a C++ Program, Header Files And Libraries, Tokens In C++, Variable Declaration And Initialization, Scope Access Operator, Namespace, Memory Management Operators.

UNIT-II **(7 Contact hours)**

Control & Decision Statements in C++: Decision Statements, Control Loop Statements.

Functions in C++: Introduction, Structure Of Function, Passing Arguments, Default Arguments, Constant Arguments, Inputting Default Arguments, Inline Functions, Function Overloading, Principles of Function Overloading, Recursion.

UNIT-III **(7 Contact hours)**

Classes and Objects : Introduction, Classes In C++, Declaring Objects, Access Specifiers And Their Scope, Member Functions, Outside Member Function As Inline, Data Hiding or Encapsulation, Classes, Objects and Memory, Static Member Variables, Static Member Functions Static Object, Array Of Objects, Objects As Function Arguments, Friend Functions, The Const Member Functions, The Volatile Member Function, Recursive Member Function, Static And Const Classes, Member Function and Non- Member Function, Overloading Member Functions, Nested Class.

UNIT – IV **(8 Contact hours)**

Constructors and Destructors : Introduction, Characteristic Of Constructors & Destructors, Applications With Constructors, Parameterized Constructor, Overloading Constructors (Multiple Constructors), Array Of Objects Using Constructors, Constructors With Default Arguments, Copy Constructors, The Const Objects, Destructors, Calling Constructors And Destructors, Qualifier And Nested Classes, Anonymous Objects, Private Constructors And Destructors, Dynamic Initialization Using Constructors, Dynamic Operators and Constructors, Recursive Constructor, Constructor and Destructor With Static Members.

Operator overloading and Type Conversion : Introduction, Overloading Unary Operators, Constraint on Increment And Decrement Operators, Overloading Binary Operators, Overloading With Friend Function, Overloading Assignment Operator (=), Type Conversion, Rules For Overloading Operators, One Argument Constructor And Operator Function.

UNIT – V **(8 Contact hours)**

Inheritance : Introduction, Reusability, Access Specifiers And Simple Inheritance, Types Of Inheritances, Virtual Base Classes Object As A Class Member, Abstract Classes, Qualifier Classes And Inheritance, Constructor In Derived Class, Pointers And Inheritance, Overloading Member Function, Advantages Of Inheritance, Disadvantages Of Inheritance

Binding, Polymorphism and Virtual Functions: Introduction, Binding In C++, Static (Early) Binding, Dynamic (Late) Binding, Pointer To Base And Derived Class Objects, Virtual Functions, Rules For Virtual Functions, Array Of Pointers, Pure Virtual Functions, Abstract Classes, Working Of Virtual Functions, Virtual Functions In Derived Classes, Object Slicing, Constructors And Virtual Functions, Virtual Destructors, Destructor And Virtual Functions.

UNIT – VI **(8 Contact hours)**

Generic Programming with Templates : Introduction, Need Of Template, Definition Of Class Template, Normal Function Template, Working Of Function Templates, Class Template With More Parameters, Functions Templates With More Arguments, Overloading Of Template Functions, Member Function Templates,Recursion With Template Function, Class Template With Overloaded Operators, Class Template Revisited, Class Templates And Inheritance, Container Classes , Types Of Containers, Container Adaptors, Iterators

Exception Handling : Introduction, Principles Of Exception Handling,The Keywords Try, Throw And Catch , Exception Handling Mechanism, Multiple Catch Statements, Catching Multiple Exceptions, Re- Throwing Exception, Specifying Exception, Exceptions In Constructor And Destructor.

Learning resources

Text book:

1. Programming In C++ , Ashok N Kamthane. Pearson 2nd Edition.

Reference Books:

1. Object Oriented Programming C++ , Joyce Farrell, Cengage
2. Object Oriented Programming with C++, 2nd ed, Sourav Sahay, OXFORD
3. The Complete Reference, C++, 4ed, Herbert Schildt, TMH

Web resources:

1. Indian Institute of Technology, Kharagpur, " Programming in C++", https://nptel.ac.in/courses/106105151/

Course outcomes: At the end of the course, the student will be able to

CO 1	To know the difference between C and C++
CO 2	Analyze basic programming constructs Write C++ programs for real world problems.
CO 3	Implement C++ programming by using OOPS concepts
CO 4	Able to write programs with constructor destructors and to understanding concepts of operator overloading and type conversions
CO 5	Able to use inheritance and virtual functions concepts.
CO 6	Able to understanding the concepts of generic programming and exception handling.

For Theory courses only:

Course Nature	**Theory**
Assessment Method	

Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS1202	**Data Structures**	**PCC**	**3-0-0**	**3**

Course Learning Objectives:

1. To understand the basic concepts such as Abstract Data Types, Linear, and Non Linear Data structures
2. To understand the behavior of data structures such as stacks, queues
3. To understand building of trees and its operations
4. To be familiar with searching and sorting algorithms
5. To choose the appropriate data structure for a specified application.
6. To study various graph processing algorithms and Algorithm Design technique

Course Content:

Unit- I **(7 Contact Hrs)**

Introduction to Linear and Non-Linear data structures. Singly Linked Lists-Operations-Insertion, Deletion, Searching, Concatenation of singly linked lists, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations Insertion, Deletion, Searching.

Unit- II **(8 Contact hours)**

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations, array and linked Implementations in C, Circular Queues-Insertion and deletion operations, Deque (Double ended queue) ADT, array and linked implementations in C.

Unit- III **(9 Contact hours)**

Sorting-Insertion Sort, Selection Sort, Merge Sort, Quick sort, Heap Sort, Comparison of Sorting methods and linear sorting algorithms-Counting sort, Radix sort, shell sort

Searching – Linear Search, Binary Search, Basic Concepts- Hashing Methods- Collision Resolutions- Open Addressing- Linked List Collision Resolution- Bucket Hashing

Unit- IV **(6 Hrs)**

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap, Min-Heap-Operations on Min-Heap.

Unit- V **(9 Contact hours)**

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees-Definition and operations on AVL Tree, Red Black Trees, Trie Tree, B and B+ -Trees.

Unit- VI **(6 Contact hours)**

Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph traversals – DFS and BFS. Applications of DFS and BFS- Connected Components, Topological sort.

Text Books:

1. R. Thareja “Data Structures using C” , Oxford University Press.
2. M. A. Weiss “Data structures and Algorithm Analysis in C “ , 2nd edition, Pearson.

References

1. Narsimha Karumanchi “Data Structures and Algorithms made easy in C”, 2nd Edition, Career Monk Publications.
2. Allen Weiss, “Data Structures and Algorithms Analysis in C”, Pearson, 2nd Edition

Web resources:

1. Indian Institute of Technology, Madras , “Programming and Data Structures”, URL: https://nptel.ac.in/courses/106106130/
2. Indian Institute of Technology, Delhi, ‘Data Structures and Algorithms’, https://nptel.ac.in/courses/106102064/

Course outcomes: At the end of the course, the student will be able to

CO 1	Learn how to use data structure concepts for realistic problems.
CO 2	Able to use linear and non-linear data structures like stacks, queues , linked list etc.
CO 3	Ability to identify appropriate data structure for solving computing problems in respective language.
CO 4	Ability to implement algorithms for the creation, insertion, deletion, searching, and sorting of each data structure.
CO 5	To build the different Hight balanced trees and perform the basic operations

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course code	Course name	Course Category	L-T-P	Credits
PY1281	**Physics Lab**	**BSC**	**0-0-3**	**1.5**

Course Learning Objectives:

1. To determine the wavelength of laser light using Diffraction Grating.
2. To determine the radius of curvature of a Plano convex lens by Newton’s Ring experiment.
3. To determine the specific rotation of cane sugar solution with the help of Polarimeter.
4. Measurement of velocity of ultrasonic waves
5. To study the Hall Effect and to calculate:-(i) The Hall Coefficient (RH) (ii) The concentration of charge carriers
6. To verify the postulates of Bohr’s theory and Quantization energy.
7. To study the photoelectric effect and determine the value of Plank’s constant.
8. To determine the Energy Band Gap of a Semiconductor by using a Junction Diode / Four Probe method
9. Study of I-V Characteristic of a solar cell illuminated by an incandescent lamp, at different frequencies
10. Determination of Acceptance angle and Numerical Aperture using fiber optic cable

Experiments list

1. Laser Diffraction
2. Newton’s Ring expt
3. Polarimeter.
4. Ultrasonic interferometer
5. Hall Effect
6. Frank Hertz
7. Photo electric Effect
8. Energy Band Gap of a Semiconductor
9. Solar cells
10. Optical fiber

Course outcomes: At the end of the course, the student will be able to

CO 1	Student will able to understand the diffraction of grating by laser light
CO 2	Student will able to understand the interference by division of amplitude using Newton’s Ring experiment
CO 3	Student will able to understand thespecific rotation of cane sugar solution with the help of Polarimeter.
CO 4	Student will able to understand how the velocity of ultrasonic waves varies in different media
CO 5	Student will able to understand hall coefficient, carrier density and carrier mobility of a given semiconductor
CO 6	Student will able to understand Quantization of energy
CO 7	Student will able to understand the photoelectric effect and calculation of Plank’s constant value
CO 8	Student will able to understand the energy gap of a semiconductor
CO 9	Student will able to understand the I-V characteristic of Solar cells
CO 10	Student will able to calculate the acceptance angle and numerical aperture using fiber optic cable
CO11	Student will able to understand how recording and reconstruction of holograms under Laser light

Course Nature		**Practical**		
Assessment Method				
Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS1281	**Programming through C++ Laboratory**	**PCC**	**0-0-3**	**1.5**

Course Learning Objective:

1. To strengthen their problem solving ability by applying the characteristics of an object- oriented approach.
2. To introduce object oriented concepts in C++ and Java.

List of Programming Assignments for Laboratory

Exercise – 1

a)Write a C++ program illustrating a program to find the roots of a quadratic equation use switch statements to handle different values of the discriminant (b^2-4*a*c).

b) Write a C++ program illustrating to sort integer numbers

c) Write a C++ program illustrating factorial using recursion.

Exercise – 2

a) Write a program to implement call by value and call by reference using reference variable.

b) Write a program to illustrate scope resolution, new and delete Operators. (Dynamic Memory Allocation)

c) Write a program to illustrate Storage classes

d) Write a program to illustrate Enumerations

Exercises –3

a) Write a program illustrating Inline Function

b) Write a program illustrates function overloading.

c) Write a program illustrates the use of default arguments for simple interest function.

Exercise - 4

a) Write a program to illustrate function overloading.

b) Write a program illustrate function template for power of a number.

c) Write a program to illustrate function template for swapping of two numbers.

Exercise -5

Create a Distance class with:

- Feet and inches as data members
- Member function to input distance
- Member function to output distance
- Member function to add two distance objects

a).Write a main function to create objects of DISTANCE class. Input two distances and output the sum.

b). Write a C++ Program to illustrate the use of Constructors and Destructors (use the above program.)

c) Write a program for illustrating function overloading in adding the distance between objects (use the above problem)

d). Write a C++ program demonstrating a Bank Account with necessary methods and variables

Exercise – 6

Write a program for illustrating Access Specifiers public, private, protected

a) Write a program implementing Friend Function

b) Write a program to illustrate this pointer

c) Write a Program to illustrate pointer to a class

Exercise -7

a). Write a program to Overload Unary, and Binary Operators as Member Function, and Non Member Function.

i. Unary operator as member function

ii. Binary operator as non member function

b). Write a c ++ program to implement the overloading assignment = operator

Exercise -8

a) Write C++ Programs and incorporating various forms of Inheritance

i) Single Inheritance

ii) Hierarchical Inheritance

iii) Multiple Inheritances

iv) Multi-level inheritance

v) Hybrid inheritance

b) Write a program to show Virtual Base Class

Exercise-9

a) Write a Program in C++ to illustrate the order of execution of constructors and destructors in inheritance

b) Write a Program to show how constructors are invoked in derived class

c) Write a program to illustrate runtime polymorphism

d) Write a program to illustrate this pointer

Exercise -10

a) Write a C++ Program to illustrate template class

b) Write a Program to illustrate class templates with multiple parameters

c) Write a Program to illustrate member function templates

Exercise -11

a).Write a Program for Exception Handling Divide by zero

b). Write a Program to rethrow an Exception

c) Write a Program to implement List and List Operations

Exercise -12

a) Write a Program to implement Vector and Vector Operations

b) Write a Program to implement Deque and Deque Operations

c) Write a Program to implement Map and Map Operations

Course outcomes

At the end of the course, the student will be able

CO 1	Explain what constitutes an object-oriented approach to programming
CO 2	Identify potential benefits of object-oriented programming over other approaches
CO 3	Apply an object-oriented approach to developing applications of varying complexities

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS1282	Data Structures Lab	PCC	0-0-3	1.5

Course Objectives:

1. To develop skills to design and analyze simple linear and non-linear data structures
2. To strengthen the ability to identify and apply the suitable data structures for the given real-world problem
3. To gain knowledge in practical applications of data structures.

List of Experiments:

1. Write a C program that uses functions to perform the following:

    a) Create a singly linked list of integers.

    b) Delete a given integer from the above linked list.

    c) Display the contents of the above list after deletion.

2. Write a C program that uses functions to perform the following:

    a) Create a doubly linked list of integers.

    b) Delete a given integer from the above doubly linked list.

    c) Display the contents of the above list after deletion.

3. Write a C program implement the Stack ADT using Arrays and Linked List.

4. Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent.

5. Write a C program that evaluates a postfix expression.

6. Write C program to implement queue ADT using array and doubly linked list.

7. a) Write C program to implement priority queue ADT using array.

    b) Write C program to implement circular queue ADT using array.

8. Write C program for implementing the following sorting methods:

    b) Insertion sort b) Merge sort

9. Write C program for implementing the following sorting methods:

    b) Quick sort b) Selection sort

10. Write a C program for implementing Heap sort algorithm.

11. Write a C program that uses functions to perform the following:

    a) Create a Binary Search Tree (BST).

    b) Insert data in BST

b) Traverse the above BST recursively in Postorder.

12. Write a C program that uses functions to perform the following:

    a) Deletion an element BST

    b) Traverse the above BST non recursively in Inorder.

13. Write a C program to implement all the functions of a dictionary (ADT) using hashing.

14. Write C program for implementing Depth first traversal and Breadth first traversal.

Course Outcomes:

At the end of this lab session, the student will

CO 1	Be able to design and analyze the time and space efficiency of the data structure
CO 2	Be capable to identity the appropriate data structure for given problem
CO 3	Have practical knowledge on the application of data structures

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%

Course Nature		**Practical**		
Assessment Method				
Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
BE3101	**Environmental Sciences**	**HSMC**	**1-0-0**	**0**

Course Learning Objectives:

The objective of this course is to provide knowledge about multidisciplinary nature of environment, various sources of natural energy, ecosystem etc.

Students will also be able to understand about the various environmental issues and problem.

Course Content:

UNIT-I **(3 Contact hours)**

The Multidisciplinary Nature of Environmental Studies

1.1: Definition, scope and importance

1.2: Need for public awareness.

UNIT-II **(12 Contact hours)**

Natural Resources

Renewable and non renewable resources:

2.1: Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

2.2: Role of an individual in conservation of natural resources.

2.3: Equitable use of resoureces for sustainable lifestyles.

UNIT-III **(6 Contact hours)**

Ecosystems

3.1: Concept of an ecosystem.

3.2: Structure and function of an ecosystem.

3.3: Producers, consumers and decomposers.

3.4: Energy flow in the ecosystem.

3.5: Ecological succession.

3.6: Food chains, food webs and ecological pyramids.

3.7: Introduction, types, characteristic features, structure and function of the following ecosystem:-

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT-IV **(9 Contact hours)**

Biodiversity and It's Conservation

4.1: Introduction – Definition: genetic, species and ecosystem diversity.

4.2: Biogeographical classification of India

4.3: Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values

4.4: Biodiversity at global, National and local levels.

4.5: Inida as a mega-diversity nation

4.6: Hot-sports of biodiversity.
4.7: Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
4.8: Endangered and endemic species of India
4.9: Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-V **(Contact hours-12)**

Environmental Pollution

5.1: Cause, effects and control measures of:-

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

5.2: Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
5.3: Role of an individual in prevention of pollution.
5.4: Pollution case studies.
5.5: Disaster management: floods, earthquake, cyclone and landslides.

UNIT- VI **(Contact hours-9)**

Social Issues and The Environment

6.1: From Unsustainable to Sustainable development
6.2: Urban problems related to energy
6.3: Water conservation, rain water harvesting, watershed management
6.4: Resettlement and rahabilitation of people; its problems and concerns. CaseStudies
6.5: Environmental ethics: Issues and possible solutions.• Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
6.6: Wasteland reclamation.
6.7: Consumerism and waste products.
6.8: Environment Protection Act.
6.9: Air (Prevention and Control of Pollution) Act.
6.10: Water (Prevention and control of Pollution) Act
6.11: Wildlife Protection Act
6.12: Forest Conservation Act
6.13: Issues involved in enforcement of environmental legislation.
6.14: Public awareness.

UNIT-VII **(9Contact hours)**

Human Population and The Environment

7.1: Population growth, variation among nations.

7.2: Population explosion – Family Welfare Programme.
7.3: Environment and human health.
7.4: Human Rights.
7.5: Value Education.
7.6: HIV/AIDS.
7.7: Women and Child Welfare.
7.8: Role of Information Technology in Environment and human health.
7.9: Case Studies.

UNIT-VIII

Field Work

Visit to a local area to document environment assets river / forest / grassland / hill / mountain. Visit to a local polluted site-urban/rural/industrial/agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hills lopes, etc (field work equal to 5 lecture works)

Learning resources

Text book:

1. ErachBharucha, '*Textbook of Environmental studies*', UGC

Reference Books:

Clark RS, '*Marine Pollution*', Clanderson Press, Oxofrd (TB).
De AK, '*Environmental Chemistry*', Wiley Eastern Ltd.

Course Outcomes: At the end of the course, the student will be able to

CO 1	After successful completion of the course, the learners would be able to bring about an awareness of a variety of environmental concerns.
CO 2	It attempts to create a pro-environmental attitude and a behavioral pattern in society that is based on creating sustainable lifestyles.

<table>
<tr><th colspan="2">Course Nature</th><th colspan="3">Theory</th></tr>
<tr><th colspan="5">Assessment Method</th></tr>
<tr><td>Assessment Tool</td><td>Weekly tests</td><td>Monthly tests</td><td>End Semester Test</td><td>Total</td></tr>
</table>

Weightage (%)	10%	30%	60%	100%

****

ENGINEERING SECOND YEAR: SEMESTER-1

Course code	Course Name	Course Category	L-T-P	Credits
MA2102	**Probability and Statistics**	**BSC**	**3-1-0**	**4**

Course Learning Objectives:

1. Providing students with a formal treatment of probability theory.
2. Equipping students with essential tools for statistical analysis.
3. Fostering understanding through real-world statistical applications.
4. Develop skills in presenting quantitative data using appropriate diagrams, tabulations.
5. Use appropriate statistical methods in the analysis of simple datasets.
6. Instill the belief that Statistics is important for scientific research.

Course Content:

Unit - I **(8 Contact hours)**

Permutations and Combinations, Probability introduction through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem and Independent Events.

Unit - II **(10 Contact hours)**

Random Variable , Bivariate random variable, Mathematical Expectation , Discrete Probability Distributions, Continuous Probability Distributions , Functions of Random Variables, Correlation coefficient and Bivariate Normal Distribution.

Unit - III **(8 Contact hours)**

Probability Inequalities and Generating Functions, Moment Generating Function, Characteristic Function, Cumulant Generating Function, Probability Generating Function.

Unit - IV **(8 Contact hours)**

Order Statistics, Convergence of Sequence of Random Variables, Weak Law of Large Numbers, Strong Law of Large Numbers, Central Limit Theorem.

Unit - V **(12 Contact hours)**

Definition of population, sampling, statistics and parameters. Types of sampling, Expected values of sample mean and variance, sampling distribution, standard error, sampling distribution of mean and sampling distribution of variance. Sampling -Distributions (t, F and Chi-square), confidence interval and interval estimation.

Unit – VI **(14 Contact hours)**

Definition of Null and alternative hypothesis, critical region. Type I and Type II errors, power of the test, one tail, two tail tests, Tests for the single mean, two means, single proportion and two proportions using Z-test and t-test, t-test and F-test for significance of difference variance, Chi-square test for goodness of fit, ANOVA for one-way and two-way classified data.

Learning resources

Text book:

1.William W. Hines and Douglas C. Montgomery, '*Probability and Statistics in Engineering*', Willy Publications, 4th Edition.

Reference Books:

1. Sheldon Ross, '*A First Course in Probability*', Pearson Publications, 9th Edition.
2. Athanasios Papoulis and S. Unnikrishna Pillai, '*Probability, Random Variables and Stochastic Processes*', TMH, 4th Edition,.

Web resources:

1. https://nptel.ac.in/courses/117105085/
2. https://nptel.ac.in/courses/111106112/
3. https://nptel.ac.in/courses/111102111/
4. RGUKT Course Content

Course outcomes: At the end of the course, the student will be able to

CO 1	Apply Probability theory via Bayes Rule.
CO 2	Describe the properties of Discrete and Continuous distributions.
CO 3	Apply problem-solving techniques to solving real-world events.
CO 4	Apply selected probability distributions to solve problems.
CO 5	Develop problem-solving techniques needed to accurately calculate probabilities.
CO 6	Interpret and clearly present output from statistical analysis.

Probability and Statistics		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weight age (%)	10%	30%	60%	100%

****

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course code	**Course name**	**Course Category**	**L-T-P**	**Credits**
BM 2101	**Managerial Economics and Financial Analysis**	**EC**	**3-0-0**	**3**

Course Learning Objectives:

1. To strengthen students managerial skill.

2. To enhance the conceptual clarity in economic concepts.

3. To develop to forecasting capability.

4. It will help to produce multi-disciplinary thought.

5. It will enhance their conceptual and practical/hand on practice in accounting.

6. It will help to implement and understand the uses of ratios.

Course Contents:

Unit I: **(6 hours)**

Introduction to managerial economics, consumer behavior, demand, demand analysis, demand forecasting, supply, supply analysis.

Unit II: **(7 hours)**

Theory of production, production functions, concept of cost, cost analysis, break even analysis.

Unit III: **(6 hours)**

Market structure-monopoly, oligopoly, monopolistic, prefect market; Types of business

organizations-sole proprietorship, partnership, private ltd. Companies and public ltd. Companies, formation of company.

Unit IV: **(8 hours)**

Introduction to capital, capital sources, capital budgeting- NPV, IRR, Payback period, profitability index.

Unit V: **(8 hours)**

Introduction to financial accounting, rules of debit-credit, Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments, Preparation of final account and other related accounting statements.

Unit VI: **(10 hours)**

Financial statements, comparative statement analysis, common- size statement analysis, ,ratio analysis, time series (only theories).

Learning resources

Text book:

1. 1. Aryasri, A. R., *Managerial Economics & Financial Analysis*, McGraw Hill, 2014.

Reference Books:

1. Siddiqui., *Managerial Economics & Financial Analysis*, 2e, New Age International Private Limited, 2017.

2. . Pandey, I.M., “*Financial Management*”, 11e, Vikas Publishing House, 2015.

3. . Prasanna Chandra., “*Financial Management: Theory and Practice*”, 9e, Mc Graw Hill Education, 2015.

Web resources:

1. Managerial Economics and Financial Analysis, Dr. Trupti , IIT Bombay *http://nptel.ac.in/courses/110101005/*

Course outcomes: At the end of the course, the student will be able to

CO 1	A student will be able to understand basic economics as well as management concepts.
CO 2	This subject will provide implication facilities of concepts.
CO 3	Students can be able to do primary data collection and classification.
CO 4	Students can also be able to forecast as well as generate trend series by utilizing the available secondary data.
CO 5	They have basic knowledge about accounting and its terminologies.
CO 6	They will be able to prepare and understand accounting tables.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course name	Course Category	L-T-P	Credits
EC2109	**Digital Logic Design**	**ESC**	**3-0-0**	**3**

Course Learning Objectives:

1. To discuss the relevance of Digital Logic Design with Computer Science and Engineering course.
2. To discuss the concepts of Number systems and representations, combinational design, sequential designs and complete system design at gate-level abstraction in computer Design.
3. To discuss the important features of IC design like area, power and delay.

Course Content

Unit-I **(8Contact hours)**

Number systems-Representations-Conversions, error detection and error correction, Boolean constants and variables, basic gates: operation and truth tables, describing logic gates algebraically, evaluating logic circuit outputs, implementing circuits from Boolean expressions, universality of gates, Boolean theorems

Unit-II **(8 Contact hours)**

Combinational circuit minimization using Boolean laws and karnaugh maps, multilevel synthesis, logic levels and noise margins. Single bit adders and subtractors, parallel adders, multi-bit subtraction using adders, signed multiplier, unsigned multiplier

Unit-III **(6 Contact hours)**

Decoders, Encoders, Multiplexers, Demultiplexers. Realization of various functions using Decoders, Multiplexers. Priority encoders ,IC 74x148

Unit-IV **(7 Contact hours)**

Bistable elements, Latches and Flip-flops : S-R latch, D latch, J - K Flipflop, D Flipflop, master/slave flip-flop, edge triggered J-K flip-flop with asynchronous inputs, T flip-flops. Excitation tables, Characteristic tables, Characteristic equations

Unit-V **(8Contact hours)**

Frequency division and counting. Design and analysis of synchronous counters, asynchronous counters. State diagrams for D-flipflop, T-Flip flop, J-K Flip flop, Mealy machines and Moore machines.

Unit-VI **(8Contact hours)**

Design and display of mobile number using synchronous and asynchronous counters, design and display of digital clock using synchronous and asynchronous counters.

Learning Resources:

Text books:

1. Ronald J Tocci, Neal S.Widmer, Gregory L.Moss,'Digital systems' Pearson 10th edition.
2. Stephen Brown, Zvonko Vranesic,'Fundamentals of Digital Logic with Verilog Design', TMH, 2nd edition

Reference books

1. John F.Wakerly, 'Digital Design' , Pearson 4th edition

Web Resources

1. Prof. Shankar Balachandran, NPTEL-IIT Madras, *'Digital Circuits & Systems'*
   URL: https://nptel.ac.in/courses/117106114/
2. Prof. S Srinivasan, NPTEL-IIT Madras, 'Digital Circuits and Systems'
   URL: https://nptel.ac.in/courses/117106086/

Course Outcomes

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

CO 1	Apply the knowledge of simplification in obtaining optimal digital circuits
CO 2	Employ Boolean algebra to describe the function of logic circuits
CO 3	Design circuits which represent digital logic expressions. Specifically, design a gate-level digital circuit to implement a given Boolean function
CO 4	Study and examine the SSI, MSI, LSI and Programmable elements
CO 5	Analyse the operation of synchronous and asynchronous state machines
CO 6	Design any combinational or sequential digital circuits to meet the given specifications
CO 6	Analyse any digital circuit and to debug such circuit
CO 7	Prototype a real time application on EDA tool

Assessment Method

Assessment Tool	Weekly tests/Assignments (In semester)	Monthly tests (In semester)	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course code	Course name	Course category	L-T-P	Credits
CS2101	Design & Analysis of Algorithms	PCC	3-1-0	3

Course Learning Objectives:

1. Interpret the fundamental needs of algorithms in problem solving
2. Classify the different algorithm design techniques for problem solving
3. Develop algorithms for various computing problems
4. Analyze the time and space complexity of various algorithms

Course Content

Unit I **(8 Contact Hours)**

Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Probabilistic analysis, Amortized analysis. Analysis of Insertion Sort & Heap Sort.

Unit II **(10 Contact Hours)**

Divide and conquer: General Method, solving of recurrence relations – Substitution Method, Recursion Tree Method, Masters Method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication,

Unit III **(10 Contact Hours)**

Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

Unit IV **(10 Contact Hours)**

Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Disjoint Sets- disjoint set operations, union and find algorithms, spanning trees, connected components and bi-connected components, Single source shortest path problem.

Unit V **(12 Contact Hours)**

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

Branch and Bound: General method, applications - Travelling sales person problem,0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.

Computational Geometry: Line segment, line segment intersection, Convex Hull - Graham's scan and Jarvis March.

Unit VI **(10 Contact Hours)**

String Matching: Naive string matching, Rabin Karp Algorithm, String matching with finite automata.

NP-Hard and NP-Complete problems: Basic concepts, non deterministic algorithms, NP - Hard and NP Complete classes, Reducibility.

Learning resources

Text Books:

1. Thomas H.Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein , "Introduction to Algorithms".

Reference Books:

1. SatrajSahni and Rajasekharam,*"Fundamentals of Computer Algorithms"*,
2. Galgotia publications pvt. Ltd.
3. ParagHimanshu Dave, HimanshuBhalchandraDave,*"Design and Analysis algorithms"*,Publisher: Pearson.

4. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, McGraw Hill "*Introduction to Design and Analysis of Algorithms A strategic approach*"
5. Allen Weiss "*Data structures and Algorithm Analysis in C++*", Second edition,
6. Pearson education.
7. Aho, Ullman and Hopcroft "*Design and Analysis of algorithms*" Pearson education.

Web Resources

1.https://www.oreilly.com/library/view/design-and-analysis/9788177585957/
2.https://www.tutorialspoint.com/design_and_analysis_of_algorithms
3.https://www.amazon.in/Design-Analysis-Algorithms-V-Muniswamy/dp/9380026730

Course outcomes: At the end of the course, the student will be able to

CO 1	Synthesize efficient **algorithms** in common engineering **design** situations.
CO 2	Major techniques for **algorithm design** and **analysis** are introduced through the study of various **algorithms**.
CO 3	Apply design principles and concepts to algorithm design
CO 4	Have the mathematical foundation in analysis of algorithms
CO 5	Understand different algorithmic design strategies
CO 6	Analyze the efficiency of algorithms using time and space complexity theory

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course code	Course Name	Course Category	L-T-P	Credits
CS2102	**Object Oriented Programing through JAVA**	**ESC**	**3-0-0**	**3**

Course Learning Objectives:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.,
2. Understanding the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc. and exception handling mechanisms.

3. Understand the principles of inheritance, packages and interfaces.
4. Understand the principles of Multithreading and Event handling mechanisms.

Course Content:

Unit 1: (7.5 Contact hours)
Introduction: OO Programming, Introduction to java, Key features, Fundamentals of Objects and Classes, Access Specifiers, data types, dynamic initialization, scope and life time, operators, Conditional Statements, control structures, arrays, type conversion and casting.

Unit II: (7.5 Contact hours)
Classes and Objects : Concepts, methods, constructors, usage of static, access control, this key word, garbage collection, overloading, parameter passing mechanisms, nested classes and inner classes. Strings: Exploring the String class, String buffer class, Command-line arguments. Library: StringTokenizer, Random class, Wrapper classes.

Unit III: (10 Contact hours)
OOPS Concepts: Basic concepts, Inheritance, usage of super key word, method overriding, final methods and classes, abstract classes, Polymorphism: dynamic method dispatch, Static method dispatch.Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces. Encapsulation: Abstraction. Creating User defined Data Structures: Array of Objects, User defined Linked List.

Unit IV: (6 Contact hours)
File Handling: Streams, File class, File streams. File Reader, File Writer, Buffered Reader, Buffered Writer, String Tokenizer Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes.

Unit V (6 Contact hours)
Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages. Multithreading : Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups.

Unit VI (8Contact hours)
Event Handling: Introduction to Event Handling, AWT Components, windows, Layout Managers, Event handling model of AWT, Adapter classes, Menu, Menu bar. Swing-I – swings introduction, JFrame, JPanel and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons. Combo boxes, Action Listeners.

Learning Resources

Text books:

1. Herbert Schildt, “The Complete Reference Java”, TMH Publishing Company Ltd, 9th Edition.
2. Cay Horstmann, “Big Java”, John Wiley and Sons, 2nd Edition

Reference Books:

1. Allen B.Downey,“Think Java; How to Think Like a Computer Scientist”,Paper Back 1stEdition
2. David J. Eck, Hobart and William Smith Colleges, “Introduction to Programming Using Java” Published by Paper Back .
3. H.M.Dietel and P.J.Dietel “Java How to Program”, Sixth Edition, Pearson Education/PHI

Web resources:

1. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
2. https://www.tutorialspoint.com/java/
3. https://www.javatpoint.com/java-tutorial
4. http://mooc.fi/courses/2013/programming-part-1/material.html
5. http://math.hws.edu/javanotes

Course Outcomes: At the end of the course, the student will be able to

CO 1	Explain OOP Principles and Write Basic Java Programs.
CO 2	Defining Classes and Objects. Identify classes, objects, members of a class and relationships among them needed for a specific problem
CO 3	To be able to write Java Programs to demonstrate method overloading and Demonstrate the concepts of polymorphism and inheritance. Discuss method overriding V/s method overloading.
CO 4	Explain the benefits of JAVA’s Exceptional handling mechanism compared to other Programming Language
CO 5	To be able to write Java Programs to demonstrate Packages and Threading concepts.
CO 6	Discuss and Demonstrate the AWT Concepts and develop the AWT Applications.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course code	Course name	Course category	L-T-P	Credits
CS2181	Design & Analysis of Algorithms Lab	PCC	0-0-3	1.5

Course Learning Objective:

1. This practical course should enable the students to
2. Lear how to analyze a problem and design the solution for the problem
3. Design and Implement efficient algorithms for a specified application
4. Strengthen the ability to identify and apply the suitable algorithm for a given real world problem.
5. To understand various graph algorithms

List of Experiments:

1. Lab No 1: Implementation and Analysis of Sorting Algorithms – Quick Sort, Merge Sort & Heap Sort
2. Lab No 2: Warshalls Algorithms – Applying to Topological Ordering of vertices in a given digraph and computing the transitive closure of given directed graph
3. Lab No 3: Implement 0/1 Knapsack Problem using Dynamic Programming
4. Lab No 4: Shortest Paths Algorithms : All Pair Shortest Path algorithms – Floyds Algorithm and other algorithms
5. Lab No 5: Implement any scheme to find the optimal solution for the Travelling Salesman Problem
6. Lab No 6: Implement Minimum Spanning Tree Algorithms – Prims Algorithms and Kruskal Algorithm
7. Lab No 7: Single Source Shortest Path Algorithms and other Graph Algorithms like connected components
8. Lab No 8: Implement the Sum of Subsets Problem
9. Lab No 9: Implementation of any scheme to solve the SUDOKU puzzle
10. Lab No 10: Implement N Queens Problem using the Back Trackin

Course Outcomes

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

CO 1	To analyze asymptotic notation and worst, average and best case analysis using suitable mathematical tools.
CO 2	To design efficient algorithms for computational problems using appropriate algorithmic paradigm.
CO 3	To understand different graph algorithms and traversal problems.
CO 4	To analyze the complexity of different class of problems.
CO 5	To explain the role of randomization and approximation in computation

Assessment Method

Course Nature		**Practical**		
Assessment Method				
Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

Course Nature		**Practical**		
Assessment Method				
Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS2189	Digital Logic Design Lab	**ESC**	**0-0-3**	**1.5**

Course Learning Objectives:

1. To expose to the concept of Digital knowledge and its applications
2. To understand Combinational and Sequential circuits
3. To design a prototype digital logic design

List of Experiments

1. Familiarization with logic gate IC's and Arduino kits
2. Design of code converters and comparators (8-bit) on bread board

3. Adder related experiments: Half adder , full adder , half subtractor, full subtractor , ripple carry adder, BCD adder, carry look ahead adder using IC
4. Design of a binary multiplier and displaying its inputs and outputs on seven segment display unit
5. Familiarization with multiplexer, decoder, encoder. Design of Half adder, full adder, magnitude comparator and other examples using above familiarized components
6. Bi-stable multi-vibrator design. Design and verification of SR,JK,D,T latch/flip-flops. Verification and elimination of Race Around Condition
7. Flip-flop conversions and Design of frequency dividers
8. Design of synchronous counters (Up and Down) and displaying result on seven segment display unit
9. Design of Mod n $\leq 2^n$ counter design(total 8 states, design of mod6 and mod7 with clear
10. Design and IC verification of Decade counter
11. Cascading of counters
12. Synchronous counter design and displaying result on seven segment display unit
13. Random sequence
14. Ring counter/Johnson counter
15. Verification and analysis of ALU IC
16. Design of a digital clock in synchronous state machine design and in asynchronous state machine design
17. Design and submission of term project

Note:

1. All the above experiments (except few exceptional cases) are to be implemented on Arduino kits also.

2. It is mandatory to perform experiment on any one of the EDA Tools before the experiment is done on hardware. All experiments must be unique, design specifications should not be common in the lab

Course outcomes:

After the completion of this Laboratory course, the student will be able to

CO 1	Understand the implementation of discrete digital components
CO 2	Utilize the ICs of Decoder, Multiplexer, Seven segment display unit in combination circuit design
CO 3	Utilize the ICs of suitable Flipflops in sequential circuit design
CO 4	Utilize the Programmable Logic devices in digital design

CO 5	Understand the concepts of setup time, hold time, propagation delays
CO 6	Design circuits with optimal features of Area, Power and delay
CO 7	Design and implement prototypes of complete digital systems

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

Course Nature		**Practical**		
Assessment Method				
Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

****

Course code	Course Name	Course Category	L-T-P	Credits
CS2182	**Object Oriented Programming Through JAVA Lab**	**ESC**	**0-0-3**	**1.5**

Course Learning Objective:

1. To build software development skills using java programming for real-world applications.
2. To understand and apply the concepts of classes, packages, interfaces, arraylist, User defined Linked List, File Handling, exception handling and Multi-threading.

3. To develop applications using AWT programming and event handling.

List of Experiments:

1. Lab No 1: Basic Programs in JAVA
2. Lab No 2: Programming Assignments on Arrays and Strings
3. Lab No 3: Programming Assignments on Classes, Objects and Encapsulation
4. Lab No 4: Implementing the concepts of Inheritance and Array Objects
5. Lab No 5: Implementing the OOPS Concepts of Abstract, Interfaces and Polymorphism
6. Lab No. 6: Programming Assignments on File Handling
7. Lab No. 7: Programming Exercises on Exception Handling
8. Lab No 8: Working with List Operations
9. Lab No 9: Implementing the concepts of Multi-Threading
10. Lab No 10: Programming Exercises on Event Handling

Course Outcomes

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

CO 1	Understanding the control structures and conditional statements in Java
CO 2	Understanding the arrays and String handling in java
CO 3	Understanding the difference between class and object and providing security for objects
CO 4	Understanding the reusability of objects and working with multiple objects
CO 5	Understanding about hiding the data, getting multiple inheritance through interfaces
CO 6	Understanding the data processing from files
CO 7	Understanding about handling run time abnormal program executions
CO 8	Understanding about creating user defined linked list and dynamic objects
CO 9	Understanding the multi-threaded programming and inter thread communication
CO 10	Understanding about GUI creation

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

Course Nature	**Practical**
Assessment Method	

Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

****

ENGINEERING SECOND YEAR:SEMESTER-2

INTRODUTION TO OPERATIONS RESEARCH

Course code	Course name	Course Category	L-T-P	Credits
BMXY02	**Introduction to Operation Research**	**EC**	**3-0-0**	**3**

Course Learning Objective:

1. The objective of this course is to provide the exposure to the major tools and techniques of Operations Research.

2. To create awareness and appreciation about the applications of Operations Research in the functional areas of management.

3. To provide a formal quantitative approach to problem solving and an intuition about situations where such an approach is appropriate.

4. To introduce some widely- used mathematical models.

5. The understanding of these models will allow the students to communicate with persons who run them and to evaluate the results they present.

6. To provide a tool that the students can use to solve management problems.

Course Contents:

Unit I: **(4 hours)**

Decision making, Development of OR, An overview and scope of Operations Research Application of OR

Unit II: **(12 hours)**

Linear Programming Problems (LPP), Introduction to Linear Programming (LP) Illustration of LP Problems. Formulation exercises on LP Problem, Graphical Method of solving LPP Simplex Method, Unboundedness, Multiple Optimum Solutions, Degeneracy and Cycling Problems.

UNIT III: **(10hours)**

Artificial Variables : Big-M Method, Sensitivity Analysis, Duality Problems, Economic Interpretation of Simplex Tableau Computer Software for Solving LPP.

UNIT IV: **(6hours)**

Formulation of Transportation Problems**,** Sensitivity Analysis in Transportation Problems**,** Assignment Problems.

UNIT V: **(4 hours)**

Elements of queuing models, Poisson arrival and exponential service time distributions, M/M/1 Queue; Finite population models. Queuing cost models, Applications.

UNIT VI: **(4 hours)**

Introduction of Costs, Deterministic and Stochastic models.

Learning Recourses:

Text Book:

1. Taha H.A., *Operation Research- An Introduction*, PHI, (2008)

Reference Books:

1. Ravindran, Phillips & Solberg, *Operations research*, John Wiley, Singapore, (2007)

2. Richard Levin & David Rubin, *Quantitative approaches to Management*, Mc GrawHill International, (1992).

3. Hillier & Lieberman, *Operation Research*, Addison Wesley, (1974)

4. Hadley G., *Linear Programming*, Addison-Wesley, (1962).

Web resources:

1. Introduction to Operation Research, Prof. G.S, Srinivasan, IIT Madras https://nptel.ac.in/courses/110106062/

Course outcomes: At the end of the course, the student will be able to

CO 1	A student will be able to understand basic of operation research and its multipurpose uses
CO 2	It will provide application facilities of concepts.
CO 3	Students can be able to explore different uses of linear programming with its advance technique.
CO 4	It will enable to take decision regarding assignment, transportation and queuing related issues
CO 5	This will provide alternative techniques with its effective uses
CO 6	It will have a overall impact on the decision taking related to various type of real time issues.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total

Weightage (%)	10%	30%	60%	100%

****

Course code	Course name	Course Category	L-T-P	Credits
CS2201	**COMPUTER ORGANIZATION AND ARCHITECTURE**	**PCC**	**3-0-0**	**3**

Course Learning Objectives:

1. To conceptualize the basics of organizational and architectural issues of a digital computer.
2. To analyze performance issues in processor and memory design of a digital

computer.

3. To understand various data transfer techniques in digital computer.
4. To analyze processor performance improvement using instruction level parallelism

Course content:

UNIT-I

Basic Functional blocks of a computer: CPU, memory, input -output subsystems, control unit.

Data Representation: Number systems, signed number representation, fixed and floating point representations, character representation.

UNIT-II

ALU: Computer Integer Arithmetic: addition, subtraction, multiplication, division, floating point arithmetic: Addition, subtraction, multiplication, division.

Instruction set architecture of a CPU registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. RISC and CISC architecture. Case study instruction sets of some common CPUs.

UNIT-III

CPU control unit design: Introduction to CPU design, Processor Organization, Execution of Complete Execution, Design of Control Unit: hardwired and micro-programmed control, Case study design of a simple hypothetical CPU.

UNIT-IV

Memory system design: Concept of memory: Memory hierarchy, SRAM vs DRAM ,Internal organization of memory chips , cache memory: Mapping functions, replacement algorithms, Memory management, virtual memory.

UNIT-V

Input -output subsystems, I/O transfers: programmed I/O, interrupt driven and DMA.

I/O Buses, Peripheral devices and their characteristics, Disk Performance

UNIT-VI

Performance enhancement techniques: Pipelining: Basic concepts of pipelining,
Through put and speedup, pipeline hazards.

Parallel processing: Introduction to parallel processing, Introduction to Network, Cache coherence

Text Books:

V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, *"Computer Organization,"* 5/e, McGraw Hill, 2002.

William Stallings, *"Computer Organization and Architecture"*: Designing for Performance, 8/e, Pearson Education India. 2010.

Morris Mano, " Computer System Architecture", Pearson Education India, Third edition.

References:

A. S. Tanenbaum, *"Structured Computer Organization"*, 5/e, Prentice Hall of India, 2009.

Course code	Course name	Course Category	L-T-P	Credits
CS2202	**Database Management Systems**	**PCC**	**3-0-0**	**3**

D. A. Patterson and J. L. Hennessy, *“Computer Organization and Design,”* 4/e, Morgan Kaufmann, 2008.

J. L. Hennessy and D. A. Patterson,” *Computer Architecture: A Quantitative Approach"*,4/e, Morgan Kaufmann, 2006.

D. V. Hall, “*Microprocessors and Interfacing”*, 2/e, McGraw Hall, 2006

“ 8086 Assembler Tutorial for Beginners “By Prof. Emerson GiovaniCarati.

Web referneces:

https://en.wikibooks.org/wiki/IB/Group_4/Computer_Science/Computer_Organisation

http://www.cs.uwm.edu/classes/cs458/Lecture/HTML/ch05.html

http://www.cse.iitm.ac.in/~vplab/courses/comp_org.htm

OA IIT-Guwahati Pdf

Course outcomes: At the end of the course, the student will be able to

CO1	Understand the basic organization of computer and different instruction formats and addressing modes.
CO2	Analyze the concept of pipelining, segment registers and pin diagram of CPU.
CO3	Understand and analyze various issues related to memory hierarchy.
CO4	Evaluate various modes of data transfer between CPU and I/O devices.
CO5	Examine various inter connection structures of multi processors.

For Theory courses only:

Course Nature	**Theory**			
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Learning Objectives:

1. To Understand the role of a database management system in an organization.
2. To Understand the basics of ER Diagram, Relational model, Relational Algebra and Relational Calculus.

1. To Understand basic database concepts, including the structure and operation of the relational data model.
2. To Construct simple and moderately advanced database queries using Structured Query Language (SQL).
3. To Understand and successfully apply logical database design principles, including E-R diagrams and database normalization.
4. To Understand the concept of a database transaction and related database facilities and indexing techniques.

Course Content:

Unit I **(8Contacts hours)**

Introduction to database systems, File System vs. Database Systems, Database system structure, Views of data in a database system, Data models and Database languages.

Introduction to Entity-Relationship data model, Elements of an ER model, Constructing ER diagrams, Modelling of constraints, Reduction of ER diagrams to relational tables.

Unit II **(6 Contact hours)**

Basics of relational model, ER diagrams to relational design, Relational algebra: Simple operations and extended operations, writing relational algebra expressions for queries, Introduction to tuple relational calculus and writing basic queries using tuple calculus

Unit III **(9 Contact Hours)**

Basic structure of SQL queries, Writing simple queries, Complex queries and nested Subqueries in SQL, Aggregate functions in SQL, Effect of NULL values on result, Defining a Relational Schema, View definitions and constraints, types of keys.

Unit IV **(7 Contact hours)**

Features of Good Relational Designs, Atomic Domains and First Normal Form, Problems encountered in bad schema design, Motivation for normal forms, Dependency theory-functional dependencies, Armstrong's Axioms for FD, Closure of a set of FD's, Minimal Cover, Definition of 1NF, 2NF, 3NF and BCNF, Decomposition and desirable properties of them.

Unit V **(6Contact hours)**

Storing data in disk and files and the memory hierarchy, RAID, File organization and indexes, ISAM Tree, B+ Tree, Linear Hashing and Extendible Hashing

Unit VI **(9 Hours)**

Transaction concept, ACID properties, Concurrency in a DBMS, Serializability and Recoverability, Concurrency control Protocols (lock-based and time-stamp based)

Text Books

A. Silberschatatz, H. F. Korth and S. Sudarshan, Database System Concepts, 5/e, McGraw Hill,2006

R. Ramakrishnan and J. Gehrke, Database System Concepts, 3/e, McGraw Hill, 2003

Wilfried Lemahieu, Seppe Vanden Broucke and Bart baesens Principles of Database Management Systems, 1/e Cambridge 2018

Reference Books

Ramez Elmasri, Shamkant B. Navathe , Fundamentals of Database (7th Edition), Paperback, 2007

Theorey T J, Database Modeling & Design, 2/e, Morgan Kaufmann Publishers, 1994.

H. GarciaMolina, J. D. Ullman and J. Widom, Database Systems The Complete Book, 1/e, Pearson Education, 2007

Web resources:

Department of CS&E, IIT M, "Introduction to Database Sytems and Design", https://nptel.ac.in/courses/106106095/

Indian Institute of Technology, Kharagpur, " Database Management Systems", https://nptel.ac.in/courses/106105175/

Course outcomes: At the end of the course, the student will be able to

CO 1	Demonstrate the basic elements of a relational database management system,
CO 2	Ability to identify the data models for relevant problems.
CO 3	Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data.
CO 4	Apply normalization for the development of application software
CO 5	Ability to learn about Disk Management, Buffer management
CO 6	Ability learn about transaction management

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course code	Course Name	Course Category	L-T-P	Credits
CS2203	**Formal Languages and Automata Theory**	**PCC**	**3-0-0**	**3**

Course Learning Objectives:

1. **To understand and design Finite State Machines and applications.**
2. **To Understand about Regular Expressions and its applications.**
3. **Understanding of formal grammars and their applications.**
4. **Understanding various other formal languages and their designing models.**
5. **To understand Decidability and Undecidability of various problems in the theoretical computer science.**

UNIT I: Introduction to Automata **(6 Contact hours)**

Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non-deterministic finite automaton, transition diagrams and Language recognizers.

UNIT II: Finite Automata **(9 Contact hours)**

NFA with Ɛ-transitions - Significance, acceptance of languages. Conversions and Equivalence: Equivalence between NFA with and without Ɛ transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Mealy machines, Equivalence between Moore and Mealy.

UNIT III: Regular Languages **(6 Contact hours)**

Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, Closure properties of regular sets (Proofs not required).

UNIT IV: Grammars **(9 Contact hours)**

Regular grammars: Right linear and left linear grammars, Equivalence between regular linear grammar and FA, Inter conversion, Context free grammar, derivation trees, and sentential forms. Right most and leftmost derivation of strings.

Context Free Grammars: Ambiguity in context free grammars. Minimization of Context Free Grammars. Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL (Proofs omitted).

UNIT V: Push Down Automata **(7 Contact hours)**

Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, Inter conversion. (Proofs not required). Introduction to DCFL and DPDA.

UNIT VI: Turing Machine & Computability Theory (8 Hrs)

Recursive and Recursively enumerable languages, and Church's Hypothesis. Turing Machine: Introduction, Components of Turing Machine, Description of Turing Machine, Elements of TM, Language accepted by a TM, Role of TMs, Design of TMs, Universal Turing Machine, Undecidability of Post Correspondence problem.

Text Books:

Hopcroft, J D Ullman "Introduction to Automata and Language Theory", 3rd Edition, 2006

C. Papadimitrou and C. L. Lewis. Elements of Theory of Computation, Prentice-Hall, 1981.

Reference Books:

John.C.Martin, "Introduction to Languages and the Theory of Computation" McGraw-Hill Education, 01- May-2010.

Kamala Krithivasan, Rama.R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education India, 01-Sep-2009

Web Resources

Indian Institute of Technology, Guwahati, " Formal Languages and Automata Theory", https://nptel.ac.in/courses/111103016/

Course outcomes: At the end of the course, the student will be able to

CO 1	Construct finite state diagrams while solving problems of computer science
CO 2	Ability to convert NFA to DFA and Epsilon NFA to DFA
CO 3	Ability to convert RE to Finite Automata and vise versa
CO 4	Design of new grammar and language
CO 5	Ability to design PDA and NPDA
CO 6	Ability to learn design of Turing machine and Find solutions to the problems using Turing machines

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS2204	**Web Technologies**	**PCC**	**3-0-0**	**3**

Course Learning Objectives:

1. To demonstrate basic skills in analysing the usability of a web site.
2. To identify how to plan user research related to web design.
3. Learn how to combine basic HTML elements to create Web pages.
4. To learn the language of the web: HTML and CSS.
5. To learn the language of the web: Javascript and XML.
6. To learn the language of the Web: jQuery Frontend design and Bootstrap
7. To learn the language of Web: Node

UNIT I **(8 Contact hours)**

Introduction to HTML: Basics of HTML, formatting elements and fonts, commenting code, color, hyperlinks,lists, tables, images, forms, frames and frame sets.

CSS: Introduction to CSS, basic syntax and structure, background images, colors and properties, manipulating texts and fonts, borders and boxes, margins, padding lists, positioning.

UNITT-II **(8 Contact hours)**

JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, objects,HTML DOM and web, Browser environments, form validation, Events and Event Listeners

UNIT-III **(8 Contact hours)**

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 **(10 Contact hours)**

jQuery: Introduction, Selectors, Attributes, Event Handlers, Style Methods, Traversing the DOM, Effects, and Introduction to jQuery Plugins

Front-End Web UI Frameworks and Tools: Bootstrap, Full-Stack Web Development, Setting up Git, Basic Git commands, Online Git Repositories, Node.js and NPM, Front-end Web UI Frameworks.

UNIT V **(7Contact hours)**

Bootstrap: Introduction to Bootstrap, Responsive Design, Bootstrap Grid system, Navigation and Navigation Bar, Icon Fonts, User Inputs, Bootstrap CSS Components, Bootstrap and JavaScript Components, Bootstrap and JQuery, Building and Deployment, NPM Scripts, Task Runners

UNIT VI **(7Contact hours)**

NodeJs: Introduction, Environment Setup, First Application, REPL Terminal, Package Manager(NPM), Web Module, Express Framework, RESTFul API

Learning resources:
Text Books

1. Ralph Moseley and M. T. Savaliya, WileyIndia "*Developing Web Applications*"
2. Jeffrey C.Jackson,"*Web Technologies--A Computer Science Perspective*", PearsonEducation,
3. Dreamtech Press "*Web TechnologiesBlack Book*," HTML 5,
4. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Black Book Kindle Edition by Kogent Learning Solutions Inc. (Author)
5. O'Reilly - Head First Servlets and JSP, 2nd Edition
6. Node.js Web Development: Create real-time server-side applications with this practical, step-by-step guide, 3rd Edition
7. Bootstrap: Responsive Web Development Book by Jake Spurlock

Reference Books

1. Joel Sklar, Cengage " *Web Design*", Learning
2. Robert. W. Sebesta, "*Programming the World Wide Web*", Fourth Edition, PearsonEducation
3. P.J. Deitel& H.M. Deitel "*Internet and World Wide Web How to program*", Pearson

Web Resources

https://www.w3schools.com/
https://www.tutorialspoint.com/web_development_tutorials.htm
https://html.com/
https://www.coursera.org/learn/bootstrap-4
https://www.tutorialspoint.com/jquery/index.htm
https://www.tutorialspoint.com/nodejs/
http://www.ntu.edu.sg/home/ehchua/programming/java/javaservlets.html
http://wiki.lib.sun.ac.za/images/0/07/Bootstrap-tutorial.pdf
https://media.readthedocs.org/pdf/htmlguide/latest/htmlguide.pdf

Course outcomes: At the end of the course, the student will be able to

CO 1	Learn how to design and publish web page
CO 2	Learn how to combine basic HTML elements to create Web pages.
CO 3	Learn how to apply CSS styles to Web pages.
CO 4	Learn how to validate Web pages and client side scripting.
CO 5	Learn how to store XML data.
CO 6	Learn server side scripting PHP.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Rajiv Gandhi University of Knowledge Technologies - Nuzvid/RKV/Srikakulam/Ongole

Course Code	Course Name	Course Category	L – T - P	Credits
EG2282	**English-II Laboratory**	**HSC**	**0L: 0T: 3 P**	**1.5 credits**

Course Learning Objectives:

1. To expose the students to a variety of self-instructional, learner friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To initiate them into greater use of the computer in resume preparation, report writing, format making etc.

Unit 1

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

1. Listening – Learn English Select – British Council
   1.1 A Request From Your Boss
   1.2 A Voice Mail Message

2. Speaking
   2.1 British Council – A 2 – Modules – 6-10 – Text Material
   2.2 At The Post Office – Spoken English – EFLU

3. Reading

3.1 Vocabulary Skills

4. Writing
   4.1 Curriculum Vitae
   4.2 E- Correspondence

5. Essential English Grammar
   5.1 I – me – mine – myself (59-63)
   5.2 Kate’s camera – (64)
   5.3 a/an and some – (65-68)
   5.4 a/an and the – (69-73)
   5.5 Some – any – no – none – (76-77)

6. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

7. Life Skills – Mega living! Achieving Mastery of the mind, body and character
   6.1 The Ultimate Challenge

Unit 2

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

1. Listening – Learn English Select – British Council
   1.1 Booking A Table
   1.2 Business Cards

2. Speaking
   2.1 British Council – A 2 – Modules – 11-15 – Text Material
   2.2 At The Doctor’s – Spoken English – EFLU

3. Reading

3.1 Eye Reading and Visual Perception
3.2 Prediction Techniques

4. Writing
   4.1 Note Making

5. Essential English Grammar
   5.1 Someone – anything – nowhere (78-79)
   5.2 Every and all – (80)
   5.3 All – most – some – any – no – none (81)
   5.4 Both – either – neither (82)
   5.5 A lot – much – many – (a) little / (a) few (83-84)

6. Oxford Interactive Laboratory – LSRW software – Compulsory Practice – Intermediate Level

7. Life Skills – Mega living! Achieving Mastery of the mind, body and character
   6.1 The Power of Limitless Living

Unit 3

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

1. Listening – Learn English Select – British Council
   1.1 Finding The Library
   1.2 Meeting A New Team Member

2. Speaking
   2.1 British Council – A 2 – Modules – 16-20 – Text Material
   2.2 Buying A Shirt – Spoken English – EFLU

3. Reading
   3.1 Scanning Skills
   3.2 Skimming Skills

4. Writing
   4.1 Report Writing
5. Essential English Grammar
   5.1 old – nice- interesting – quickly – badly – suddenly - (85 -86)
   5.2 older (than) – the oldest – not as old as – (87-90)
   5.3 enough and too – (91-92)
   5.4 word order – (93-95)
   5.5 and – but – or – because – when … - (97 - 98)

6. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

7. Life Skills – Mega living! Achieving Mastery of the mind, body and character
   6.1 The Promise of Mega Living

Unit 4

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

1. Listening – Learn English Select – British Council
   1.1 Meeting Other Students
   1.2 Meeting people At A Dinner

2. Speaking
   2.1 British Council – B1 – Modules – 1-5 – Text Material
   2.2 At The Market – Spoken English – EFLU

3. Reading

   3.1 Intensive Reading Skills

4. Writing
   4.1 Expansion Of Proverbs And Other

5. Essential English Grammar
   5.1 If we go and if we went – (99-100)
   5.2 A person (who) … a thing (that/which) … - (101-102)
   5.3 At – until – before – (103- 105)
   5.4 Is – under – through – (106 - 110)
   5.5 Good at (doing) – listen to – (112-113)

6. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

7. Life Skills – Mega living! Achieving Mastery of the mind, body and character
   7.1 Excelling With The and Igniting Yourself

Unit 5

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

1. Listening – Learn English Select – British Council
   1.1 Ordering In A Cafe
   1.2 Organizing A Group Project

2. Speaking
   2.1 British Council – B 1 – Modules – 6-10 – Text Material
   2.2 In The Library– Spoken English – EFLU

3. Reading
   3.1 Reading Practice Exercises

4. Writing
   4.1 Describing Pictures

5. Essential English Grammar
   5.1 go in – fall off – run away - (114 – 115)
   5.2 varieties of English

6. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

7. Life Skills – Mega living! Achieving Mastery of the mind, body and character
   7.1 Your Mind And Its Unlimited Potential – Your Commitment To Self Mastery:Kaizen

Resources

Text

1. British Council A2 Level Book
2. Spoken English : A Self Learning Guide To conversation Practice –
   By: V.Sasi Kumar
   PV Dhamija
3. Effective Technical Communication
   By: M Ashraf Rizvi
4. English For Empowerment
   By: G. Damodar
   D. Venkateshwarlu
   M. Narendra
   M. Sarath Babu
   GM. Sundaravalli
5. Mega Living
   By: Robin Sharma
6. Raymond Murphy: Essential English Grammar: A Self-Study Reference and Practice Book (CUP)

7. A Communicative Grammar of English – Geoffrey Leech and Jan Svartvik

Web

1. https://learnenglish.britishcouncil.org/beginner-a1-listening/request-your-boss
2. https://learnenglish.britishcouncil.org/beginner-a1-listening/voicemail-message
3. https://learnenglish.britishcouncil.org/beginner-a1-listening/booking-table
4. https://learnenglish.britishcouncil.org/beginner-a1-listening/business-cards
5. https://learnenglish.britishcouncil.org/beginner-a1-listening/finding-library
6. https://learnenglish.britishcouncil.org/beginner-a1-listening/meeting-new-team-member
7. https://learnenglish.britishcouncil.org/beginner-a1-listening/meeting-other-students
8. https://learnenglish.britishcouncil.org/beginner-a1-listening/meeting-people-dinner
9. https://learnenglish.britishcouncil.org/beginner-a1-listening/ordering-caf
10. https://learnenglish.britishcouncil.org/beginner-a1-listening/organising-group-project

Overall Course Outcomes

1. Using English languages, both written and spoken, competently and correctly.
2. Improving Comprehension and fluency of speech.
3. Gaining confidence in using English in verbal situations.

Assessment Method

Weightage (%)	Internal Marks	External Marks	Total Marks
	40%	60%	100%

Course code	Course Name	Course Category	L-T-P	Credits
CS2281	Computer Organization and Architecture Laboratory	PCC	0-0-3	1.5

Course Learning Objective

1. To expose the students to the various key aspects of Computer Organization & Architecture.
2. To aquaint with various registers in the CPU and understand about the assembly language programming.

List of Experiments:

Lab No 1.a) Verification of Logic gates
b) Assembly language program to find largest number in an Array.

Lab No 2. a) Verification of Full-Adder and Full-Subtractor
b) Assembly language program to find smallest number in an array.

Lab No 3. a)Verification of Ripple Carry Adder and Carry-look-ahead adder.
b) Assembly language program for adding to two arrays

Lab No 4. a) Combinational Multipliers
b) Assembly language program to separate even and odd numbers from an array.

Lab No 5. a) Booth's Multiplier
b) Assembly language rogram to find prime numbers between a given range

Lab No 6. a) Wallace Tree Adder
b) Assembly language program to find factorial of the given number.

Lab No 7. a) Arithmetic Logic Unit
b) Assembly language program to find LCM.

Lab No 8. a) Verification of Registers and Counters
b) Assembly language program to find GCD.

Lab No 9. a) Memory Design
b) Assembly language program to search an element using linear search.

Lab No 10. a) Direct Mapped cache Design
b) Assembly language program to search an element using binary search.

Lab No 11. a) Associative cache Design
b) Assembly language program to sort numbers using bubble sort.

Course Outcomes

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

CO 1	Understand the basic logic gates
CO 2	Understand the full adder and full subtractor
CO 3	**Ripple Carry Adder** examine the behavior of the working module to understand how the carry ripples through the adder stages to design a ripple carry adder using full adders to mimic the behavior of the working module . **Carry Lookahead Adder** understand the behaviour of carry lookahead adder understand the concept of reducing computation time with respect of ripple carry adder by using carry generate and propagate functions
CO4	**Combinational Multipliers** understand the behaviour of combinational multiplier . understand the scheme implemented for the multiplication. it can be designed by unrolling the multiplier loop instead of handling the carry out of partial product summation bit,the carry out can be sent to the next bit of the next step this scheme of handling the carry is called *carry save addition*
CO 5	**Booth's Multiplier** Understand the behaviour of Booth's multiplication**.** Design Booth's multiplier with a controller and a datapath. This will also help in the learning of control unit design as a finite state machine Understand the advantages of Booth's multiplier It can handle signed integers in 2's complement notion It decreases the number of addition and subtraction It requires less hardware than combinational multiplier It is faster than straightforward sequential multiplier
CO 6	**Wallace Tree Adder** Understand the behaviour of wallace tree**.** understand the concept of reducing gate delay by using tree of adders instead of using cascaded full adders

CO 7	**Arithmetic Logic Unit** Understand the behaviourof arithmetic logic unit. Design an arithmetic logic unit for given parameter**.**
CO8	**Registers** to understand the shifting of data to examine the behavior of different modes of data input and data output(serial-in serial-out, serial-in parallel-out, parallel-in serial out,parallel-in parallel-out) to make use of shift register in data transfer developing skills in the designing and testing of sequential logic circuits developing skills in analysing timing signals. **Counters** understand the concept of counting upto certain limiting value and returning back to the start state from final state understand the generation of timing sequences to control operations in a digital system develop skills in the design and testing of counters for given timing sequences develop skills in generating timing signals .
CO 9	**Memory Design** Understand the **behavior of memory.** **D**esign memory for given parameter**.**
CO 10	**Direct Mapped Cache Design** Understand the behavior of direct mapped cache from working module Design a direct mapped cache for given parameters.
CO 11	**Associative Cache Design** Understand the behavior of associative cache. Designs a associative cache for given parameters**.**
Understand and develop Assembly Language Programs	

Assessment Method

Assessment Tool	Experiments	Record/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course code	Course name	Course Category	L-T-P	Credits
CS2282	Database Management Systems Laboratory	PCC	0-0-3	1.5

Course Objectives:

1. Analyze the problem and identify the Entities and Relationships, keys for given database.
2. Design, develop and query a database.
3. Able to construct queries and maintain a simple database using MySQL.
4. Normalization of data present in database tables.
5. Develop triggers programs using PL/SQL.

List of Experiments:

1. Designing the Database through Identifying Entities, Relationship Attributes.

MySQL

1. Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions,
2. Queries to facilitate acquaintance of Date Functions and Conversion Functions.
3. Queries for Creating, Dropping, and Altering Tables
4. Queries using operators in SQL
5. Queries to Retrieve and Change Data: Select, Insert, Delete, and Update
6. Queries using Group By, Order By, and Having Clauses
7. Queries on Controlling Data: Commit, Rollback, and Save point
8. Queries for creating Views, and Constraints
9. Queries on Joins (Outer and Inner joins)
10. Queries on Correlated Sub-Queries

PL/SQL

1. Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation
2. Write a PL/SQL block using SQL and Control Structures in PL/SQL
3. Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types
4. Write a PL/SQL Code using Procedures, Functions, and Packages FORMS

Course Outcomes:

After completing this course the student must demonstrate the knowledge and ability to:

CO 1	Identify the entities, attributes, relationships, keys for given database.
CO 2	Design a database schema for given problem.
CO 3	Formulate queries using MySQL DML, DDL commands.
CO 4	Formulate SQL queries using constraints and set comparison operators.
CO 5	Apply the normalization techniques for development of application software to realistic problems.
CO 6	Develop PL/SQL programs using triggers, procedures
CO 7	Ability to design and implement given case study.

Course Nature		**Practical**		
Assessment Method				
Assessment Tool	Experiments	Record	Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	5%	10%	40%
End Semester Examination weightage (%)				60%

****

Course code	Course name	Course Category	L-T-P	Credits
CS2283	Web Technologies Lab	PCC	0-0-3	1.5

Course Learning Objective:

The course will enable the students to:

1. Demonstrate the ability to retrieve data from a database and present it in a web page.
2. Create web pages that meet accessibility needs of those with physical disabilities and apply the effects of CSS in web page creation.
3. Create effective scripts using JavaScript and jQuery to enhance the end user experience.
4. Demonstrate knowledge of introductory programming concepts.
5. Test, debug, and deploy web pages containing JavaScript and jQuery
6. learn to create pages common to all web applications, and implement the most frequently used components and classes provided by Bootstrap
7. Understand the JavaScript and technical concepts behind Node JS
8. Understand the Servlet programming and deploying application in Web server

List of Experiments:

1. Install and configure the IDE
2. Incorporating JavaScript on an HTML page, and how to link to an external .js file
3. Comparing JavaScript with jQuery for same tasks
4. Using major methods/events in jQuery
5. Using Plugins and local data storage
6. Implement Bootstrap in existing web sites
7. Common Bootstrap components and use Bootstrap themes
8. Setup a Node.js project using npm
9. Use the Node.js core modules

Course Outcomes

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

CO 1	and configure the IDE
CO 2	orating JavaScript on an HTML page, and how to link to an external .js file
CO 3	Comparing JavaScript with jQuery for same tasks

CO 4	major methods/events in jQuery
CO 5	Plugins and local data storage
CO 6	Implement Bootstrap in existing web sites
CO 7	ıon Bootstrap components and use Bootstrap themes
CO 8	a Node.js project using npm
CO 9	e Node.js core modules
CO 10	ng Servlet application and deploying application in web server

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3101	Compiler Design	PCC	3-0-0	3

Course Learning Objectives:

1. To implement the concept learned in automata theory and languages to the field of Computer Science.
2. Analyze the basic steps involved in converting a source language to target code.
3. Understands the concepts of parsers and can write solutions for various grammars by using tools, and also analyzes different storage techniques, error recovery strategies
4. Gain the knowledge to write a compiler program or can able to build a compiler.

Course Content:

Unit I

Introduction to Compilers **(6 Contact hours)**

Introduction to compilers, Phases of compiler, Lexical Analyzer, The role of the lexical analyzer, input buffering, specification of tokens, Recognition of tokens.

Unit II

Syntax Analysis -I **(9 Contact hours)**

Role of the parser, writing grammars and context free grammars, Top down parsing, Brute-force approach, Recursive descent parsing, Predictive parsing, FIRST and FOLLOW constructs.

Unit III

Syntax Analysis -II **(8 Contact hours)**

Bottom-up parsing, shift-reduce parsing, operator precedence parsing, LR parsers, SLR parser, canonical LR parser, LALR parser.

Unit IV

Semantic Analysis **(8 Contact hours)**

Syntax directed translations, applications of syntax directed translations, Syntax directed definitions, construction of syntax tree, Bottom-up evaluation of S-attributed definitions, L-attributed definitions.

Unit V

Intermediate Code Generation and Code Optimization **(8 Contact hours)**

Intermediate languages, Declarations, Assignment statements, Boolean Expressions, case statements, back patching, Procedure calls, Principal sources of optimization, optimization of basic blocks, DAG representation of basic blocks, flow graphs.

Unit VI
Code generation **(6 Contact hours)**

Issues in the design of code generator, the target machine, run time storage management, peephole optimization.

Learning resources

Text book:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, *"Compilers: Principles Techniques & Tools"*, Pearson Education,2nd Edition 2013.

Reference Books:

1. Kenneth C Louden, "*Compiler Construction: Principles and Practice*", Cengage Learning. Lex &Yacc, John R Levine, Oreilly Publishers.
2. Keith D Cooper & Linda Tarezon, "*Engineering a Compiler*", Morgan Kafman, Second edition. Lex &Yacc, John R Levine, Tony Mason, Doug Brown, Shroff Publishers.
3. Muchnik, "*Advanced Compiler Design and Implementation*", Kauffman(1998)

Course outcomes:

CO1	Identify the basic concepts needed for the development of a compiler
CO2	Analyze the various phases and Tools of a Compiler
CO3	Describe the differences between Top-Down and Bottom-Up Parsers and apply parsing methods for various grammars.
CO4	Compare and Contrast Symbol table organization for Block Structured and Non-Block Structured languages.
CO5	Analyze the concepts involved in Intermediate, Code Generation and Code Optimization Process.
CO6	Recognize the various types of errors and error recovery strategies in phases of Compilation

Assessment Method:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests (In semester)	Monthly tests (In semester)	End Semester Test	Total

Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3102	**Computer Networks**	**PCC**	**3-0-0**	**3**

Course Learning Objectives:

1. Build an understanding of the fundamental concept of computer networking.
2. Formalize the student with the basic terminology of the computer networking.
3. Introduce the advanced networking concepts.
4. Preparing the students for entry Advanced courses in Computer Networking.

Course Content:

Unit - I **(7Contact hours)**

Introduction: Network Hardware, Network Software, References Models. Physical Layer-Guided medium and unguided medium , topologies.

Unit - II **(8 Contact hours)**

The Data Link Layer : Data link Layer Design Issues, Error Control.

Elementary Data Link Protocols, Sliding Window Protocols. The Medium Access Control Sublayer: The Channel allocation Problem, Multiple Access protocols, Ethernet - Ethernet Cabling, standard Ethernet , Switched Ethernet, Fast Ethernet.

Unit - III **(9 Contact hours)**

The Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms. Internetworking,subnetting, The Network Layer in the Internet.

Unit - IV **(7 Contact hours)**

The Transport Layer: The Transport Service, Elements of Transport Protocols, The Internet Transport Protocols: UDP, The Internet Transport Protocols: TCP.

Unit - V **(7 Contact hours)**

The Application Layer: DNS - The Domain Name System, Electronic Mail. The World Wide Web, file transfer protocol Multimedia.

Unit – VI **(7 Contact hours)**

Network Security: Cryptography, Symmetric - Key Algorithms, Public - Key Algorithms, Digital Signatures.

Learning resources

Text book:

1. Andrew S. Tanenbaum “*Computer Networks”*, 4e, Pearson Education.
2. Behrouz A. Forouzan “*Data Communications and Networking”*, 4e , Tata McGraw Hill.
3. W. Stallings, “*Data and Computer Communication*”, 8e, Pearson

Reference Books:

1. S. Kshev *“An Engineering Approach to Computer Networks* “, 2nd edition
2. W.A.Shay,Thomson *“Understanding Communications and Networks*”,3rd edition,

Web resources:

1. https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
2. https://www.geeksforgeeks.org/computer-network-tutorials/
3. https://nptel.ac.in/courses/106105081/

Course outcomes: At the end of the course, the student will be able to

CO 1	Independently understand basic Computer Network technology
CO 2	Identify the different types network topology and protocols
CO 3	Enumerate the OSI layers and TCP/IP.
CO 4	Explain the each layer functions.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Type	L-T-P	Credits
CS3103	**Software Engineering**	**PCC**	**3-0-0**	**3**

Course Learning Objectives:

1. To recognize the emergence and importance of Software engineering
2. To identify the different phases in Software Development Life Cycle
3. To prepare the SRS(Software Requirement Specifications) Document for suitable product
4. To discuss the characteristics of good software design
5. To draw the UML Pattern designs for suitable design
6. To validate the product using various testing methods for producing quality software product.

Course Content:

Unit - I **(7 Contact Hours)**

Introduction: Introduction to Software Engineering, Exploratory style Vs. Modern style of development; Software Development Life Cycle; Process Models.

Unit - II **(8 Contact Hours)**

Software Project management: project Planning, estimation, **Software requirements and specification**: gathering, analysis, specification, characteristics, organization.

Unit – III **(9 Contact Hours)**

Software design: overview, characteristics of good design, function-oriented software design, object oriented design, UML, design patterns.

Unit –IV **(7 Contact Hours)**

Coding: Implementation, Coding Standard and Guidelines, review, Unit Testing; Verification and validation.

Unit – V **(7 Contact Hours)**

Testing: Integration and systems testing, Black box & White Box Testing, debugging techniques.

Unit – VI **(7 Contact Hours)**

Software Reliability And Quality Management: Software quality, SEI CMM and ISO- 9001, Reliability, Safety, Risk Analysis, computer-aided software engineering (CASE).

Learning Resources:

Text Book:

1. 1.Rajib Mall, ‘*Fundamentals of Software Engineering*’, PHI; Fourth edition (2014)
2. 2.Pressman, R.S., ‘*Software Engineering: A Practitioner's Approach*’, McGraw Hill, seventh edition, 2010.
3. Pankaj Jalote. ‘*An Integrated Approach to Software Engineering*’, 2nd edition, Narosa Publishing House

Reference Books:

1. Pressman, R.S., ‘*Software Engineering: A Practitioner's Approach*’, McGraw Hill, seventh edition, 2010.
2. Pankaj Jalote. ‘*An Integrated Approach to Software Engineering*’, 2nd edition, Narosa Publishing House
3. Bennett S., McRobb S. & Farmer R., ‘*Object Oriented Systems Analysis and Design using UML*’, Tata McGraw-Hill, second edition, 2004.
4. Summerville Ian, ‘*Software Engineering*’, Addison-Wesley, fifth edition, 2000
5. K.K.Agarwal, ‘*Software Engineering*’

Video Resources :

1. Primary Producer: NPTEL: *Prof. Sarda*, IIT Bombay, Publication Date: October 8, 2008, ‘*Introduction to Software Engineering*’ *URL* **https://nptel.ac.in/courses/106101061/**

Web Resources:

1. https://www.tutorialspoint.com/software_engineering/
2. https://www.geeksforgeeks.org/software-engineering
3. https://onlinecourses.nptel.ac.in/noc18_cs43

Course Outcomes: At the end of the course the students will be able to

CO1	Describe the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
CO2	An ability to work in one or more significant application domain
CO3	To develop and deliver quality software by working as an individual and as part of a multidisciplinary team
CO4	Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
CO5	Deliver quality software products by possessing the leadership skills as an individual or contributing to the team development and demonstrating effective and modern working strategies by applying both communication and negotiation management skill.
CO6	Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.

For Theory courses only:

Course Nature	**Theory**
Assessment Method	

Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3104	**Operating System**	**PCC**	**3-0-0**	**3**

Course Learning Objectives:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication
3. To learn the mechanisms involved in memory management in contemporary OS
4. To know the components and management aspects of concurrency management
5. To learn programmatically to implement simple OS mechanisms

Course Content:

Unit - I **(6 Contact Hours)**

Basics: Evaluation, definition, Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems: Kernel and user mode. Introduction to Systems calls.

Unit - II **(7 Contact Hours)**

Process Management: definition: Process and PCB, description, Life cycle, Process Scheduling: Preemptive and Non-Preemptive; (Round Robin, FIFO, SJF and priority based) Uniprocessor scheduling algorithms, Multiprocessor and Real-time scheduling algorithms

Unit - III **(8 Contact Hours)**

Process Synchronization - Peterson's Solution, Banker's Algorithm,, Semaphores, Critical Regions: Producer-consumer problems, Readers writers problem, dining Philosophers problem. Monitors

Unit - IV **(7 Contact Hours)**

Introduction to deadlocks, Resource allocations, Deadlock Conditions, Deadlock prevention, Deadlock Detection- safe and unsafe states, deadlock avoidance- Banker's algorithms, and Recovery.

Unit - V **(10 Contact Hours)**

Memory Management: Partitioning, Paging and Segmentation and space allocation; Page replacement algorithms, Analysis of page allocation policies - Working Set, Virtual memory, Demand Paging.

Unit – VI **(9 Contact Hours)**

File Systems And Secondary Storage Management: : Free space management: Contiguous, Sequential and Indexed Allocation, File system interface, File System implementation, Disk Scheduling, Device drivers - block and character devices, streams, Character and Block device switch tables,

Learning Resources

Text book:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne,"*Operating System Concepts*", John Wiley & Sons Inc., 6th Edition.
2. William Stallings, "*Operating System: Internals and Design Principles*", Pearson, 5th Edition.

Reference Books:

1. Andrew S Tanenbaum, "*Modern Operating Systems*", Pearson Prentice Hall, 4th Edition.
2. Systmes D M Dhamdhere, *Operating Systems - System Programming and Operating*, Tata McGraw Hill
3. Gary Nutt, *Operating Systems: A Modern Perspective*, Addison Wesley, 2nd Edition.

Web resources:

1. PCP Bhattm, December 31 2009, *Operating Systems*, https://nptel.ac.in/courses/106108101/

Course outcomes: At the end of the course, the student will be able to

CO 1	Identify the structure of OS and basic architectural components involved in OS design.
CO 2	Explain the Mutual exclusion, Deadlock Handling Methods
CO 3	Design applications to simulate process scheduling and memory management algorithms.
CO 4	Differentiate the system functionalities in between old and modern OS
CO 5	Tell the need of protection and security in OS

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3181	Computer Networks Lab	PCC	0-0-3	1.5

Course Learning Objectives:

1. To understand the principles of subnetting and types of sub netting
2. To Simulate the network communication and packet routing
3. To differentiate various subnet masking models
4. To analyze the various routing algorithms
5. To know the concept Virtual Lan's and Spanning ports

List of Experiments:

1. Lab No 1: Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whois etc..

2. Lab No 2: Understanding packet tracer and independent components in packet tracer

3. Lab No 3: Understanding the subnetting concept and types, Fixed Length subnet Masking (FLSM)and Variable length subnet masking (VLSM).

4. Lab No 4: To implement Static Routing using FLSM & VLSM.

5. Lab No 5: To configure DHCP as a pool router & Service Server.

6. Lab No 6: To implement Dynamic Routing using RIP version 1

7. Lab No 6: To implement Dynamic Routing using RIP version 2

8. Lab No 7: To implement Dynamic Routing using OSPF single area network

9. Lab No 8: To implement Dynamic Routing using OSPF multi area network

10. Lab No 9: To implement NAT(Network Address Translation) ,PAT(Port Address Translation)

11. Lab No 10: To implement VLAN
12. Lab No 11: Implementation of Socket program (Client server chat application using JAVA)
13. Lab No 12: Implementation FTP application to transfer multimedia

Course Outcomes

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

CO 1	Understand details and functionality of Network Devices and Network commands
CO 2	Apply subnetting techniques to design various topologies in computer networking
CO 3	Compare various routing algorithms and it's simulation.
CO 4	Understanding the implementation of VLAN's and DHCP servers.
CO 5	Applying Network Address Translation
CO 6	Understand how to implement client-server applications using JAVA.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3182	**Software Engineering Laboratory**	**PCC**	**0-0-3**	**1.5**

Course Learning Objectives:

1. To get familiar with objective and abstract of the project.
2. To get familiar with preparing a document which is used before starting the project
3. Prepare System Design & Architecture
4. Identify & draw different UML based diagrams
5. To understand actual system using analysis model
6. To understand the project implementation according to MVC architecture
7. To understand various testing techniques.

List of Experiments:

1. Identify the Objective and Abstract of the project based on the given Scenarios
2. Prepare Software Requirement Analysis document to respective project
3. Compute function point of the selected project
4. Prepare System Design & Architecture design
5. UML based design diagrams
6. Prepare Data Flow Diagrams of the selected project
7. Complete design part of the selected project
8. Design of the Test Cases of the selected project
9. On completion of coding prepare test cases and perform black-box testing , record the defects and its time of identification
10. Do vulnerability analysis of the selected project

Course Outcomes

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

CO 1	Objective and Abstract of the project
CO 2	SRS document which contains detailed information about the given project

CO 3	Design document which contains detailed diagrams of System design and System Architecture of the given project
CO 4	Design document which contains detailed diagrams of Use case, Class, Sequence, Activity, State, State transition Diagrams
CO 5	E-R diagram, data-flow diagram, state-transition diagram for the project
CO 6	Understanding about Unit testing, regression testing, integration testing, validation and system testing
CO 7	Implementing the given project with Advanced Java programming according to MVC Architecture

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3183	Operating System Lab	PCC	0-0-3	1.5

Career Objectives:

1. To understand the design aspects of operating system.
2. To study the process management concepts & Techniques.
3. To study the paging and segmentation concepts.
4. To familiarize students with the Linux environment

List of Experiments:

1. Introduction to system calls – implementation of open(), creat(),close(), write(), read(), lseek()
2. Implementation of fork (), wait (), exec() and exit () system calls
3. Write a program to simulate the following non-preemptive CPU scheduling algorithms to find
turnaround time and waiting time.
a) FCFS b) SJF
4. Write a program to simulate the following preemptive CPU scheduling algorithms to find
turnaround time and waiting time.
a) Round Robin b) Priority
5. Write a program to simulate producer-consumer problem using multi-threading.
6. Write a program to simulate Bankers algorithm for the purpose of deadlock avoidance.
7. Write a program to simulate the following contiguous memory allocation techniques
a) Worst-fit b) Best-fit c) First-fit
8. Write a program to simulate paging technique of memory management.
9. Write a C program to simulate page replacement algorithms
a) FIFO b) LRU
10. Write a C program to simulate disk scheduling algorithms
a) FCFS b) SCAN c) C-SCAN
11. Study and practice of Unix/Linux general purpose utility command list
man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history,

chmod, chown, finger, pwd, cal, logout, shutdown.

12. Write a C program that makes a copy of a file using standard I/O, and system calls

13. Write a C program to emulate the UNIX **ls –l** command.

14. Write a C program that illustrates how to execute two commands concurrently with a command pipe.

    Ex: - l**s –l | sort**

15. a) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system.

    b) Study of Unix/Linux file system (tree structure).

    c) Study of .bashrc, /etc/bashrc and Environment variables.

At the end of this lab session, the student will be able

Course Outcomes:

CO 1	To use Unix utilities and perform basic shell control of the utilities
CO 2	To use the Unix file system and file access control.
CO 3	To use of an operating system to develop software
CO 4	To use Linux environment efficiently

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L – T - P	Credits
EG3284	English-III Laboratory	HSC	0L: 0T: 3 P	1.5 credits

Course Learning Objectives:

5. To expose the students to a variety of self-instructional, learner friendly modes of language learning.
6. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.
7. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
8. To initiate them into greater use of the computer in resume preparation, report writing, format making etc.
9. Soft Skills Will Enable the students become more aware of perfect life and to improve their quality of their personal and professional lives.

Unit 1

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

8. Listening – Learn English Select – British Council
   8.1 A Morning Briefing
   8.2 An Invitation To A Party

9. Speaking
   9.1 British Council – B1 – Modules – 6-8 – Text Material
   9.2 At The Tailors – Spoken English – EFLU

10. Reading
    10.1 A Poster AT Work
    10.2 A Poster For Exam Candidates

11. Writing
    11.1 Learning About Collocations

12. Communicative Grammar
    5.1 Intonation

13. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

14. Life Skills – Mega living! Achieving Mastery of the mind, body and character
    14.1 Your Mind And Its Unlimited Potential
    14.2 The nature of The Mind-The Ultimate Super Power

Unit 2

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

8. Listening – Learn English Select – British Council
   8.1 Changing A Meeting Time

8.2 Changing Plans

9. Speaking
   9.1 British Council – B1 – Modules – 9-11 – Text Material
   9.2 At The Chemists– Spoken English – EFLU

10. Reading
    10.1 A Message To a New Friend
    10.2 An Email From a Friend

11. Writing
    11.1 Grammatical Aspects of Collocations

12. Communicative Grammar
    5.1 Intonation

13. Oxford Interactive Laboratory – LSRW software – Compulsory Practice – Intermediate Level

14. Life Skills – Mega living! Achieving Mastery of the mind, body and character
    6.1 Discipline And Will Power-The Golden Keys

Unit 3

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

8. Listening – Learn English Select – British Council
   8.1 Four Conversations
   8.2 Leaving a Message

9. Speaking
   9.1 British Council – A 2 – Modules – 12-14 – Text Material
   9.2 At The Railway Station– Spoken English – EFLU

10. Reading
    - 10.1 An End of term report
    - 10.2 An Invitation to a Job Interview

11. Writing
    - 11.1 Special Aspects of Collocations

12. Communicative Grammar
    - 12.1 Intonation

13. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

14. Life Skills – Mega living! Achieving Mastery of the mind, body and character
    6.1 The Feel Good Principle And Beliefs: How To Unleash vitality

Unit 4

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

8. Listening – Learn English Select – British Council
    - 8.1 Missing a Class
    - 8.2 Understanding an Explanation

9. Speaking
    - 9.1 British Council – B1 – Modules – 15-17 – Text Material
    - 9.2 At The Tea Stall – Spoken English – EFLU

10. Reading
    - 10.1 Choosing a Conference Venue
    - 10.2 English Course Prospectus

11. Writing
    - 11.1 Travel and the Environment

12. Communicative Grammar
    - 5.1 Intonation

13. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

14. Life Skills – Mega living! Achieving Mastery of the mind, body and character
    - 14.1 Mega Things And The Enhancement of Positivity

Unit 5

Laboratory/Practicals 1.5 credits – 3 hrs Contact Period in a Week

(Total contact hours = 9 hrs)

8. Listening – Learn English Select – British Council
    - 8.1 Who's who in the Office
    - 8.2 A Phone Call From a Customer

9. Speaking
    - 9.1 British Council – B 1 – Modules – 18-20– Text Material
    - 9.2 An Interview– Spoken English – EFLU

10. Reading
    - 10.1 Professional Profile Summaries
    - 10.2 Study Skills Tips

11. Writing
    - 11.1 People and Relationships

12. Communicative Grammar

5.1 Intonation

13. Communicative Grammar
    5.1 Intonation

14. Oxford Interactive Laboratory – LSRW software – Compulsory Practice - Intermediate Level

15. Life Skills – Mega living! Achieving Mastery of the mind, body and character
    15.1 The Magic of Goals: Your Visions of Excellence

Resources

Text

8. British Council A2 Level Book
9. Spoken English : A Self Learning Guide To conversation Practice – By: V.Sasi Kumar
   PV Dhamija
10. English Collocations in Use – Michael Mc Carthy and Felicity O'Dell
11. Mega Living
    By: Robin Sharma
12. A Communicative Grammar of English – Geoffrey Leech and Jan Svartvik

Web

Listening

11. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/morning-briefing
12. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/invitation-party
13. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/changing-meeting-time
14. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/changing-plans
15. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/four-conversations
16. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/leaving-message
17. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/missing-class

18. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/understanding-explanation
19. https://learnenglish.britishcouncil.org/pre-intermediate-a2-listening/whos-who-office
20. https://learnenglish.britishcouncil.org/intermediate-b1-listening/phone-call-customer

Reading

1. https://learnenglish.britishcouncil.org/beginner-a1-reading/poster-work
2. https://learnenglish.britishcouncil.org/beginner-a1-reading/poster-exam-candidates
3. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/message-new-friend
4. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/email-friend
5. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/end-term-report
6. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/invitation-job-interview
7. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/choosing-conference-venue
8. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/english-course-prospectus
9. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/professional-profile-summaries
10. https://learnenglish.britishcouncil.org/pre-intermediate-a2-reading/study-skills-tips

Overall Course Outcomes

4. Using English languages, both written and spoken, competently and correctly.
5. Improving Comprehension and fluency of speech.
6. Gaining confidence in using English in verbal situations.
7. Life skills will enable them become decent citizens

Assessment Method

Weightage (%)	Internal Marks	External Marks	Total Marks
	40%	60%	100%

ENGINEERING THIRD YEAR: SEMESTER-II

ourse code	Course name	Course Category	L-T-P	Credits
CS3201	Cryptography and Network Security	PCC	3-0-0	3

Course Learning Objectives:

1. To understand basics of Cryptography and Network Security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand various protocols for network security to protect against the threats in the networks.

Course Content:

Unit 1: **(10 Contact hours)**

Introduction to security attacks, services and mechanism, introduction to cryptography - Conventional Encryption: Conventional encryption model, classical encryption techniques - substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers ,Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, AES.

Unit II: **(8 Contact hours)**

Confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation, Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's

Algorithm, Chinese Remainder theorem, discrete algorithms.

Unit III: **(7 Contact hours)**

Principles of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elgamel encryption, Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS.

Unit IV: **(7 Contact hours)**

MD5 message digest algorithm, Secure hash algorithm (SHA), Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm, Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security, pretty good privacy (PGP), S/MIME.

Unit V: **(7 Contact hours)**

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management.

Unit VI: **(7 Contact hours)**

Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET), System Security: Intruders - Viruses and related threats

Learning Resources

Text books:

1. William Stallings, “Crpyptography and Network security Principles and Practices”, Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, “ Introduction to Cryptography with coding theory”, Pearson**.**

Reference Books:

1. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

Web resources:

1. http://nptel.ac.in/courses/106105031/ lecture by Dr. Debdeep Mukhopadhyay IIT Kharagpur

2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/ lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.

Course Outcomes: At the end of the course, the student will be able to

CO 1	Implement security of the data over the network.
CO 2	Explore emerging areas of cryptography and network security.
CO 3	Implement various networking protocols.
CO 4	Demonstrate how to protect any network from the threats in the world.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

LIST OF PROFESSIONAL ELECTIVES COURSE(PEC)

Elective group-1

Course Code	Course Name	Course Category	L-T-P	Credits
CS3121	Data Mining	PEC	3-0-0	3

Course Learning Objectives

1. Interpret the contribution of data warehousing and data mining to the decision-support level of organizations
2. Categorize and carefully differentiate between situations for applying different data-mining techniques: frequent pattern mining, association, correlation, classification, prediction, and cluster and outlier analysis
3. Design and implement systems for data mining
4. Evaluate the performance of different data-mining algorithms
5. Propose data-mining solutions for different applications

Course Content:

Unit - I: **(6 Contact hours)**

Introduction to Data Mining (DM): OLAP vs OLTP, Origins of DM and Types of Data, Data Mining Tasks, Data Measures of Similarity and Dissimilarity, KDD, Preprocessing

Unit-II: **(9 Contact hours)**

Classification: Basic Concepts and techniques - Introduction about Classification, Nearest Neighbor Classifiers, Attribute Selection Measures, Decision Tree Induction, Model Over fitting, Metrics for Classification performance and comparisons

Unit - III: **(9 Contact hours)**

Classification: Alternative techniques – Naïve Bayesian classifiers, Bayesian Belief networks, Perceptron model, Multi Layer perceptron model, Back propagation, Support vector Machine, Introduction to Regression Analysis

Unit – IV: **(7 Contact hours)**

Association Analysis: Basic Concepts, Frequent Item set Generation, Rule Generation, Apriori Algorithm, FP-Growth algorithm, Vertical Partitioning, Multi Dimensional Associations

Unit – V: **(9 Contact hours)**

Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering, Methods, Partitioning Methods, K Mean and K-Medoid clustering, Density Based Methods etc, Hierarchical Clustering.

Unit – VI: **(5 Contact hours)**

Introduction to outlier detection, design and implementation of naïve methods related to data mining techniques.

Learning resources:

Text book:

1. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar. *Introduction to Data Mining.*
2. Jiawei Han, MichelineKamber,*"Data Mining: Concepts and Techniques"*, Morgan Kaufmann Publishers editor, 2006.
3. David J. Hand, HeikkiMannila, PadhraicSmyth ,*"Principles of Data mining"* MIT Press
4. Parteek Bhatia "Data Mining and Data Warehousing " 1/e, Cambridge,19

Reference Books:

1. *"Advances in Knowledge Discovery and Data Mining"*. AAAI/MIT Press, 1996. Selected papers from conferences and journals, conference tutorials.
2. *Jiawei Han, Micheline Kamber, and Jian Pei.* Data Mining:*Concepts and Techniques* (3rd ed.). Morgan Kaufmann, 2012. eText ISBN: 9780123814807.

Web resources:

http://nptel.ac.in/courses/106106093/35

Course outcomes: At the end of the course, the student will be able to

CO 1	Discover interesting pattern from large amount of data to analyze and extract patterns to solve problems make predictions of outcomes.
CO 2	Evaluate systematically supervised models and algorithms w.r.t their accuracy.
CO 3	Evaluate and implement a wide range of emerging and newly-adopted methodology and technologies to facilitate the knowledge discovery.
CO 4	Design and implement of a data mining applications using sample, realistic data

	sets and modern tools.
CO 5	Evaluate and select appropriate data mining algorithms apply, interpret and report the output appropriately.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3123	**Distributed Computing**	**PEC**	**3-0-0**	**3**

Course Learning Objectives:

1. To expose students to both the abstraction and details of file systems
2. To introduce concepts related to distributed computing systems.
3. To focus on performance and flexibility issues related to systems design decisions.
4. To prepare students for life-long learning
5. To evaluate how and not just the memorize the details.
6. To expose students to current literature in distributed systems.

Course Content:

UNIT – I **(8 Contact hours)**

Fundamentals: Evolution of Distributed Computing Systems, System models, issues in design of Distributed Systems, Distributed computing environment, web based distributed model, computer networks related to distributed systems and web based protocols

UNIT-II **(8 Contact hours)**

Message Passing: Inter process Communication, Desirable Features of Good Message-Passing Systems, Issues in IPC by Message, Synchronization, Buffering, Multidatagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication

UNIT-III **(7 Contact hours)**

Remote Procedure Calls: The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Server Management, Communication

Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling,Some Special Types of RPCs, Lightweight RPC, Optimization for Better Performance.

UNIT- IV **(8 Contact hours)**

Distributed Shared Memory: Design and Implementation issues of DSM, Granularity, Structure of Shared memory Space, Consistency Models, replacement Strategy, Thrashing, Other Approaches to DSM, Advantages of DSM.

UNIT – V **(8 Contact hours)**

Synchronization: Clock Synchronization, Event Ordering, Mutual Exclusion, Election Algorithms. Constant.

Resource and Process Management: Desirable Features of a good global scheduling algorithm, Load Balancing approach, Load Sharing Approach, Process Migration, Threads, Processor allocation, Real time distributed Systems.

UNIT – VI **(8 Contact hours)**

Distributed File Systems: Desirable Features of a good Distributed File Systems, File-sharing Semantics, File Models, File Accessing Models,ile caching Schemes, File Replication, Design Principles, Sun's network file system, Andrews file system, comparison of NFS and AFS.

Learning resources

Text book:

1. Ajay D. Kshemkalyani, Mukesh Singhal , "Distributed Computing: Principles, Algorithms, and Systems Reissue Edition",

2. Sukumar Ghosh, Distributed Systems: An Algorithmic Approach, Second Edition

Reference Books:

1. Distributed OS by Pradeep K. Sinha (PHI)
2. Tanenbaum S.: Distributed Operating Systems, Pearson Education
3. Tanenbaum S. Maarten V.S.: Distributed Systems Principles and Paradigms, (Pearson Education)
4. George Coulouris, Jean Dollimore. Tim Kindberg: Distributed Systems concepts and design.

Web resources:

https://eclass.uoa.gr/modules/document/file.php/D245/2015/DistrComp.pdf

Course outcomes: At the end of the course, the student will be able to

CO 1	Study software components of distributed computing systems.
CO 2	Know about the communication and interconnection architecture of multiple computer systems.
CO 3	Recognize the inherent difficulties that arise due to distributed-ness of computing resources.
CO 4	Understanding of networks & protocols, mobile & wireless computing and their applications to real world problems

CO 5	Able to use pointers in C programming

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3124	**Advanced Computer Architecture**	PEC	**3-0-0**	**3**

Course Learning Objectives:

1. To understand the Concept of Parallel Processing and its applications.
2. To understand the micro-architectural design of processors.
3. To learn about the various techniques used to obtain performance improvement and power savings in current processors.
4. To develop the Pipelining Concept for a given set of Instructions.
5. To distinguish the performance of pipelining and non pipelining environment in a processor.
6. To ability to improve the performance of applications on modern and high performance computers.

Course Content:

UNIT – I **(10 Contact hours)**

Introduction and Pipelinig: Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design;Pipeline hazards; Implementation of pipeline; What makes pipelining hard to implement?

UNIT-II **(10 Contact hours)**

Instruction –Level Parallelism: ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with prediction; Overcoming Data hazards with Dynamic scheduling; Hardware-based speculation

UNIT-III **(8 Contact hours)**

Instruction –Level Parallelism – 2: Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example.

UNIT – IV **(12 Contact hours)**

Multiprocessors and Thread –Level Parallelism: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency.

UNIT – V **(12 Contact hours)**

Memory Hierarchy and Design : Introduction; Cache performance; Cache Optimizations, Virtual memory;Advanced optimizations of Cache performance; Memory technology and optimizations; Protection: Virtual memory and virtual machines.

UNIT – VI **(10 Contact hours)**

Hardware and Software for VLIW and EPIC: Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor;

Learning resources

Text book:

1. John L Hennessey and David A Patterson, “Computer Architecture A Quantitative Approach”, Morgan Kaufmann/ Elsevier, Fifth Edition, 2012

Reference Books:

1. Kai Hwang and Faye Briggs, “Computer Architecture and Parallel Processing”, Mc Graw-Hill International Edition, 2000.
2. Sima D, Fountain T and Kacsuk P, ”Advanced Computer Architectures: A Design Space Approach”, Addison Wesley, 2000.

Web resources:

Higher Performance Computer Architecture, NPTEL Course
https://nptel.ac.in/courses/106105033/1

Course outcomes: At the end of the course, the student will be able to

CO 1	Evaluate performance of different architectures with respect to various parameters
CO 2	Analyze performance of different ILP techniques.
CO 3	Identify cache and memory related issues in multi-processors

CO 4	Design the overall organization of cache and virtual memories, and pipelined processors.
CO 5	Describe the challenges faced in the implementation of these high performance system
CO 6	Improve application performance for different cpu architectures

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

LIST OF PROFESSIONAL ELECTIVES COURSE(PEC)

Elective group-2

Course Code	Course Name	Course Category	L-T-P	Credits
CS3225	**MACHINE LEARNING**	PEC	**3-0-0**	**3**

Course outcomes:

At the end of the course the students should be able

- To understand complexity of Machine Learning algorithms and their limitations;
- To describe modern notions in data analysis oriented computing;
- To be capable of confidently applying common Machine Learning algorithms in practice and implementing their own
- To be capable of performing experiments in Machine Learning using real-world data.
- To design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

Course Content:

UNIT I: Introduction to ML **(10 Contact hours)**

A brief introduction to Machine Learnin`g, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Statistical decision theory – Regression, Classification, Bias-variance, Linear Regression, Multivariate Regression, and Dimensionality Reduction: Subset Selection, Shrinkage Methods, Principle Component Regression, and Partial Least Square.

Unit II: Statistical Models (10 Contact hours)

Naïve Bayes, Bayesian Classifier, Gaussian Multivariate model, Gaussian Mixture model, Parameter Estimation: Maximum Likelihood Estimation, Expectation and Maximization, Priors & MAP Estimation, Bayesian Parameter Estimation

Unit II: Artificial Neural Networks and SVM (10 Contact hours)

Feed forward network, Perceptron Learning, Back propagation, Radial Basis NN, SVM – Formulation, SVM – Interpretation & Analysis, SVMs for Linearly Non-Separable Data, SVM Kernels.

Unit IV: Decision Trees and Ensemble method (10 Contact hours)

Introduction, Entropy, Information gain, Multi-way splits, Decision Trees, Stopping Criteria, Loss-Function for Classification, Missing Values, Ensemble Methods: Bagging, Boosting

Unit V: Evaluation Measures& Hypothesis Testing (10 Contact hours)

Evaluation Measures: Evaluation Measure, Bootstrapping & Cross Validation, Class Evaluation Measure, the ROC Curve, Hypothesis Testing: Introduction to Hypothesis testing, basic concept, Sampling Distributions & the Z Test, Student's t-test, The Two Sample & Paired Sample t-tests, Confidence Intervals.

Unit VI: Clustering (10 Contact hours)

Clustering: Partitional Clustering, Hierarchical Clustering, Threshold Graphs, The K-mean, Algorithm, The Diana Algorithm, Density Based Clustering.

Text Books:

1. T. Mitchell. "*Machine Learning*" McGraw-Hill, First Edition.
2. Stephen Marsland," Machine *Learning: An Algorithmic Perspective*",Chapman and Hall/CRC, Second Edition.

Reference Books:

1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Trevor Hastie," *An Introduction to Statistical Learning: with Applications in R*", Springer, First Edition.
2. Kevin Murphy, "*Machine learning: a probabilistic perspective*", MIT Press, First Edition.
3. Christopher Bishop, "*pattern recognition and machine learning*", Springer, First Edition.
4. C.R. Kothari,Gaurav Garg, "*Research Methodology: Methods and Techniques*", Fourth Edition.
5. Simon haykin, "neural networks & learning machines", prentice hall, First Edition.
6. Peter Fach "Machine Learning" Cambridge

Web resources:

Introduction to machine learning by Prof. Balaraman Ravindran **http://nptel.ac.in/courses/106106139/**

Course Outcomes

CO 1	Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

CO 2	Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
CO 3	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
CO 4	Be able to design and implement various machine learning algorithms in a range of real-world applications.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weight age (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3266	**MACHINE LEARNING LAB**	PEC	0-0-2	**1**

Course Learning Objectives:

1. To understand the principles of Machine learning and its python libraries
2. To Implement various data preprocessing techniques
3. To Analyze supervised learning algorithms of regression models
4. To analyze unsupervised learning algorithms of classification models
5. To understand dimensionality reduction

List of Experiments:

1. Introduction to the python Machine Learning libraries NumPy Arrays, using data frames in pandas and dealing of excel,csv,pdf files using pandas.
2. Introduction to matplotlib and seaborn for data visualizations and Machine SciKit Learn etc..
3. Data preprocessing Techniques

Regression

1. Simple Linear Regression

2. Multi- Linear Regression
3. Polynomial Regression
4. Logistic regression

Classification

1. Naive Bayes,
2. SVM
3. Decision Tree Classification
4. Random Forest Classification

Clustering

1. K- means
2. Hierarchical Clustering

Dimensionality Reduction

1. PCA

Course Outcomes

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

CO 1	Understand details and functionality of Python machine Learning libraries
CO 2	Apply implement various machine learning plots using python libraries
CO 3	Compare Regression and classification and implement
CO 4	Understanding the implementation of clustering Algorithms
CO 5	Applying Dimensionality reduction
CO 6	Understand how to implement client-server applications using JAVA.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total

Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3226	OBJECT ORIENTED ANALYSIS & DESIGN(OOAD)	PEC	3-0-0	**3**

Course Learning Objectives:

1. Master the implementation of different Models

2. Be familiar with models,relationships,roles,types and interfaces
3. Demonstrate understanding the abstractions of various system models
4. Demonstrate understanding of various common modeling techniques
5. Implement various object models designing in more than one manner.
6. Choose the appropriate model for a specified application and different mechanisms

Course Content:

UNIT I : Introduction to UML **(6 Contact hours)**

Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle.

UNIT II : Basic Structural Modeling **(9 Contact hours)**
Classes Relationships, Common Mechanisms, and diagrams.

Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.

UNIT III: Class & Object Diagrams **(7 Contact hours)**
Terms, concepts, modeling techniques for class & object diagrams

UNIT IV : Basic Behavioral Modeling **(7 Contact hours)**
Interactions, Interaction diagrams, Use cases, Use case diagrams, Activity Diagrams.

UNIT V : Advanced Behavioral Modeling **(8 Contact hours)**
Events and signals, state machines, processes and threads, time and space, state chart diagrams**.**

UNIT VI :Architectural Modeling **(8 Contact hours)**
Component, Deployment, Component diagrams and Deployment diagrams and case study.

Learning resources:

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: *'The Unified Modeling Language User Guide'*, Pearson Education.

Refernce books:

1. Meilir Page-Jones, *'Fundamentals of Object Oriented Design in UML'*, Pearson Education.
2. AtulKahate, *'Object Oriented Analysis & Design'*, The McGraw-Hill Companies

Web resources:

1. IIT Kharagpur, July 22 2016, *'Foundations of the Object Model'*,
   a. URL:**https://nptel.ac.in/courses/106105153/10**
2. IIT Kharagpur, August 12 2016, *'Overview of UML'*,
   a. URL: **https://www.youtube.com/watch?time_continue=31&v=iN4Ft6loL7o**
3. IIT Kharagpur, July 29 2016, *'Relationship among objects'*,
   a. URL: **https://nptel.ac.in/courses/106105153/20**

Course outcomes: At the end of the course, the student will be able to

CO 1	Define basic terms necessery for modeling computer systems
CO 2	Collect requirements and prepare their scenarios

CO 3	Draw diagrams by UML
CO 4	Prepare and use of design patterns
CO 5	Prepare supporting documentation.
CO 6	Create a New Models as per requirements.

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3267	**Object Oriented Analysis and Design Laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. To develop a mini-project following the 12 exercises listed below.
2. To develop a problem statement.
3. Develop an IEEE standard SRS document. Also develop risk management andproject plan (Gantt chart).
4. Identify Use Cases and develop the Use Case model.
5. Identify the business activities and develop an UML Activity diagram.
6. Identity the conceptual classes and develop a domain model with UML Class diagram.
7. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.

8. Draw the State Chart diagram.
9. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
10. Implement the Technical services layer.
11. Implement the Domain objects layer.
12. Implement the User Interface layer.
13. Draw Component and Deployment diagrams.

Suggested domains for Mini-projects

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management

System Suggested Software Tools: Argo UML, Eclipse IDE, Visual Paradigm, Visual case, and Rational Suite

Reference websites: www.vidyarthiplus.com, www.vidyarthiplus.com

Course outcomes

At the end of the course, the student will be able

CO 1	Show the importance of systems analysis and design in solving complex problems
CO 2	how the object-oriented approach differs from the traditional approach to systems analysis and design.
CO 3	Construct various UML models (including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams, and implementation diagrams) using the appropriate notation
CO 4	Recognize the difference between various object relationships: inheritance, association, whole-part, and dependency relationships
CO 5	Show the role and function of each UML model in developing object-oriented software

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3227	DISTRIBUTED SYSTEMS	PEC	3-0-0	3

Course Learning Objectives:

1. To learn the fundamentals of Distributed Systems
2. To learn distributed services such as the world-wide web
3. To learn examples of research and commercial distributed systems
4. To learn about distributed algorithms and distributed file systems and distributed
5. databases, security and protection
6. To expose students to past and current research issues in the field of distributed systems
7. challenges in cloud computing.
8. To create an awareness of the fundamental technical challenges in advanced distributed
9. systems design and implementation.

Course Contents:

UNIT I **(7 Contact hours)**

Definition of distributed systems, Goals of distributed system, types of distributed systems, Architectural Styles , types of architectures

UNIT II **(8 Contact hours)**

Threads in Distributed Systems ,Virtualization, clients , servers , client server design issues, code migration.

UNIT III **(8 Contact hours)**

Distributed systems communication fundamentals, RPC,Message-Oriented Communication Stream-Oriented Communication , Multicast communication .

UNIT IV **(9 Contact hours)**

Names ,Distributed Hash Tables ,Attribute-based Naming Hierarchical Implementations ,Decentralized Implementations .clock synchronization,logical clocks, mutual exclusion, election algorithms, atomic transaction, deadlocks in distributed systems.

UNIT V **(8 Contact hours)**

Distributed file systems, distributed file system design, distributed file system implementation, trends in distributed file system.

UNIT VI **(9 Contact hours)**

Distributed shared memory, introduction, what is shared memory, consistency models, page based distributed shared memory, shared-variable distributed shared memory, object based distributed shared memory.

Text Book:

1. Andrew S. Tanenbaum, ”Distributed Operating Systems”, PHI, Third Edition.

2. George Coulouris,”Distributed Systems: Concepts and Design”Pearson,5th Edition

References:

1. William Stallings. “Operating Systems, Internal and Design principles”, Pearson india,Fourth Edition,

Video References:

1. NPTEL Lecture: Prof. Ananthanarayana V.S https://nptel.ac.in/courses/106106107
2. NPTEL Lecture: Dr.Rajiv Misra https://nptel.ac.in/courses/106104182

Course Outcomes: At the end of the course, the student will be able to

CO 1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies
CO 2	Demonstrate knowledge of the core architectural aspects of distributed systems

CO 3	Design and implement distributed applications
CO 4	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems)
CO 5	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems)
CO 6	Demonstrate experience in building large-scale distributed applications.

For Theory courses only:

Course Nature	**Theory**			
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3268	**DISTRIBUTED SYSTEMS LAB**	**PEC**	**0-0-2**	**1**

Course Learning Objectives

1. To understand and conceptual visualize of theoretical aspects of Distributed Systems.
2. To introduce basic concepts middleware, states of art middleware technology and middleware services like RMI,CORBA,DCOM and EJB.

List of experiments

1. To study Client Server based program using RPC.
2. To study Client Server based program using RMI.
3. To Study Implementation of Clock Synchronization (logical/physical).
4. To Study Implementation of Election algorithm.
5. To study Implementation of Mutual Exclusion algorithms.
6. To write Program multi-threaded client/server processes.
7. To write Program to demonstrate process/code migration.

8. Write a distributed application using EJB.
9. Write a program using CORBA to demonstrate object brokering.
10. Use .Net framework to deploy a distributed application.

Course Outcomes

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

CO 1	Understand Remote Procedure Call
CO 2	Understand Client Server based program using RMI
CO 3	Understand and implement Clock synchronization Algorithms
CO4	Understand and implement Election algorithms
CO5	Understand and implement Mutual exclusion algorithms
CO6	Understand and implement multi-threaded client/Server processes
CO7	Understand process/code migration
CO8	Understand and implement distributed application using EJB
CO9	Understand and implement object borkering using CORBA
C10	To deploy a distributed application using .Net

Assessment Method

Assessment Tool	Experiments	Record/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3228	Real Time Operating Systems	PEC	3-0-0	3

Course learning Objectives:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5. To know the components and management aspects of concurrency management, To learn programmatically to implement simple OS mechanisms
6. Syllabus deals with issues in real time operating systems, importance of deadlines and concept of task scheduling

Course Content:

UNIT-I: REVIEW OF OPERATING SYSTEMS (8 Contact Hours)

Overview, OS structures, system calls, process cooperation, process communication, semaphores, conditional critical regions, deadlock, processor management, scheduling algorithms, Queuing system model.

UNIT-II AN INTRODUCTION TO RTOS (8 Contact hours)
Introduction to RTOS, types of RTOS, GPOS vs RTOS, applications of RTOS, Issues in real time computing.

UNIT-III: REAL TIME MODELS AND LANGUAGES (8 Contact hours)
Event Based – Process Based and Graph based Models – Pertinent Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

UNIT-IV: REAL TIME KERNEL (8 Contact hours)
Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and study of RTOS VX works and μCOS – Case studies.

UNIT-V: RTOS APPLICATION DOMAINS (9 Contact hours)
RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

UNIT-VI: DISTRIBUTED OPERATING SYSTEMS (8 Contact hours)
Distributed operating systems concept, file systems, mode of computation, load balancing, event ordering, synchronization, distributed mutual exclusion, drinking philosophers problem, deadlocks in distributed systems.

Text Books:

1. ***R.Mall***, Real Time Systems: Theory and Practice, Pearson Education, 2007.
2. ***William Stallings***, Operating Systems: Internals and Design Principles, 8th edition Pearson Education Limited, 2014 ISBN: 1292061944, 9781292061948

References:

1. ***Tanenbaum***, "Distributed Operating Systems", Pearson Education.
2. ***Jane Liu***, Real Time Systems, Pearson Education, 2000.
3. ***C.M.Krishna*** and K.G.Shin, Real Time Systems, Tata McGraw Hill, 1997.
4. ***Raymond J.A.Bhur, Donald L.Bailey***, "An Introduction to Real Time Systems", PHI 1999.
5. ***D.M Dhamdhere***: Operating systems - A concept based Approach, 3rd Edition, Tata McGraw- Hill, 2012.
6. ***P.C.P. Bhatt***: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.

Video Reference:

1. NPTEL Lecture: Prof.Rajib Mall https://nptel.ac.in/courses/106105172
2. NPTEL Lecture: Prof. Chester Rebeiro https://nptel.ac.in/courses/106106144

Course Outcomes: At the end of the course, the student will be able to

CO 1	Summarize the issues in real time computing
CO 2	Understand the concept of the tradeoffs in design and implementation concepts used in the development of Operating Systems
CO 3	Understand the differences between the processes and Threads.
CO 4	Understanding of memory management techniques are used in operating system.
CO 5	Understanding of I/O techniques are used in operating system.
CO 6	Analyze the situation of fault occurrence and will be able to apply solutions accordingly.
CO 7	Solve scheduling problems and can apply them in real time applications in industry.
CO 8	Design an RTOS and will be able to interpret the feasibility of a task set to accomplish or not.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3269	**Real time Operating System LAB**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. To provide students a practical experience working on a real-time platform
2. To understand the concepts of Real time operating systems
3. To improve C++ and reusability skills.
4. To improve programming syntax and algorithm checking.
5. To Perform Multithreaded Programming in RTOS Platform.
6. To Acquire the Knowledge on working of Interrupts and Writing ISRs.

List of Programming Assignments for Laboratory

S.NO	Name of the Experiment
1	Write the pseudo code in Linux using C/C++ to perform FCFS scheduling
2	Write the pseudo code in Linux using C/C++ to perform Round Robin scheduling

3	Write the pseudo code in Linux using C/C++ to perform Priority Based scheduling
4	Write the pseudo code in Linux using C/C++ to perform Print parent process ID & child process ID using Fork()
5	Study of POSIX thread & Write appropriate the pseudo code in Linux using C/C++
6	Study of Semaphore & Write appropriate the pseudo code in Linux using C/C++
7	Study of Raspberry pi & Write appropriate the pseudo code for blinking of LED and keypad in Linux using python
8	Write appropriate the pseudo code for Pipe in Linux
9	Study of Dining Table philosophy problem and write appropriate pseudo code for the same
10	Write a C/C++ Program to perform the task Management in FreeRTOS, using win32 port on Visual Studio IDE: a. Create Two Tasks and Pass the "Task-Name" as an argument to the task function. b. Demonstrate the use of idle task hook function. c. Update the task priority dynamically.
11	Write a C Program to create a task in Free RTOS, using win32 port on Visual Studio IDE; that periodically generates a software interrupt for every 1sec
12	Write a C Program to Demonstrate Inter-Task Communication using Queues in Free RTOS, use ARM Cortex-M3 Port (LPC1768 MCU Kit) a. Task-1 creates data (stores in a structure) and sends it to the queue b. Task-2 reads the message packet from the queue and reacts accordingly.

Course outcomes

At the end of the course, the student will be able

CO 1	Familiarity with key Real-Time Operating System terms and concepts
CO 2	Ability to program using system calls in a uC/OS-II environment.
CO 3	Ability to demonstrate Task Management
CO 4	Ability to demonstrate Inter-Task communication

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3229	**EMBEDED SYSTEMS**	**PEC**	**3-0-0**	**3**

Course Learning Objectives:

1. This course emphasizes on comprehensive treatment of embedded hardware and real time operating systems along with case studies, in tune with the requirements of Industry.
2. The objective of this course is to enable the students to understand embedded-system programming and apply that knowledge to design and develop embedded solutions.

Course Content:

Unit – I **(8 Contact hours)**

Introduction to Embedded Systems: Definition, Applications of ES, Embedded Hardware Units and Devices, Embedded Software, Design Metrics in ES, Challenges in ES Design.

Unit- II **(7 Contact hours)**

Architecture of 8051: 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, Interrupts and Programming 8051**.**

UNIT –III **(8 Contact hours)**

ARM- Embedded Processor: History, Architecture, Interrupt vector, Programming the ARM, ARM Assembly language, Instruction set, Conditional Execution, Arithmetic and Logical Compare**.**

UNIT – IV **(8 Contact hours)**

ARM PROGRAMMING: Assembly programming, General structure of assembly language, Writing programs, Branch instructions, Loading constrains, load and store instructions, Readonly and read/write Memory, Multiple Register Load and Store.

UNIT – V **(8 Contact hours)**

REAL TIME OPERATING SYSTEMS: Introduction, Tasks and Task States, Tasks and Data, Reentrancy, Semaphores and Shared Data, Inter Process Communication-Message Queues, Mailboxes and Pipes.

UNIT – VI **(7 Contact hours)**

REAL TIME OPERATING SYSTEMS-I : Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

TEXT BOOKS:

1. Raj Kamal, “Embedded Systems”, 2nd edition, Tata McGraw Hill, 2009.

2. Lyla B Das, “Embedded Systems an Integrated Approach”, 1st edition, Pearson, 2012.

3. David E. Simon, “An Embedded Software Primer”, 1st edition, Pearson Education, 2008.

REFERENCE BOOKS:

1. Wayne Wolf, “Computers as Components-principles of Embedded Computer system Design”, 1st edition, Elseveir, 2009.
2. Labrosse, “Embedding system building blocks”, 2rd edition, CMP Publishers, 2007.
3. Kenneth J. Ayala and Thomson, “The 8051 Microcontroller”, 3rd edition, Thompson Delmar, Learning, 2008.
4. Frank Vahid, Tony Givargis and John Wiley, “Embedded System Design, Microcontrollers”, 3rd edition, Pearson Education, 2008. 5. Michael J. Pont, “Embedded C”, Addison Wesley, 2002

Course outcomes: At the end of the course, the student will be able to

CO 1	Understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions
CO 2	Get familiarized with programming environment to develop embedded solutions
CO 3	Program ARM microcontroller to perform various tasks.
CO 4	Understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3270	**Embeded System laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

Lab Programs List

Week – 1
1. Write a program to toggle all the led to port and with some time delay using ARM7
Week – 2
2.Write a program to interface LCD with ARM7
Week – 3
3.Write a program to interface 4*4 matrix keypad with ARM7
Week – 4
4.Write a program for interfacing LED and PWM and to verify the output in the **ARM7**
Week – 5
5.Write a program to interface Stepper motor with ARM7
Week – 6
6.Write a program for interfacing of DC motor with ARM7
Week – 7
7.Write a program to study and characteristics of the programmable gain amplifier **(PGA)**
Week – 8
8.Write a Program realization of low pass, high pass and band pass filters and their **characteristics**
Week – 9
9.Write a program to interface ADC and DAC with PSOC
Week - 10
10. Write a program for digital function implementation using digital blocks A. Counter for blinking LED B. PWW C. Digital buffer and digital inverter
Week – 11
11. Write a program to verify Timer operation in different modes
Week – 12
12. Write a Program to interface stepper motor with PSOC

Course outcomes
At the end of the course, the student will be able

CO 1	An ability to apply the knowledge of mathematics, science, engineering fundamentals in ECE to various areas, like Analog & Digital Electronic Systems, Signal & Image Processing, VLSI & Embedded systems, Microwave & Antennas, wired & wireless communication systems etc., in the design and implementation of complex systems.
CO 2	An ability to solve complex Electronics and communication engineering problems, using latest hardware and software tools, along with significant analytical knowledge in Electronics and Communication Engineering
CO 3	Acquire necessary soft skills, aptitude and technical skills to work in the software industry and/or core sector and able to participate and succeed in competitive examinations.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3230	**Digital Image Processing**	**PEC**	**3-0-2**	**4**

Course Objectives:

1. To describe the image fundamentals and mathematical transforms necessary for image processing.
2. To explain the image enhancement techniques
3. To analyze images in the frequency domain using various transforms.
4. To explain image restoration procedures.
5. To describe Image Compression and Segmentation used in digital image processing.
6. To describe image feature extraction methods.

Course Outcomes:

1. Be able to apply, design and implement solutions for digital image processing problems.
2. Be able to discuss the strengths and limitations of DIP applications in solving problems with both professional peers and lay clients.

Course content:

UNIT I **(8 Content hours)**

Digital image fundamentals – Electromagnetic spectrum and imaging, Image acquisition, image formation. Digitization-sampling and quantization, Resolution-pixel, gray scale, spatial, basic relationship between pixels, Distance measure, Mathematical operations on image, Geometrical and spatial transformation.

UNIT II **(8 Content hours)**

Intensity transformation and spatial filtering: Image enhancement, log transformation, Gamma transformation, Histogram processing, Histogram matching, Special filtering- spatial correlation and convolution, generating spatial filter mask, mage smoothing, Image sharpening-Laplacian filter, Highboost filter. Edge detection- gradient filter, Morphological image processing-erosion, Dilation, opening and closing operations, Boundary extraction, Hole Filling, Extraction of connected components, Thinning, and thickening.

UNIT III **(7 Content hours)**

Image Restoration-Noise model, Restoration-Mean filter, Geometric filter, median filter, adaptive filter, band pass filter, Notch filter, least mean square filters. Color fundamental-RGB color model, CMY color model, HSI color model. Converting RGB to HSI and vice-versa.

UNIT IV **(7 Content hours)**

Filtering in Frequency domain-Preliminary concept: Fourier series, Fourier transform, convolution, Sampling, DFT, Enhancement in frequency domain, low pass filter, high pass filter. Computing IDFT from DFT.

UNIT V **(8 Content hours)**

Image compression fundamental, coding, temporal and spatial redundancy, Error-free (Lossless) and Lossy compression. Image segmentation, Point-line-edge detection. Image gradients operator, canny edge detection, Edge linking and boundary detection, local processing, thresholding, variable thresholding, Region Growing, Texture Segmentation; Region oriented segmentation.

UNIT VI **(8 Content hours)**

Feature Extraction: Edges – Canny, Sobel; Line detectors, Corners - Harris, Orientation Histogram, SIFT, SURF, Scale-Space Analysis- Image Pyramids, Haar transform. Decision-theoretic and structure descriptors.

Textbooks:

1. Digital Image processing – R.C. Gonzalez & R.E. Woods, Addison Wesley/ Pearson education, 3rd edition.
2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, PHI Learning 2009.
3. Milan Soanka, Vaclav Hlavac and Roger Boyle, Digital Image Processing and Computer Vision, Cengage Learning.

REFERENCES:

Fundamentals of Digital Image processing – A.K.Jain , PHI

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3271	**Digital image Processing Laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

Students will be able to

1. Do Image acquision and to digitize the image.
2. Apply various mathematical operations on digital image.
3. Apply various filtering and smoothing operations on digital image.
4. Transform the image from spatial domain to frequency domain and vice versa.
5. Transform the image in various color models.
6. Segment and detect various objects in the image.

List of Experiments/Programming (in Python) :

Install Python and libraries; Numpy, Matplotlib, Opencv

1. Read an Image, convert then in grayscale, subtract mean and display.
2. Read an Image, resize image to its half dimensions, resize image to its double dimensions, stretch the image to its double width only.

3. Enhance the image by applying power law transform.
4. Enhance the image by applying histogram equalization.
5. Enhance the image by applying Gaussian smoothing filter.
6. Transform image in frequency domain and apply low pass and high pass filter then apply inverse Fourier transform and display the image.
7. Convert image from RGB to HIS, CMY and vice versa.
8. Apply image compression
9. Apply erosion and dilation, opening and closing.
10. Apply canny and Sobel filter for line and edge detection
11. Apply variable thresholding to enhance shaded text image.
12. Pattern matching by correlation, and shape number.

Course outcomes

CO 1	Analyze general terminology of digital image processing.
CO 2	Develop Fourier transform for image processing in frequency domain.
CO 3	Evaluate the methodologies for image segmentation, restoration etc.
CO 4	Apply image processing algorithms in practical applications

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course code	Course name	Course Category	L-T-P	Credits
CS3257	**MOBILEAPPLICATION DEVELOPMENT**	**ESC**	**3-0-0**	**3**

Syllabus:

Course Objective:

- Describe those aspects of mobile programming that make it unique from programming for other platforms,
- Critique mobile applications on their design pros and cons,
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
- Program mobile applications for the Android operating system that use basic and advanced phone features, and

- Deploy applications to the Android marketplace for distribution.

UNIT I: **(6 Hours)**

J2ME Overview: Java 2 Micro Edition and the World of Java, Introduction to Mobile app Development, Reasons to Build Mobile App, Mobile Application Development Today, Myths of Mobile Application Design. Diving into Mobile: App or Website? Mobile Web Presence

UNIT II : **(12 Hours)**

Android Platform and Development Environment: Intro to Android, Create your First Android App, Layouts, Views and Resources. Text and Scrolling Views. Activities and Intents. Debugging and Testing your App

UNIT III : **(9 Hours)**

User Input Controls, Menus, Screen Navigation, Recycler View, Drawables, Themes and Styles. Material Design

UNIT IV: **(10 Hours)**

Async Task and Async TaskLoaders, Connecting to the Internet, Broadcast Receivers, Services, Notifications, Alarm Managers, Transferring Data Efficiently. Shared Preferences

UNIT V: **(5 Hours)**

SQLite Primer, Store Data using SQLite, Content Providers, Using Loaders to Load and Display Data, Permissions, Performance and Security.

UNIT VI : **(10 Hours)**

Kotlin : Introduction to kotlin, Environment Setup , Architecture, Functions, Classes, Visibility Control, Inheritance and Interfaces, Extensions, Data and Sealed Classes, Delegation, Example to build basic apps using Kotlin.

Text Books

1. Professional Mobile Application Development by Jeff McWherter, Scott Gowell Wiley india pvt.ltd 2013
2. https://google-developer-training.gitbooks.io/android-developer-fundamentals-course-practicals/content/en/
3. https://developers.google.com/training/courses/android-fundamentals
4. https://kotlinlang.org/docs/tutorials/edu-tools-learner.html

Open Source Videos Link:

Course Name: Android Fundamentals Developer - Videos

https://www.youtube.com/playlist?list=PLlyCyjh2pUe9wv-hU4my-Nen_SvXIzxGB

Reading Material Open Source Link:

https://google-developer-training.gitbooks.io/android-developer-fundamentals-course-concepts/content/en/

https://www.tutorialspoint.com/kotlin

Tutorial Hours (Practical Problem sets) Open Source Link:

https://google-developer-training.gitbooks.io/android-developer-fundamentals-course-practicals/content/en/

Course outcomes: At the end of the course, the student will be able to

CO 1	Understand importance of mobile presence
CO 2	Will be able to design mobile applications
CO 3	Understand the Android Studio installation, Project structure, creating activities, testing apps and using the Android Support Library
CO 4	Understand that how to get input from the user, implement navigation strategies, use themes and styles, test your user interface, and follow Material Design principles
CO 5	Understand how to do background work, how to schedule tasks, and how to trigger events
CO 6	Understand the difference between other languages and kotlin, how to build apps using kotlin.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	**Course Name**	**Course Category**	**L-T-P**	**Credits**
CS3272	**Mobile Application Development Laboratory**	**ESC**	**0-0-2**	**1**

Course Learning Objective:

1. Learning basic Android programming concepts.
2. Building a variety of apps, starting with Hello World.
3. Working your way up to apps that schedule jobs , update settings etc
4. Learn to use the Architecture Components
5. Working with various APIs and Databases

List of Experiments:

LAB No	**Name of Assignment**
1	Research document on Mobile Application Development
2	Understanding and Exploring Android Studio Tool
3	Working with Layouts, Views and Resources
4	Adding the Activities and Intents
5	Debugging and Testing your App
6	Adding the User Input Controls
7	Working with Menus
8	Implementing the Screen Navigation
9	Recycler View
10	Working with Async Task and Loaders
11	Working with Databases Transferring Data
12	Shared Preference

Course Outcomes

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

CO 1	Survey on Existing Mobile Operating Systems
CO 2	Understanding about Install and use the Android IDE, Create an Android project from a basic app template
CO 3	Using Layouts, Working with TextView Elements
CO 4	Create and Start Activities, Understand the activity lifecycle, and Implicit Intents
CO 5	Understanding about Run your app in debug mode in an emulator or on a device
CO 6	Understanding about Using Keyboards, Input Controls, Alerts, and Pickers
CO 7	Understanding about Using an Options Menu
CO 8	Understanding about Using the App Bar and Tabs for Navigation

CO 9	Understanding about the Use of RecyclerView class to display items in a scrollable list
CO 10	understanding the benefits and drawbacks of using AsyncTask for background tasks
CO 11	Understanding about SQLite database with an SQLiteOpenHelper

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

LIST OF PROFESSIONAL ELECTIVES COURSE(PEC)

Elective group -3

Course Code	Couse Name	Course Category	L-T-P	Credits
CS3231	**Information Retrieval**	**PEC**	**3-0-0**	**3**

Course Learning Objectives:

1 To use different information retrieval techniques in various application areas

2 To apply IR principles to locate relevant information large collections of data

3 To analyze performance of retrieval systems when dealing with unmanaged data sources

4 To implement retrieval systems for web search tasks.

Course Content:

Unit I **(7Contact hours)**

Boolean retrieval. The term vocabulary and postings lists. Dictionaries and tolerant retrieval. Index construction.

Unit II **(8 Contact hours)**

Index Compression, Scoring, term weighting and the vector space model. Computing scores in a complete search system, Relevance feedback and query expansion.

Unit III **(9 Contact hours)**

XML retrieval. Probabilistic information retrieval, Text classification. Vector space classification.

Unit IV **(7 Contact hours)**

Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.

Unit V **(7 Contact hours)**

Web search basics. Web crawling and indexes, Link analysis.

Unit VI **(7 Contact hours)**

Learning to Rank, Future of web search, Recommender Systems, Content Based Filtering, Collaborative Filtering.

Learning resources:

Text Book:

1.Introduction to Information Retrieval , Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2008**.**

Reference Books:

1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, Springer.
2. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.
3. Information Retrieval: Algorithms and Heuristics, David A Grossman and Ophir Frieder, 2nd Edition, Springer, 2004.
4. Information Retrieval Data Structures and Algorithms, William B Frakes, Ricardo BaezaYates, Pearson Education, 1992. 5. Information Storage & Retieval, Robert Korfhage, John Wiley & Sons
5. C.D. Manning, P. Raghavan, H. Schütze. Introduction to Information Retrieval, Camb ridge UP, 2008. (available in the Web, http://nlp.stanford.edu/IR□book/).
6. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.

Web Resources:

https://youtu.be/q0srNT_XM_Y?list=PL0ZVw5- GryEkGAQT7lX7oIHqyDPeUyOMQ
https://youtu.be/j789k96g5aQ?list=PL0ZVw5-GryEkGAQT7lX7oIHqyDPeUyOMQ
https://youtu.be/Bl_tfdy6814

Course outcomes: At the end of the course, the student will be able to

CO 1	Ability to identify Data Base Management systems and data ware houses
CO 2	Ability to use knowledge of data structures and indexing methods in information retrieval Systems
CO 3	Ability to choose clustering and searching techniques for different data base systems
CO 4	Ability to Explain different types of search algorithms like Hardware text search systems and software text search systems
CO 5	understand the underlined problems related to IR

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly Tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	**Course Name**	**Course Category**	**L-T-P**	**Credits**
CS3273	**Information Retrieval Laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. To present the basic concepts in information retrieval and more advance techniques of Multimodal based information systems.
2. To understand the underlined problems related to IR
3. Acquired the necessary experience to design, and implement real applications using Information Retrieval systems.
4. To understand how information retrieval principles are implemented in various digital Information environments

List of Programming Assignments for Laboratory

1 Setting up a retrieval test-bed

1. Case study project: Searching Stack Overflow Q&A
2. Dataset
3. Building and searching the index
4. Evaluation
5. Data workflow
6. Understanding search results

2 Text pre-processing

1. Analyzers
2. Text based Token filters
3. HTML Token filters
4. Fields extraction with regular expressions
5. Experiments automation
6. Experiment: Stream readers
7. Experiment: Tokenizes
8. Experiment: Filters
9. Discussion: Tested combinations

3 Evaluation metrics

1. Search utility metrics
2. Search stability metrics
3. Systematic evaluation

4 Retrieval Models

1. Case study: Washington Post news index
2. Documents ranking with Lukens's retrieval models
3. Vector Space Model (Cosine TF-IDF)
4. Best Model 25 (BM 25)
5. Language Model with Dirichlet Smoothing (LMD)
6. Discussion
7. Advanced discussion

5 Query Expansion

1. Linguistic query expansion
2. Corpus-based query expansion
3. Pseudo-relevance feedback
4. Discussion

6 Indexing Multiple Fields

1. Creating a large set of indexing fields
2. Per Field processing
3. Query processing

4. Discussion

7 Rank Fusion and Learning to Rank

1. Searching with multiple fields
2. Unsupervised rank fusion
3. Learning-to-rank (LETOR)
4. Discussion

Course outcomes

At the end of the course, the student will be able

CO 1	Learn the concept of information relevance.
CO 2	Analyse Web and multimedia data.
CO 3	Learn how to rank information by relevance.
CO 4	Understand evaluation protocols.
CO 5	Select the right IR techniques for particular problems.
CO 6	Design information retrieval systems.
CO 7	Ability to do critical thinking about retrieval results.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3232	**Software Testing**	**PEC**	**3-0-0**	**3**

Course Learning Objectives:

1. To understand the basic concepts of software engineering, life cycle models
2. To understand in detail about the requirement analysis and requirement engineering processes and testing methods.
3. To understand the concepts and principles involved in software design .
4. To understand the concepts and various types of software testing and project implementation techniques.

5. To understand the techniques involved in software project management and Risk management.
6. To understand the scope of test automation and tools for testing.

Course Content:

UNIT – I **(8 Contact hours)**

Introduction to software testing: testing as an engineering activity, testing as a process, testing axioms, basic definitions, software testing principles, tester's role in a software development organization.

UNIT-II **(8 Contact hours)**

Introduction to software defects: origin of defects, costs of defects, defect classes, defect repository and test design, defect examples, developer/tester support for developing a defect repository, defect prevention techniques.

UNIT-III **(12 Contact hours)**

test case design : test case design strategies: black box approach to test design, random testing, requirements based testing, boundary value analysis, equivalence class partitioning, state-based testing, cause-effect graph, compatibility testing, user documentation testing, domain testing, using white box approach to test design: test adequacy criteria, static testing vs. structural testing, code functional testing, coverage and control-flow graph, covering-code logic, paths, code-complexity testing, evaluating test-adequacy criteria.

UNIT – IV **(12 Contact hours)**

Levels of testing: need of levels of testing, unit testing,designing the unit tests, the test harness, running the unit tests and recording results, integration tests, designing integration tests, integration test planning,defect bash elimination system testing, acceptance testing, performance testing, regression testing, ad-hoc testing, alpha-beta tests, testing Object Oriented systems-usability and accessibility testing, configuration testing, compatibility testing, testing the documentation, website testing.

UNIT – V **(10 Contact hours)**

Test management: People and organizational issues in testing, organization structure for testing teams, testing services,test plan components, test plan attachments, locating test items, test management, test process, reporting test results, the role of three groups in test planning and policy development-introducing test specialist, skills needed by test specialist, building a testing group.

UNIT – VI **(10 Contact hours)**

Test Automation: software test automation, skills needed for automation, scope of automation, design and architecture for automation, requirements for a test tool, challenges in automation, test metrics and measurements, project progress and productivity metrics.

Learning resources:

Text books:

1. SrinivasanDesikan and gopalaswamyramesh, "Software testing-principles and practices", Pearson Education, 2006

2. Ron Patton, “Software testing”, Second Edition, Sams Publishing, Pearson education, 2007

References:

1. Ilene Burnstein, “Practical software testing”, Springer International Edition, 2003
2. Edward Kit, “Software testing in real world- improving the process”, Pearson Education, 1995
3. Boris Beizer, “Software testing techniques”, Second Edition,
4. AdityaP.Mathur, “Foundations of software testing-fundamental algorithms and techniques”, Pearson Education, 2008

Web resources:

1. https://nptel.ac.in/courses/106105171/

Course outcomes: At the end of the course, the student will be able to

CO 1	Various test processess and continuous quality improvement
CO 2	Methods of test generation from requirements
CO 3	Behavior modeling using UML
CO 4	Test adequacy assessment using: control flow, data flow, and program mutations
CO 5	The use of various test tools
CO 6	Application of software testing techniques in commercial environments

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3274	**Software testing Laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. To understand the basic concepts of software engineering, life cycle models

2. To understand in detail about the requirement analysis and requirement engineering processes and testing methods.
3. To understand the concepts and principles involved in software design
4. To understand the concepts and various types of software testing and project implementation techniques.
5. To understand the techniques involved in software project management and Risk management.
6. **6.** To understand the scope of test automation and tools for testing.

List of Programming Assignments for Laboratory

EXPT NO :-1

1. Understand The Automation Testing Approach (Theory Concept)
2. Automation
3. Automation is making a process automatic eliminating the need for human
4. intervention. It is a self-controlling or self-moving process. Automation Software
5. offers automation wizards and commands of its own in addition to providing a task
6. recording and re-play capabilities. Using these programs you can record an IT or
7. business task.
8. Benefits of Automation
9. Fast
10. Reliable
11. Repeatable
12. Programmable
13. Reusable
14. Makes Regression testing easy
15. Enables 24*78 Testing
16. Robust verification.

INTRODUCTION TO SELENIUM:

1. **History of Selenium**

a) In 2004 invented by Jason R. Huggins and team.
b) Original name is JavaScript Functional Tester [JSFT]
c) Open source browser based integration test framework built originally by Thoughtworks.
d) 100% JavaScript and HTML
e) Web testing tool
f) That supports testing Web 2.0 applications
g) Supports for Cross-Browser Testing(ON Multiple Browsers)
h) And multiple Operating Systems
i) Cross browser – IE 6/7, Firefox .8+, Opera, Safari 2.0+

2. **What is Selenium?**

a) Acceptance Testing tool for web-apps
b) Tests run directly in browser
c) Selenium can be deployed on Windows, Linux, and Macintosh.
d) Implemented entirely using browser technologies -
   - JavaScript
   - DHTML
   - Frames

3. **Selenium Components**

a) Selenium IDE

b) Selenium Core

c) Selenium RC

Recording and Run settings:

1. When Selenium-IDE is first opened, the record button is ON by default.
2. During recording, Selenium-IDE will automatically insert commands into your
3. test case based on your actions.
   a. Remember Base URL MODE - Using Base URL to Run Test Cases in Different Domains
   b. Record Absolute recording mode – Run Test Cases in Particular Domain.

Running Test Cases:

1. Run a Test Case Click the Run button to run the currently displayed test case.
2. Run a Test Suite Click the Run All button to run all the test cases in the currently loaded test suite.
3. Stop and Start The Pause button can be used to stop the test case while it is running. The icon of this button then changes to indicate the Resume button. To continue click Resume. Stop in the Middle You can set a breakpoint in the test case to cause it to stop on a particular command. This is useful for debugging your test case.

Test Suite: A test suite is a collection of tests. Often one will run all the tests in a test suite as one continuous batch-job. When using Selenium-IDE, test suites also can be defined using a simple HTML file. The syntax again is simple. An HTML table defines a list of tests where each row defines the filesystem path to each test.

LIST OF EXPERIMENTS:

1. write programs in C language to demonstrate the working of the following

i)do...while ii)while...do iii)if...else iv) switch v)for

2. A program written in C for matrix multiplication fails !!Introspect the causes for its failure and write down the possible causes for its failure.
3. Take any system (eg: ATM) and study its sustem specifications and report the various bugs.
4. Write the test cases for any known applications (eg: Banking Application)
5. Create a test plan document for any application(eg: Library Management system)
6. Study of any testing tool(eg: win runner)
7. Study of any Web testing tool(eg: selenium)
8. Study of any Bug tracking tool(eg: Bugzilla,bugbit)
9. Study of any test management tool(eg: Test director)
10. Study of any open source testing tool(eg: Test link)

DEVELOPING TEST CASES:

1. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss the results.

ALGORITHM:

```
Step 1: Input a, b & c i.e three integer values which represent three sides of
the triangle.
Step 2: if $(a < (b + c))$ and $(b < (a + c))$ and $(c < (a + b)$ then
do step 3
else
print not a triangle. do step 6.
Step 3: if $(a=b)$ and $(b=c)$ then
Print triangle formed is equilateral. do step 6.
Step 4: if $(a \neq b)$ and $(a \neq c)$ and $(b \neq c)$ then
Print triangle formed is scalene. do step 6.
Step 5: Print triangle formed is Isosceles.
Step 6: stop
```

PROGRAM CODE:

```
#include<stdio.h>
#include<ctype.h>
#include<conio.h>
#include<process.h>
int main()
{
int a, b, c;
clrscr();
printf("Enter three sides of the triangle");
scanf("%d%d%d",&a,&b,
if((a > 10) || (b > 10) || (c > 10))
{
printf("Out of range");
getch();
exit(0);
}
if((a<b+c)&&(b<a+c)&&(c<a+b))
{
if((a==b)&&(b==c))
{
printf("Equilateral triangle");
}
else if((a!=b)&&(a!=c)&&(b!=c))
{
printf("Scalene triangle");
}
else
printf("Isosceles triangle");
}
else
{
```

```
printf("triangle cannot be formed");
}
getch();
return 0;
}
```

Test Report:

Case Id	Description	Input Data			Expected Output	Actual Output	Comments
		a	b	c			

2. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

ALGORITHM

```
STEP 1: Define lockPrice=45.0, stockPrice=30.0, barrelPrice=25.0
STEP2: Input locks
STEP3: while(locks!=-1) „input device uses -1 to indicate end of data
goto STEP 12
STEP4:input (stocks, barrels)
STEP5: compute lockSales, stockSales, barrelSales and sales
STEP6: output(“Total sales:” sales)
STEP7: if (sales > 1800.0) goto STEP 8 else goto STEP 9
STEP8: commission=0.10*1000.0; commission=commission+0.15 * 800.0;
commission = commission + 0.20 * (sales-1800.0)
STEP9: if (sales > 1000.0) goto STEP 10 else goto STEP 11
STEP10: commission=0.10* 1000.0; commission=commission + 0.15 *
(sales-1000.0)
```

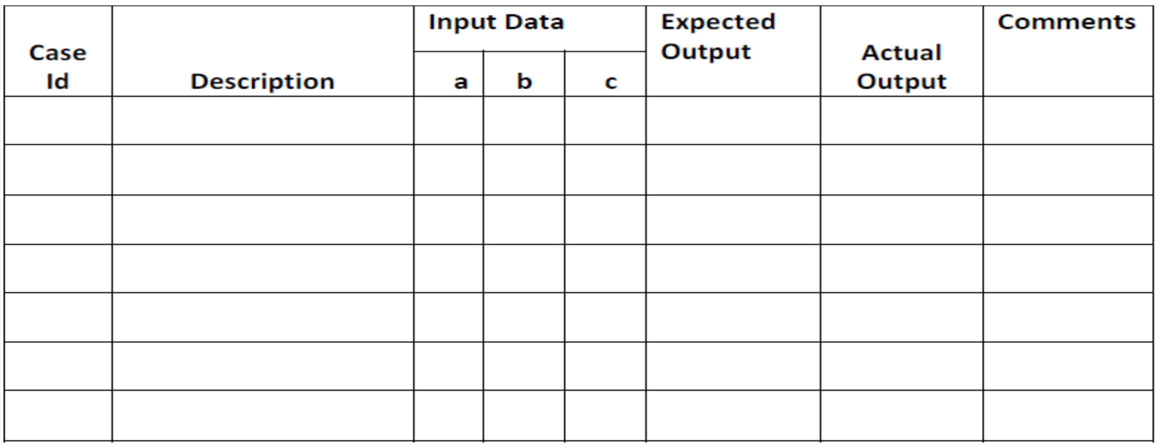
STEP11: Output(“Commission is $”, commission)
STEP12: exit

PROGRAM CODE:

```
#include<stdio.h>
#include<conio.h>
int main()
{
int locks, stocks, barrels, t_sales, flag = 0;
float commission;
clrscr();
printf("Enter the total number of locks");
scanf("%d",&locks);
if ((locks <= 0) || (locks > 70))
{
flag = 1;
}
printf("Enter the total number of stocks");
scanf("%d",&stocks);
if ((stocks <= 0) || (stocks > 80))
{
flag = 1;
}
printf("Enter the total number of barrelss");
scanf("%d",&barrels);
if ((barrels <= 0) || (barrels > 90))
{
flag = 1;
}
if (flag == 1)
{
printf("invalid input");
getch();
exit(0);
}
t_sales = (locks * 45) + (stocks * 30) + (barrels * 25);
if (t_sales <= 1000)
{
commission = 0.10 * t_sales;
}
else if (t_sales < 1800)
{
```

```
commission = 0.10 * 1000;
commission = commission + (0.15 * (t_sales - 1000));
}
else
{
commission = 0.10 * 1000;
commission = commission + (0.15 * 800);
commission = commission + (0.20 * (t_sales - 1800));
}
printf("The total sales is %d \n The commission is %f",t_sales, commission);
getch();
return;
}
```

Test Report:



Case Id	Description	Input Data			Expected Output	Actual Output	Comments
		a	b	c			

3. Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

ALGORITHM

STEP 1: Input date in format DD.MM.YYYY

STEP2: if MM is 01, 03, 05,07,08,10 do STEP3 else STEP6

STEP3:if DD < 31 then do STEP4 else if DD=31 do STEP5 else output(Invalid Date);

STEP4: tomorrowday=DD+1 goto STEP18

STEP5: tomorrowday=1; tomorrowmonth=month + 1 goto STEP18

STEP6: if MM is 04, 06, 09, 11 do STEP7

STEP7: if DD<30 then do STEP4 else if DD=30 do STEP5 else

```
output(Invalid Date);
STEP8: if MM is 12
STEP9: if DD<31 then STEP4 else STEP10
STEP10: tomorrowday=1, tommorowmonth=1,
tommorowyear=YYYY+1; goto STEP18
STEP11: if MM is 2
STEP12: if DD<28 do STEP4 else do STEP13
STEP13: if DD=28 & YYYY is a leap do STEP14 else STEP15
STEP14: tommorowday=29 goto STEP18
STEP15: tommorowday=1, tomorrowmonth=3, goto STEP18;
STEP16: if DD=29 then do STEP15 else STEP17
STEP17: output("Cannot have feb", DD); STEP19
STEP18: output(tomorrowday, tomorrowmonth, tomorrowyear);
STEP19: exit
```

PROGRAM CODE:

```
#include<stdio.h>
#include<conio.h>
main( )
{
int
month[12]={31,28,31,30,31,30,31,31,30,31,30,31};
int d,m,y,nd,nm,ny,ndays;
clrscr( );
printf("enter the date,month,year");
scanf("%d%d%d",&d,&m,&y);
ndays=month[m-1];
if(y<=1812 && y>2012)
{
printf("Invalid Input Year");
exit(0);
}
if(d<=0 || d>ndays)
```

```
{
printf("Invalid Input Day");
exit(0);
}
if(m<1 && m>12)
{
printf("Invalid Input Month");
exit(0);
}
if(m==2)
{
if(y%100==0)
{
if(y%400==0)
ndays=29;
}
else if(y%4==0)
ndays=29;
}
nd=d+1;
nm=m;
ny=y;
if(nd>ndays)
{
nd=1;
nm++;
}
if(nm>12)
{
nm=1;
ny++;
}
```

```
printf("\n Given date is %d:%d:%d",d,m,y);
printf("\n Next day‟s date is %d:%d:%d",nd,nm,ny);
getch( );
}
```

Test Report:

Case Id	Description	Input Data			Expected Output	Actual Output	Comments
		a	b	c			

4. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results.

ALGORITHM:

```
Step 1: Input a, b & c i.e three integer values which represent three sides of
the triangle.
Step 2: if (a < (b + c)) and (b < (a + c)) and (c < (a + b) then
do step 3
else
print not a triangle. do step 6.
Step 3: if (a=b) and (b=c) then
Print triangle formed is equilateral. do step 6.
Step 4: if (a ≠ b) and (a ≠ c) and (b ≠ c) then
Print triangle formed is scalene. do step 6.
Step 5: Print triangle formed is Isosceles.
```

Step 6: stop

PROGRAM CODE

```
#include<stdio.h>
#include<ctype.h>
#include<conio.h>
#include<process.h>
int main()
{
int a, b, c;
clrscr();
printf("Enter three sides of the triangle");
scanf("%d%d%d", &a, &b, &c);
if((a > 10) || (b > 10) || (c > 10))
{
printf("Out of range");
getch();
exit(0);
}
if((a<b+c)&&(b<a+c)&&(c<a+b))
{
if((a==b)&&(b==c))
{
printf("Equilateral triangle");
}
else if((a!=b)&&(a!=c)&&(b!=c))
{
printf("Scalene triangle");
}
else
printf("Isosceles triangle");
}
else
{
printf("triangle cannot be formed");
}
getch();
return 0;
}
```

Test Report:

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.

ALGORITHM

```
STEP 1: Define lockPrice=45.0, stockPrice=30.0, barrelPrice=25.0
STEP2: Input locks
STEP3: while(locks!=-1) „input device uses -1 to indicate end of data goto STEP 12
STEP4:input (stocks, barrels)
STEP5: compute lockSales, stockSales, barrelSales and sales
STEP6: output("Total sales:" sales)
STEP7: if (sales > 1800.0) goto STEP 8 else goto STEP 9
STEP8: commission=0.10*1000.0; commission=commission+0.15 * 800.0; commission = commission + 0.20 * (sales-1800.0)
STEP9: if (sales > 1000.0) goto STEP 10 else goto STEP 11
STEP10: commission=0.10* 1000.0; commission=commission + 0.15 * (sales-1000.0)
STEP11: Output("Commission is $", commission)
STEP12: exit
```

PROGRAM CODE:

```
#include<stdio.h>
#include<conio.h>
int main()
{
int locks, stocks, barrels, t_sales, flag = 0;
float commission;
clrscr();
printf("Enter the total number of locks");
scanf("%d",&locks);
if ((locks <= 0) || (locks > 70))
{
flag = 1;
```

```
}
printf("Enter the total number of stocks");
scanf("%d",&stocks);
if ((stocks <= 0) || (stocks > 80))
{
flag = 1;
}
printf("Enter the total number of barrelss");
scanf("%d",&barrels);
if ((barrels <= 0) || (barrels > 90))
{
flag = 1;
}
if (flag == 1)
{
printf("invalid input");
getch();
exit(0);
}
t_sales = (locks * 45) + (stocks * 30) + (barrels * 25);
if (t_sales <= 1000)
{
commission = 0.10 * t_sales;
}
else if (t_sales < 1800)
{
commission = 0.10 * 1000;
commission = commission + (0.15 * (t_sales - 1000));
}
else
{
commission = 0.10 * 1000;
commission = commission + (0.15 * 800);
commission = commission + (0.20 * (t_sales - 1800));
}
printf("The total sales is %d \n The commission is %f",t_sales,
commission);
getch();
return;
}
```

Test Report:

Case Id	Description	Input Data			Expected Output	Actual Output	Comments
		a	b	c			

6. Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results.

ALGORITHM

```
STEP 1: Input date in format DD.MM.YYYY
STEP2: if MM is 01, 03, 05,07,08,10 do STEP3 else STEP6
STEP3:if DD < 31 then do STEP4 else if DD=31 do STEP5 else
output(Invalid Date);
STEP4: tomorrowday=DD+1 goto STEP18
STEP5: tomorrowday=1; tomorrowmonth=month + 1 goto STEP18
STEP6: if MM is 04, 06, 09, 11 do STEP7
STEP7: if DD<30 then do STEP4 else if DD=30 do STEP5 else
output(Invalid Date);
STEP8: if MM is 12
STEP9: if DD<31 then STEP4 else STEP10
```

```
STEP10: tomorrowday=1, tommorowmonth=1, tommorowyear=YYYY+1;
goto STEP18
STEP11: if MM is 2
STEP12: if DD<28 do STEP4 else do STEP13
STEP13: if DD=28 & YYYY is a leap do STEP14 else STEP15
STEP14: tommorowday=29 goto STEP18
STEP15: tommorowday=1, tomorrowmonth=3, goto STEP18;
STEP16: if DD=29 then do STEP15 else STEP17
STEP17: output("Cannot have feb", DD); STEP19
STEP18: output(tomorrowday, tomorrowmonth, tomorrowyear);
STEP19: exit
```

PROGRAM CODE:

```
#include<stdio.h>
#include<conio.h>
main( )
{
int month[12]={31,28,31,30,31,30,31,31,30,31,30,31};
int d,m,y,nd,nm,ny,ndays;
clrscr( );
printf("enter the date,month,year");
scanf("%d%d%d",&d,&m,&y);
ndays=month[m-1];
if(y<=1812 && y>2012)
{
printf("Invalid Input Year");
exit(0);
}
if(d<=0 || d>ndays)
{
printf("Invalid Input Day");
exit(0);
}
if(m<1 && m>12)
{
printf("Invalid Input Month");
exit(0);
}
if(m==2)
{
if(y%100==0)
{
if(y%400==0)
ndays=29;
}
else if(y%4==0)
ndays=29;
}
nd=d+1;
nm=m;
ny=y;
if(nd>ndays)
{
nd=1;
nm++;
}
if(nm>12)
{
nm=1;
ny++;
}
printf("\n Given date is %d:%d:%d",d,m,y);
printf("\n Next day‟s date is %d:%d:%d",nd,nm,ny);
getch( );
}
```

Test Report:

Course outcomes:

At the end of the course, the student will be able

CO 1	To formulate the algorithms for simple problems
CO 2	To translate the given algorithms to a working and correct program
CO 3	To identify and correct logical errors encountered at run time
CO 4	To write iterative as well as recursive programs
CO 5	To run scripts on Selenium and in other tools.
CO 6	To decompose a problem into functions and synthesize a complete program
CO 7	To generate test reports and identify errors

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3233	Mobile Computing	PEC	3-0-0	3

Course Learning Objectives:

1. To understand the basic concepts of mobile computing.
2. To learn the basics of mobile telecommunication system.
3. To be familiar with the network layer protocols and Ad-Hoc networks.
4. To know the basis of transport and application layer protocols.
5. To gain knowledge about different mobile platforms and application development.

Course Content:

UNIT I: INTRODUCTION (9 Contact hours)

Mobile Computing – Mobile Computing Vs Wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT II: Mobile Internet Protocol And Transport Layer (9 Contact hours)

Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization – DHCP. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

UNIT III: MOBILE TELECOMMUNICATION SYSTEM (9 Contact hours)

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

UNIT IV: MOBILE AD-HOC NETWORKS (9 Contact hours)

Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.

UNIT V MOBILE PLATFORMS AND APPLICATIONS (8 Contact hours)

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone.

UNIT VI: MOBILE COMMERCE (8 Contact hours)

Applications of MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

Learning resources

Text book:

Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi – 2012
Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003.

Reference Books:

Dharma Prakash Agarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005.
Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
William. C. Y. Lee, “Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition, TataMcGraw Hill Edition ,2006.
C. K. Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

Course outcomes: At the end of the course, the student will be able to

CO 1	Explain the basics of mobile telecommunication systems
CO 2	Illustrate the generations of telecommunication systems in wireless networks
CO 3	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
CO 4	Explain the functionality of Transport and Application layers
CO 5	Develop a mobile application using android/blackberry/ios/Windows SDK
CO 6	Understand the M commerce

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3275	**Mobile Computing Laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. To learn different modulation techniques, multiple access techniques for wireless communication and propagation models.
2. To understand modern mobile communication systems
3. To design various types of pages using WML/J2ME.
4. To understand working of Bluetooth and WAP.

List of Programming Assignments for Laboratory

1. To implement Code Division Multiple Access (CDMA).
2. To study frequency reuse concept.
3. To study basic concept J2ME.
4. To study various classes (such as TextBox, ChoiceGroup, Drop Down menus etc.) and their implementation in J2ME.
5. To design a simple WML page using various WML tags.
6. To design a simple calculator having +, -, * and / using WML /J2ME
7. To design a WML page to display an image and to accept input from the user.
8. To implement mobile network using NS2.
9. Study Assignment 1: Detailed study of Bluetooth
10. Study Assignment 2: Detailed study of Wireless Application Protocol.

Course outcomes

At the end of the course, the student will be able

CO 1	To implement and practical experiments by manually.
CO 2	To find the practical obstacle related to the wireless communication.
CO 3	To develop various forms and pages having different styles.
CO 4	To understand various applications like Bluetooth and WAP.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Code	CourseNname	Course category	L-T-P	Credits
CS3234	Data Compression	PEC	3-0-2	4

Course Objectives:

1. Define compression; understand compression as an example of representation.
2. Understand the idea of lossless and lossy compression.
3. Understand the most common file formats for image, sound and video.
4. Distinguish the basic techniques of lossless compression.

Course Content:

Unit 1: **(6 Contact hours)**

Introduction: Mathematical Preliminaries, Lossy and Lossless compression, Measure of performances, Application of compression, Introduction to information theory.

Unit II: **(8 Contact hours)**

Simple lossless Encoding, Run length encoding: Huffman coding, Applications of Huffman coding, Adaptive Huffman coding, LZW coding, LZ77 and LZ78, Run length encoding, Arithmetic coding.

Unit III: **(8 Contact hours)**

Fundamentals of Information Theory: Concepts of entropy, probability models, Markov models, Fundamentals of coding theory, Algorithmic information theory & Minimum description.

Unit IV: **(10 Contact hours)**

Lossless Compression Standards: zip, gzip, bzip, unix compression, GIF, JBIG, predictive coding

Unit V: **(6 Contact hours)**

Image and Video Compression: Basis functions and transforms from an intuitive point, JPEG, MPEG, Vector Quantization, Case study of WinZip, WinRar

Unit VI: **(7 Contact hours)**

Wavelet Based Compression, Quantization: Fundamentals of wavelets, various standard wavelet bases, Multi resolution analysis and scaling function, JPEG 2000, scaler and vector quantization.

Learning Resources

Text books:

1. Khalid Sayood, “Introduction to Data Compression”, Elsevier, Fifth edition

Reference Books:

1. Mark Nelson, “The Data Compression book”, BPB Publications, First edition
2. Colt McAnlis, “Understanding Compression::Data Compression for Modern Developers” PublishShroff Publishers & Distributors Pvt Ltd,First edition

Web resources:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-050j-information-and-entropy-spring-2008/videos-homework-and-readings/unit-2-lecture-1/
2. https://nptel.ac.in/courses/106102064/19
3. https://www.ics.uci.edu/~dan/pubs/DataCompression.html.

Course Outcomes: At the end of the course, the student will be able to

CO 1	Explain lossless and lossy compression and correlating them with mathematical concepts.
CO 2	Implement Huffman encoding, LZW, LZ77 and LZ78 in various projects.
CO 3	Discuss the concept of Information theory and its relation to data compression.
CO 4	Use the standards like zip, bzip etc. according to the requirements.
CO 5	Perform image and video compression according to the real world project requirements.
CO 6	Use the concepts like wavelet transform and quantization.

Assessment Method:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3276	**Data Compression Laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. Identify situations where lossy and lossless compression can be used.
2. Implement various algorithms to perform compression and decompression.
3. Explain the procedure to encode and decode images and video files.
4. Demonstrate the dictionary encoding schemes.

List of Programming Assignments for Laboratory

1. Write a program to count the occurrences of different letters by reading the given text file and also find the probability of each letter with number of bits required for them using the formula: No. of bits=1/log2 probi
2. Write a program to implement a Huffman Coding and Adaptive Huffman Coding.
3. Write a program to implement applications and limitations of Huffman Coding (Run length coding, Arithmetic coding and Predictive coding).
4. Write a program to implement LZ77 and LZ78 algorithm.
5. Write a program to implement LZSS algorithm.
6. Write a program to implement Shannon-Fano Compression Algorithm.
7. Write a program to compress and decompress the given input string
8. Implement the compression and decompression .JPEG files.
9. Implement the compression and decompression .BMP files.
10. Implement the compression and decompression of audio files.
11. Implement the compression and decompression of video files.
12. Write a code to implement speech compression.

Course outcomes

At the end of the course, the student will be able

CO 1	To implement Shannon-fano algorithm in various domains.
CO 2	To illustrate the lossy and lossless compression techniques.
CO 3	To analyze any image file and perform compression and decompression.
CO 4	To demonstrate encoding and decoding of video files.
CO 5	To analyze Huffman coding and its adaptive variant.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Rajiv Gandhi University of Knowledge Technologies -

Nuzvid/RKV/Srikakulam/Ongole

Course Code	CourseNname	Course category	L-T-P	Credits
CS3235	COMPUTER GRAPHICS	PEC	3-0-0	3

OBJECTIVES:

1. Gain knowledge about graphics hardware devices and software used. · Understand the two dimensional graphics and their transformations.
2. Understand the three dimensional graphics and their transformations. · Appreciate illumination and color models.
3. Be familiar with understand clipping techniques.

Course Content:

UNIT I INTRODUCTION (8 Contact hours)

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

UNIT II Two Dimensional Graphics (8 Contact hours)

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

UNIT III Three Dimensional Graphics (8 Contact hours)

Three dimensional concepts; Three dimensional object representations – Polygon surfaces-Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

UNIT IV Illumination And Colour Models (7 Contact hours)

Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.

UNIT V Animations & Realism 10 Animation Graphics (8 Contact hours)

Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening. COMPUTER GRAPHICS REALISM: Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

UNIT –VI Multimedia System: (8 Contact hours)

An Introduction, Multimedia hardware, Multimedia System Architecture. Data & File Format standards. i.e RTF, TIFF, MIDI, JPEG, DIB, MPEG,Audio: digital audio, MIDI, processing sound, sampling, compression. Video: Avi, 3GP,MOV, MPEG .

Text Books:

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", , 3rd Edition, Addison- Wesley Professional,2013. (UNIT I, II, III, IV).
2. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007 (UNIT V).

References:

1. Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010.
2. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
3. Hill F S Jr., "Computer Graphics", Maxwell Macmillan" , 1990.
4. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.
5. William M. Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", Mc GrawHill 1978. http://nptel.ac.in/

Outcomes:

CO1	Design two dimensional graphics.
CO2	Apply two dimensional transformations.
CO3	Design three dimensional graphics.
CO4	Apply three dimensional transformations.
CO5	Apply Illumination and color models.
CO6	Apply clipping techniques to graphics.
CO7	Design animation sequences.

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3277	Computer Graphics Laboratory	PEC	0-0-2	1

Course Objective:

1. Learn the basic principles of 3-dimensional computer graphics..
2. Given a computational problem, identify and abstractthe programming task involved.
3. Approach how to transform the shapes to fit them as per the picture definition.
4. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

5.To be able to discuss the application of computer graphics concepts in the development of computer games.

List of Programming Assignments for Laboratory:

1. Write a program to draw the pixel(x,y) and display the color in which pixel(x,y) is illuminated on the screen.
2. Write a program to implement DDA line drawing algorithm.
3. Write a program to implement Bresenham’s Line drawing algorithm.
4. Write a program to implement Bresenham’s Circle drawing algorithm.
5. Write a program to implement Bresenham’s Ellips drawing algorithm.
6. Write a program to implement Boundary Fill algorithm.
7. Write a program to implement Flood Fill algorithm.
8. Write a program to Draw Rectangle from (100,200) pixel to (400,500) pixel .
9. Write a program to draw a Circle with center (150,150) pixel and radius 25.
10. Write a program to draw a Hexagon on the screen.
11. Write a program to implement Composite Transformations.
12. Write a program to implement Basic Transformations (translation ,rotation , and scaling on a rectangle).
13. Write a program to implement Bezier Curve.
14. Write a program to implement B-Spline Curve.
15. Write a program to implement a cartoon using C function.
16. Write a program to draw a chain of circles.
17. Write a program to draw concentric circles.

Hardware Requirements:

- ❖ Intel® Pentium® 4, Intel Centrino®, Intel Xeon®, or Intel Core™ Duo (or compatible)processor.

- Microsoft® Windows® 7 (64 bit) or Windows 8 (64 bit)
- 4GB of RAM
- 2.5GB of available hard-disk space for installation; additional free space require during installation (cannot install on removable flash storage devices)
- 1024x768 display (1280x800 recommended)
- QuickTime 10.x software recommended

Course outcomes

At the end of the course, the student will be able

CO 1	Concepts of 2D & 3D object representation.
CO 2	Implementation of various scan & clipping algorithms.
CO 3	2D modeling.
CO 4	Implementation of illumination model for rendering 3D objects.
CO 5	Visibility detection & 3D viewing.
CO 6	Implementation of a application based on learned concepts.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

LIST OF PROFESSIONAL ELECTIVES COURSE(PEC)

Elective group -4

Course Code	Course Name	Course Category	L-T-P	Credits
CS3236	Data Science	PEC	3-0-0	3

Course Objectives:

1. To analyze, characterize empirically complex data;
2. To describe relevant statistical quantities and quantify their confidence intervals;
3. To explain sensible models and to parameterize and validate these models;
4. To quantify inter-dependency/causality structure between different variables;

Course Outcomes:

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

- To develop practical data analysis skills, which can be applied to practical problems?
- To explain how math and information sciences can contribute to building better algorithms and tools.
- To develop applied experience with data science software, programming, applications and processes.

Course Content:

UNIT – I **(10Contact hours)**

Introduction to Data Science: Introduction to data science, exploratory data analysis, introduction to machine learning, supervised and unsupervised learning, linear regression, model selection and evolution.

UNIT-II **(12 Contact hours)**

Data structures, files and data plotting, Arrays & Matrices, Making Tables, Lists, Data frames, Conversion of Numeric Data frames into Matrices. Reading Excel Files, and text files, Plotting function, multiple plots, Scatter plot matrices. Basics on data acquisition, integration, cleaning, filtering, transformation.

UNIT-III **(9 Contact hours)**

Feature selection. Dimensionality Reduction: PCA and SVD, forward and backward feature selection, Measures of dependency. Cause and effect, spurious correlations and regularization.

Probability: Probability distributions, Marginal probability, joint probability and conditional probability. Empirical estimation of probability distributions.

UNIT–IV **(9 Contact hours)**

Classification Methods: Naive Bayes, Model validation: Bootstrapping & Cross Validation, Hypothesis testing, Sample t-tests, Confidence Intervals. ANOVA.

UNIT–VI **(9 Contact hours)**

Advanced Analytical Theory and Methods – Time Series Analysis : Overview of Time Series Analysis, ARIMA Model.

Learning resources

Text book:

1. Dunlop, Dorothy D., and Ajit C. Tamhane. '*Statistics and data analysis: from elementary to intermediate*'. Prentice Hall, 2000.

Reference Books:

1. Nina Zumel, John Mount, '*Practical Data Science with R*', Manning Publications, 2014

2. Tom Plunkett, Mark Hornick, ‘*Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop*’, McGraw-Hill/Osborne Media (2013), Oracle press.

Web resources:

1.Big data and analytics 17 Jul 2014 URL https://www.simplilearn.com/resources

Course outcomes: At the end of the course, the student will be able to

CO 1	Know basic notions and definitions in data analysis, machine learning.
CO 2	Know standard methods of data analysis and information retrieval
CO 3	Be able to formulate the problem of knowledge extraction as combinations of data filtration, analysis and exploration methods.
CO 4	Be able to translate a real-world problem into mathematical terms
CO 5	Possess main definitions of subject field
CO 6	Possess main software and development tools of data scientist, and Learn to develop complex analytical reasoning

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

ourse Code	Course Name	Course Category	L-T-P	Credits
CS3278	**Data Science Laboratory**	**PEC**	**0-0-2**	**1**

Course Learning Objective:

1. Students will establish themselves as effective professionals by solving real problems through the use of computer science knowledge and with attention to team work, effective communication, critical thinking and problem solving skills.
2. Students will develop professional skills that prepare them for immediate employment and for life-long learning in advanced areas of computer science and related fields.
3. Students will demonstrate their ability to adapt to a rapidly changing environment by having learned and applied new skills and new technologies.
4. Students will be provided with an educational foundation that prepares them for excellence, leadership roles along diverse career paths with encouragement to professional ethics and active participation needed for a successful career.

List of Programming Assignments for Laboratory:

1. R AS CALCULATOR APPLICATION:

a. Using with and without R objects on console

b. Using mathematical functions on console

c. Write an R script, to create R objects for calculator application and save in a specified location in disk

2. DESCRIPTIVE STATISTICS IN R

a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.

b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

3. READING AND WRITING DIFFERENT TYPES OF DATASETS

a. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.

b. Reading Excel data sheet in R.

c. Reading XML dataset in R.

4. VISUALIZATIONS

a. Find the data distributions using box and scatter plot.
b. Find the outliers using plot.
c. Plot the histogram, bar chart and pie chart on sample data.

5. CORRELATION AND COVARIANCE a. Find the correlation matrix.
b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

6. REGRESSION MODEL:

Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. require (foreign), require(MASS).

7. MULTIPLE REGRESSION MODEL

Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.

8. REGRESSION MODEL FOR PREDICTION Apply regression Model techniques to predict the data on above dataset

9. CLASSIFICATION MODEL

a. Install relevant package for classification.
b. Choose classifier for classification problem.
c. Evaluate the performance of classifier.

10. CLUSTERING MODEL

a. Clustering algorithms for unsupervised classification.
b.Plot the cluster data using R visualizations.

Course outcomes

At the end of the course, the student will be able

CO 1	The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity
CO 2	The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%

End Semester Examination weightage (%)	60%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3237	Unixand Shell Programming	PEC	3-0-0	3

Course Learning Objectives:

1 Written technical communication and effective use of concepts and terminology.
2 Facility with UNIX command syntax and semantics.
3 Ability to read and understand specifications, scripts and programs.
4 Individual capability in problem solving using the tools presented within the class Students will demonstrate a mastery of the course materials and concepts within in class discussions.

Course Content:

UNIT I – Introduction to UNIX **(8 Contact hours)**

Architecture of Unix, Features of Unix , Unix Commands – PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip,cpio,ln

UNIX Utilities: **(8 Contact hours)**

Process utilities, disk utilities,networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text processing utilities and backup utilities , detailed commands to be covered are tail, head , sort, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk.

UNIT II - File Management **(6 Contact hours)**

Introduction to unix file system, vi editor, file handling utilities, security by file permissions,File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

UNIT III – Introduction to Shells & Filters **(7 Contact hours)**

Introduction to Shells : Unix Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.

Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT IV – grep, sed, awk (7 Contact hours)

grep : Operation, grep Family, Searching for File Content.

sed : Scripts, Operation, Addresses, commands, Applications, grep and sed.

awk: Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands in awk, Applications, awk and grep, sed and awk.

UNIT V – Korn shell programming (7Contact hours)

Interactive Korn Shell: Korn Shell Features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, Options, Startup Scripts, Command History, Command Execution Process.

Korn Shell Programming: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

UNIT VI – C shell programming (7Contact hours)

Interactive C Shell: C shell features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, On-Off Variables, Startup and Shutdown Scripts, Command History, Command Execution Scripts.

C Shell Programming: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

Learning resources

Text Book:

1. Behrouz A. Forouzan & Richard F. Gilberg, “Unix and Shell Programming”, 1st edition, Cengage Learning, 2003

Reference Books:

1. Sumitabha Das, *“Your Unix: The Ultimate Guide”*, 1st edition, Tata Mcgraw hill, 2001
2. Graham Glass, King Ables, *“Unix for programmers and Users”*, 3rd edition, Pearson Education, 2003
3. Kernighan & Pike, *“The UNIX Programming Environment”*, 1st edition, Pearson Education India, 2015
4. Ken Rosen, James Farber, Rachel Klee, Douglas Host, and Dick Rosinski, “ *Unix: The Complete Reference”*, 2nd edition, McGraw Hill Education, 2007

Web resources:

1.Essential Linux/Unix Commands – GeeksforGeeks*https://www.geeksforgeeks.org/essential-linuxunix-commands/*

2.Introduction to Linux Shell and Shell Scripting - GeeksforGeeks
https://www.geeksforgeeks.org/introduction-linux-shell-shell-scripting/

3. UNIX /LINUX TUTORIAL
https://www.tutorialspoint.com/unix/

Course outcomes: At the end of the course, the student will be able to

CO 1	Documentation will demonstrate good organization and readability.
CO 2	Able to do Data organization, problem solving and research.
CO 3	Demonstrate simple effective user interfaces.
CO 4	Demonstrate effective use of structured programming.
CO 5	Will be accompanied by printed output demonstrating completion of a test plan

Assessment Method:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3279	Unix Shell Programming Laboratory	PEC	0-0-2	1

Course Learning Objective:

6. To familiarize students with theUnix environment.
7. To learn the fundamentals of shell scripting/programming.
8. Construct absolute and relative paths that identify specific files and directories.
9. Understand the concept of a working directory and know how to identify it.
10. Display the contents of a directory using the command line.
11. Identify the actual command and filenames in a command-line call.
12. Know about case sensitivity and why certain characters are best avoided in filenames

List of Programming Assignments for Laboratory

1. a) Study of Unix general purpose utility command list man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.
   b) Study of vi editor.
   c) Study of Bash shell, Bourne shell and C shell in Unix operating system.
   d) Study of Unix/Linux file system (tree structure).
   e) Study of .bashrc, /etc/bashrc and Environment variables.
2. Write a C program that makes a copy of a file using standard I/O, and system calls.
3. Write a C program to emulate the UNIX ls –l command.
4. Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort
5. Write a shell script that displays list of all files in the given directory.
6. Implement in C the following unix commands using system calls
   a) Cat b) ls c) mv
7. Write a C program that counts number of blanks in text file
   a) Using standard I/O b)using system call
8. Write a program that takes one or more file/directory names as command line input and reports the following information on the file.
   a) File type b) number of linksc) time of last access d) read ,write and execute permissions.

9. Write a C program that illustrates uses of mkdir,opendir,readdir,closedir and rmdir APIs.
10. Write a C program that illustrates how to execute two commands concurrently with a command pipe.
11. Write a C program that illustrates the following
    a) Two-way communication with unidirectional pipes
    b) Two-way communication with bidirectional pipes.
12. Write a C program that illustrates the creation of child process using fork system call.

Course outcomes

At the end of the course, the student will be able

CO 1	To use Unix utilities and perform basic shell control of the utilities
CO 2	To use the Unix file system and file access control.
CO 3	To use of an operating system to develop software
CO 4	Students will be able to use Unix environment efficiently
CO 5	Solve problems using bash for shell scripting
CO 6	Construct various shell scripts for simple applications**.**
CO 7	Will be able to explain the process management using system calls Unix environment

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3238	VLSI	PEC	3-0-0	3

Course Objectives

1. To make understand the student the introductory concepts of Very Large Scale Integrated Circuits design such as HDLs, CMOS circuit design, Layout techniques and fabrication

Course Content:

Unit-I **(13.5 Contact hours)**

Finite State Machines and Verilog HDL

Mealy state machines, Moore state machines, Conversion of Mealy machines to Moore machines and vice-versa, Redundancy elimination, Sequence detectors with and without overlapping, Parity detectors and generators.
Verilog HDL: Gatelevel modeling, Dataflow modeling, Behavioral modeling, Dealy modeling, Writing test bench, FSM modeling.

Unit-II **(7.5 hours)**

Digital sytem Design and Verilog HDL

Specifications, Moore's Law, Data path design, Control path design, GCD Datapath design, GCD Control path design, State machine for traffic light controller . FPGA Design flow, ASIC Design flow.
Verilog HDL: Datapath, Control path, System Design

Unit –III **(3 hours)**

Fabrication

Fabrication process flow: cleaning, oxidation, patterning, Mask Alignment, Lithography- types, etching-types, annealing, different photo-resists, Electrical and Mechanical Testing, Cleaning

Unit –IV (3 hours)

CMOS Circuit Design

Design of inverter, NAND, NOR, EXOR, Half-Adder, Full adder, Multiplexer and other circuits using CMOS logic

Unit –V (3 hours)

Circuit Layout Design

MOS Layers, Stick Diagrams, Design Rules and Layout, General Observations on the Design rules, Layout diagrams and optimization techniques

LearningResour

ceText Books

1. Stephen Brown, ZvokoVranesic, *'Fundamentals of Digital Design using Verilog'*, Mc Graw Hill publications
2. Douglas A.Pucknell and Kamran Eshraghian, *'Basic VLSI Design'*, PHI publications

Reference Books

1. Samir Palnitkar, *'Verilog HDL - A Guide to Digital Design and Synthesis'*, Pearson publications
2. Stephen D. Senturia, *'Microsystem Design'*, Kluwer Academic Publishers
3. Marc Madou, *'Fundamentals of Microfabrication*', CRC Press
4. Ian Grout, *'Digital Systems Design with FPGAs and CPLDs'*,Elsevier-2008

Web Resources

1. Prof S Shankar Balachandran, NPTEL-IIT Madras, *'Digital circuits & Systems'*. URL: http://nptel.ac.in/courses/117106114/
2. Prof S Srinivasan, NPTEL - IIT Madras, *'Digital circuits and systems*' URL: https://nptel.ac.in/courses/117106086/
3. Prof S Parasuraman, NPTEL-IIT Madras, *'Electronic materials, devices and fabrication'*. URL: https://nptel.ac.in/courses/113106062/
4. Deepak Kumar Tala, URL: http://www.asic-world.com

Course Outcomes:

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

CO 1	Understand specifications of VLSI designs, Moore's Law
CO 2	Different VLSI Design flows - FPGA, ASIC
CO 3	Understand the concepts of Finite State Machines and its relevance in IC Design
CO 4	Modeling of digital designs using hardware description language
CO 5	Understand the different steps involved in IC fabrication process
CO 6	Understand the concept of IC layout

Assessment Method

Course Nature	**Theory**

Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3280	VLSI Lab	PEC	0-0-2	1

Course Learning Objective

1. To get a practical exposure on the concepts present in Introductory to VLSI Theory course and thereby acquiring sufficient knowledge in designing basic analog and digital VLSI systems

List of Experiments

1. Familiarization with Xilinx software and Mentor Graphics software
2. Implementation of combinational and sequential circuits using Gate-level modeling of Verilog HDL
3. Implementation of combinational and sequential circuits using data flow modeling of Verilog HDL
4. Implementation of combinational and sequential circuits using behavioral modeling of Verilog HDL
5. Implementation of Finite State Machines using Verilog HDL
6. Realization of digital designs using FPGA
7. Familiarization with Mentor Graphics tool : Digital Design
8. Implementation of basic functions using system verilog
9. Implementation on Mentor Graphics tool : CMOS circuit design including layout
    i. Determine propagation delays
    ii. Determine noise margins
    iii. Tranfer characteristics and transient response

ASIC level implementation using Mentor Graphics tool

10. Term Project

Course outcome

After the completion of this Laboratory course, the student will be able to

CO 1	Understanding and utilizing the VLSI CAD tools

CO 2	Describe digital systems using hardware description language: Verilog
CO 3	Efficient in writing Verilog HDL in different modeling techniques
CO 4	Implement digital designs on hardware : FPGA
CO 5	Implementing ASIC designs on Mentor Graphics platform
CO 6	Design CMOS circuits and determine transfer characteristics, transient analysis, propagation delays and noise margin
CO 7	Peform layout design for CMOS circuits
CO 8	Design an simple analog or digital VLSI system

Assessment Method

Assessment Tool	Experiments	Report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

****

Course Coded	Course Name	Course Category	L-T-P	Cridets
CS3239	**Soft Computing**	**PEC**	**3-0-2**	**4**

Course Learning Objectives:

Students should be able to

1. To learn about soft computing techniques and their applications.
2. To analyse various neural network architectures.\
3. To define fuzzy system
4. To understand the genetic algorithm concepts and their applications.
5. To identify and select a suitable soft computing technology to solve the problem, construct a solution and implement a soft computing solution
6. To learn about hybrid systems.

Course Content:

UNIT I (Introduction to Soft Computing) (7 Contact hours)

soft computing,Hard computin**g,** Artificial neural networks-biological neurons, Basic models of artificial neural networks- Connections, Learning, Activation Functions, McCulloch and Pitts Neuron.

UNIT II (Perceptron Networks) (7 Contact hours)

Learning rule-training algorithm, multiple adaptive linear neuron, Adaptive Linear Neuron, Back propagation Network-Architecture, Applications of ANN,single layer perceptron,multilayer perceptron.

UNIT III (Fuzzy Logic) (7 Contact hours)

Fuzzy sets-properties-operations on fuzzy sets, fuzzy relations- operations on fuzzy relations,crisp logic,fuzzy logic,,Differences of fuzzy and crisp logic.

UNIT IV (Fuzzy membership functions) (7Contact hours)

Fuzzification, Methods of membership value assignments- intuition- inference-rank ordering, Lambda-cuts for fuzzy sets, Defuzzification methods,

UNIT V (Truth values and fuzzy logic) (8 Contact hours)

Fuzzy propositions, Formation of fuzzy rules- Decomposition of rules –Aggregation of r ules, Fuzzy Interface Systems – Mamdani and Surgeon types, Neuro-fuzzy hybrid systems – characteristics- Classification.

UNIT VI (Genetic Algorithm) (8 Contact hours)

Introduction to genetic algorithm, operators in genetic algorithm – coding – selection – cross over- Find Mutation, stopping condition for genetic algorithm flow, Genetic-neurohybrid systems, Genetic-Fuzzy rule-based system.

Learning resources:

Text books:

1. S.N.Sivanandam and S.N.Deepa, "*Principles of soft computing*", Wiley India.
2. Timothy J.Ross, "*Fuzzy Logic with engineering applications*", Wiley India.

Reference Books:

1. N.K. Sinha and M.M Gupt, *Soft Computing & Intelligent Systems: Theory & Applications*-Academic Press /Elsevier.2009.
2. Simon Haykin, *Netural Network- A Comprehensive Foundation*- Prentice Hall International,Inc.
3. R.Eberhart and Y. Shi,*Computational Intelligence: Concepts to Implementation*, Morgon Kaufman/Elsevier,2007.
4. Drainkov T.j. "*Fuzzy Logic With Engineering Applications*" McGraw Hill.
5. Bart KOsko, "*Neural Network and Fuzzy Systems*-Prentice"Hall,Englewood Cliffs.
6. Goldberg D.E, "*Genetic Algorithms in Search,Optimization,and Machine Learing*

Web resources:

1. https://www.scribd.com/document/250449108/Definition-of-Soft-Computing

2. https://bookboon.com/en/introduction-to-soft-computing-ebook

Course outcomes: At the end of the course, the student will be able to

CO 1	Knowledge about fuzzy logic and concept of fuzziness involved in various systems and fuzzy set theory.
CO 2	Knowledge about fuzzy sets, representing fuzzy rules, approximate reasoning, fuzzy inference systems and fuzzy logic,
CO 3	Knowledge about fundamental theory of neural networks, neural network architectures, algorithms, applications and their limitations.
CO 4	Knowledge for appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.
CO 5	Knowledge of revealing different applications of these models to solve engineering and other problems.

For Theory courses only:

Course Nature	**Theory**
Assessment Method	

Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS3281	S oft Computing Laboratory	PEC	0-0-2	1

Course Learning Objective:

1. **Identify the Artificial neural networks and fuzzy logic**
2. **Implement various networks like ADALINE,MADALINE etc.**
3. **Implements the various functions like XOR , AND etc**

List of Programming Assignments for Laboratory

1. Write a program to implement Artificial neural networks using MAT LAB
2. WAP to implement Activation Functions
3. WAP to implement Adaptive prediction in ADALINE NN
4. WAP to implement LMS and Perceptron Learning Rule
5. WAP to implement XOR function in MADALINE NN
6. WAP to implement AND function in Perceptron NN
7. WAP to implement Feed Forward Network.
8. WAP to implement Perceptron Network
9. WAP to implement Weight vector Matrix
10. WAP to implement Hebb Network

Course outcomes: At the end of the course, the student will be able

CO 1	**To understand concept of ANN**
CO 2	**To Understand adaptive prediction in ADALINE NN**
CO 3	**To understand LMS and MADALINE NN**
CO 4	**To understand weight vector Matrix**
CO 5	**To understand perceptron and Hebb networks**

Assessment Method

Assessment Tool	Experiments	report/Viva-Voce/ Quiz/MCQ/Lab project	Total
Weightage (%)	25%	15%	40%
End Semester Examination weightage (%)			60%

Course Code	Course Name	Course Category	L-T-P	Credits
CS3240	**File Structures**	PEC	3-0-0	3

Course Learning Objectives:

1. Understand file structures including sequential, indexed, indexed sequential, hashed file structures
2. Apply object-oriented concepts to design file systems
3. Understand B^+-trees to implement file systems
4. Implement file operations including read, write, update and search
5. Develop and analyse external sorting methods

UNIT-I **(8 Contact hours)**

Fundamental File Structure Concepts: Field and Record Organization, Using Classes to Manipulate Buffers, Using Inheritance for Record Buffer Classes, Managing Fixed Length, Fixed Field Buffers, An Object-Oriented Class for Record Files.

Managing Files and Records: Record Access, More about Record Structures, Encapsulating Record I/O Operations in a Single Class, File Access and File Organization.

UNIT-II **(8 Contact hours)**

Fundamental File Processing Operations: Physical Files and Logical Files, Opening Files, Closing Files, Reading and Writing, Seeking, Special Characters in Files, The UNIX Directory Structure, Physical Devices and Logical Files, Physical Devices as Files ,File-related Header Files, UNIX File System Commands.

Indexed Files of Data Objects- Indexing: A Simple Index for Entry-Sequenced File, Template Classes in C++, Object-Oriented support for Indexed, Entry-Sequenced Files of Data Objects, Indexes That Are Too Large to Hold in Memory, Indexing to Provide Access by Multiple Keys, Retrieval Using Combinations of Secondary Keys, Improving the Secondary Index Structure: Inverted Lists, Selective Indexes, Binding.

UNIT-III **(8 Contact hours)**

Multilevel Indexing and B-Trees: Introduction: The Invention of the B-Tree, Statement of the Problem, Indexing with Binary Search Trees, Multi-level Indexing, A Better Approach to

Tree Indexes, B-Trees: Working up from the Bottom, Example of Creating a B-Tree, An Object-Oriented Representation of B-Trees, B-Tree Methods Search, Insert, and Others, B-Tree Nomenclature, Formal Definition of B-Tree Properties, Worst-case Search Depth, Deletion, Merging, and Redistribution, Redistribution during Insertion: A Way to Improve Storage Utilization, B* Trees, Buffering of Pages: Virtual B-Trees, Variable-length Records and Keys.

UNIT-IV **(8 Contact hours)**

Indexed Sequential File Access and B+ Trees : Indexed Sequential Access, Maintaining a Sequence Set, Adding a Simple Index to the Sequence Set, The Content of the Index: Separators Instead of Keys, The Simple Prefix B+ Tree, Simple Prefix B+ Tree Maintenance, Index Set Block Size, Internal Structure of Index Set Blocks: A Variable-order B-Tree, Loading a Simple Prefix B+ Tree, B+ Trees, B-Trees, B+ Trees, and Simple Prefix B+ Trees in Perspective.

UNIT-V **(8 Contact hours)**

Hashing: Introduction, A Simple Hashing Algorithm, Hashing Functions and Record Distributions, How Much Extra Memory Should Be Used, Collision Resolution by Progressive Overflow, Storing More Than One Record per Address: Buckets, Making Deletions, Other Collision Resolution Techniques, Patterns of Record Access.

UNIT-VI **(7 Contact hours)**

Extendible Hashing: Introduction, How Extendible Hashing Works, Implementation, Deletion, Extendible Hashing Performance, Alternative Approaches, Multi list and Inverted Files, Sorting of Large Files.

External sorting: Secondary storage algorithms.

Text Book

1. Michael j. Folk, Greg Riccardi, Bill Zoellick; *File Structures: An Object Oriented Approach with C++*, 3/e Pearson Publishers.
2. Suggested Reading

Course outcomes: At the end of the course, the student will be able to

CO 1	Understand file structures including sequential, indexed, indexed sequential, hashed file structures
CO 2	Apply object-oriented concepts to design file systems
CO 3	Implement file operations including read, write, update and search
CO 4	Develop and analyze external sorting methods

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total

Weightage (%)	10%	30%	60%	100%

****

Course code	**Course name**	**Course Category**	**L-T-P**	**Credits**
HSXY04	**Aptitude and Reasoning**	**MC**	**2: 0: 0**	**0**

Course Learning Objectives:

1. To enable the students for their competitive exams

2. To enhance their capability in aptitude and reasoning.

3. To develop their reasoning skill.

4. To prepare them for all type of competitive exams

Course Contents:

Unit I: (1.5 hours)

Number system: Base System, Exponents, Factorials, LCM & HCF, Properties of Numbers, Remainders, Successive Divisions

Sequence & Series: Arithmetic Progression, Harmonic Progression, Geometric Progression

Unit II: (8 hours)

Arithmetic: Averages, Clocks & Calendars, Simple Interest & Compoud Interest, Mixture & Alligations, Percentages, Profit, Loss & Discounts, Ratio & Proportion, Speed, Time & Distance, Time & Work

Algebra: Binomial Theorem, Complex Numbers, Functions, Higher Degree Equations, Inequalities , Linear Equations, Logarithm, Quadratic Equations

Unit III: (6 hours)

Geometry: Mensuration, Lines & Angles, Circles, Polygons, Triangles, Co-ordinate Geometry, Trigonometry

Probability & Statistics: Mean, Median & Mode, Permutation & Combination, Probability Set Theory & Venn Diagram

Unit IV: (7 hours)

Logical Reasoning: Logical Sequence, Premise, Assumption & Conclusion, Binary Logic, Blood Relations, Linear & Matrix Arrangement, Seating Arrangement, Coding & Decoding, Statements & Assumptions Puzzles

Analytical Reasoning: Course of Action Fact, Inference & Judgement, Logical Deduction, Statement & Assumption, Strong & Weak Arguments, Syllogism

Unit V: (4.5 hours)

Data Interpretation: Charts (Column, Pie & Bar), Tables Graphs (Line & Area), Venn Diagram, Data Sufficiency. Reading Comprehension

Unit VI: (3 hours)

Verbal Ability: Cloze Test Error Spotting, Fill in the blanks, Sentence Correction, Word Usage, Para jumbles, Paragraph Completion, Paragraph Summary

Learning resources

Text book:

1. Sarvesh K Verma, '*Quantitative Aptitude Quantum CAT*', arihant publications
2. Arun Sharma, Meenakshi Upadhyay, *' Verbal Ability and Reading Comprehension'* , McGraw Hill publications
3. Arun Sharma, '*Data Interpretation*', McGraw Hill publications
4. Arun Sharma, '*Logical Reasoning*', McGraw Hill publications

Reference books:

1. Nishit K Sinha, 'Logical Reasoning and Data Interpretation', Pearson publications
2. Arun Sharma, '*Quantitative Aptitude*', McGraw Hill publications

Web resources:

1. https://unacademy.com/

Course outcomes: At the end of the course, the student will be able to

CO 1	Improve aptitude, problem solving skills and reasoning abilities

CO 2	Improve Verbal ability skills, Data interpretation skills
CO 3	Understand the basic techniques required for solving Reading Comprehension
CO 4	Familiarize with the written tests of competitive exams, campus placements and PSUs
CO 5	Collectively solve problems in teams and group
CO 6	Adopt and acquire new techniques in solving problem

Assessment Method

Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	Nil	Nil	100	100

LIST OF PROFESSIONAL ELECTIVES COURSE(PEC)
ELECTIVE GROUP-5

Course Code	Course Name	Course Category	L-T-P	Credits
CS4141	**Big Data Analytics**	PEC	3-0-0	3

Course Learning Objectives:

1. Applying and understanding the big data flow for the actual projects.
2. Understands the lifecycle of the data analytics & big data ecosystem and able to apply for real world problems.
3. Acquires knowledge on the tools and techniques for solving big data analytics.
4. Learns how to apply the mining techniques on big data

Course Content:

Unit - I **(8 Contact hours)**

Introduction to Big Data Analytics:Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics.

Data Analytics Lifecycle:Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize.

Unit - II **(8 Contact hours)**

Advanced Analytical Theory and Methods- Clustering: Overview of Clustering, K-means, Additional Algorithms Advanced Analytical Theory and Methods-Association Rules: Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, An Example: Transactions in a Grocery Store, Validation and Testing, Diagnostics.

Unit-III **(8 Contact hours)**

Advanced Analytical Theory and Methods- Regression: Linear Regression, Logistic Regression, Reasons to Choose and Cautions, Additional Regression Models Advanced Analytical Theory and Methods-Classification: Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods

Unit – IV **(8 Contact hours)**

Advanced Analytical Theory and Methods-Time Series Analysis: Overview of Time Series Analysis, ARIMA Model, Additional Methods.

Advanced Analytical Theory and Methods-Text Analysis: Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency--Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

UNIT V: **(7 Contact hours)**

Advanced Analytics--Technology and Tools-MapReduce and Hadoop:Analytics for Unstructured Data, The Hadoop Ecosystem, NoSQL.Advanced Analytics--Technology and Tools-In-Database Analytics: SQL Essentials, In-Database Text Analysis, Advanced SQL.The Endgame or Putting It All Together:Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Data Visualization Basics.

UNIT – VI: **(7 Contact hours)**

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;

Learning resources

Text book:

1. Dunlop, Dorothy D., and Ajit C. Tamhane. ‘*Statistics and data analysis: from elementary to intermediate’*. Prentice Hall, 2000.
2. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data” Wiley Publishers.
3. Tom White “ Hadoop: The Definitive Guide” Third Edition, O‟reilly Media, 2011.
4. Prajapati, "V. Big data analytics with R and Hadoop",Packt Publishing Ltd, 2013.

Reference Books:

1. Ohlhorst, Frank J. *‘Big data analytics: turning big data into big money’*. John Wiley & Sons, 2012.
2. W.N. Venables, D.M Smith, *‘An introduction to R’*, Network Theory Ltd.
3. Nina Zumel, John Mount, ‘*Practical Data Science with R*’, Manning Publications, 2014
4. Tom Plunkett, Mark Hornick, ‘*Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop’*, McGraw-Hill/Osborne Media (2013), Oracle press.

Web resources:

1. Implementing big data analysis, 19 Dec 2017 URL https://aiodex.com/?ref=5b45a599c7165
2. Big data and Hadoop introduction 17 Jul 2014 URL http://www.simplilearn.com/big-data-a
3. Big data and analytics 17 Jul 2014 URL https://www.simplilearn.com/resources

Course outcomes: At the end of the course, the student will be able to

CO 1	Have a clear idea about the big data flow and its ecosystem**.**
CO 2	Apply the tools and techniques on big data while applying data mining techniques**.**
CO 3	Use statistical tool and statistical methods that can be applied on big data.
CO 4	Have a clear idea about how to represent the unstructured data in the data bases
CO 5	Understand the common Hadoop ecosystem components, Hadoop Architecture, HDFS, Anatomy of File Write and Read, Rack Awareness.
CO 6	Have a clear idea about social media data,text mining,mobile analytics.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS4142	DESIGN PATTERNS	PEC	3-0-0	3

Course Objectives

1. The focus of this course is on design rather than implementation.
2. Introducing the Unified Process and showing how UML can be used within process.
3. Presenting a comparison of the major UML tools for industrial-strength development.
4. Introduction to design patterns, practical experience with a selection of central patterns.

Course Content: **(8 Contact hours)**

Unit I Introduction : Introduction to OOAD; typical activities / workflows / disciplines in OOAD, Introduction to iterative development and the Unified Process, Introduction to UML; mapping disciplines to UML artifacts, Introduction to Design Patterns – goals of a good design, Introducing a case study & MVC architecture.

Unit II Inception: **(8 Contact hours)**

Artifacts in inception, Understanding requirements – the FURPS model, Understanding Use case model – introduction, use case types and formats, Writing use cases – goals and scope of a use case, elements / sections of a use case, Use case diagrams, Use cases in the UP context and UP artifacts, Identifying additional requirements, Writing requirements for the case study in the use case model.

Unit III Elaboration: **(8 Contact hours)**

System sequence diagrams for use case model, Domain model : identifying concepts, adding associations, adding attributes, Interaction Diagrams, Introduction to GRASP design Patterns ,Design Model: Use case realizations with GRASP patterns, Design Class diagrams in each MVC layer Mapping Design to Code, Design class diagrams for case study and skeleton code

Unit IV More Design Patterns: **(7 Contact hours)**
Fabrication, Indirection, Singleton, Factory, Facade, Publish-Subscribe

Unit V More UML diagrams : **(7 Contact hours)**
State-Chart diagrams, Activity diagrams, Component Diagrams, Deployment diagrams, Object diagrams.

Unit VI Advanced concepts in OOAD : **(7 Contact hours)**
Use case relationships, Generalizations Domain Model refinements, Architecture, Packaging model elements.

Course Outcomes

1. Students successfully completing this course will be able to:
2. identify the purpose and methods of use of common object-oriented design patterns
3. select and apply these patterns in their own designs for simple programs
4. represent the data dependencies of a simple program using UML
5. represent user and programmatic interactions using UML
6. create design documentation outlining the testable and complete design of a simple program
7. produce and present documents for the purpose of capturing software requirements and specification
8. produce plans to limit risks specific to software designed for use in a particular social context

Text books

1. Applying UML and patterns' by Craig Larman, Pearson
2. Object-Oriented Analysis & Design with the Unified Process by Satzinger, Jackson & Burd Cengage Learning
3. 'UML distilled' by Martin Fowler , Addison Wesley, 2003
4. Reference
5. O'reilly ' s 'Head-First Design Patterns' by Eric Freeman et al, Oreillly
6. UML 2 Toolkit, by Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado:WILE\'-Dreamtech lndia Pvt. Lid.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

Course Code	Course Name	Course Category	L-T-P	Credits
CS4143	CLOUD COMPUTING	PEC	3-0-0	3

Course Learning Objectives:

1. Understand various basic concepts related to cloud computing technologies. 2.Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS.
2. Understand big data analysis tools and techniques.
3. Understand of cloud virtualization, cloud storage, data management and data visualization. Understand different cloud programming platforms and tools.

Course Content:

UNIT-I **(9 Contact hours)**

Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models .

UNIT-II **(9 Contact hours)**

Virtual Machines and Virtualization of Clusters and Data Centers, Levels of Virtualization, Virtualization Structures / tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Centre Automation.

UNIT-III **(7 Contact hours)**

Cloud computing architectures: over Virtualized Data Centers: Data–Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Managemen.

UNIT-IV **(8 Contact hours)**

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWs and Microsoft Azure, Emerging Cloud Software Environments.

UNIT-V **(7 Contact hours)**

Disaster Recovery,Disaster Recovery Planning, comparing approaches in Xen,Eucalyptus,OpenNebula,Amazon,Nimbus.

UNIT-VI **(7 Contact hours)**

Various trends in computing,web services,service oriented architecture(SOA)

Learning resources

Text book:

1. John W. Rittenhouse, James F. Ransome, "Cloud Computing: Implementation, Management, and Security ", CRC Press, 2009.
2. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, “Cloud Computing:
3. Principles and Paradigms”, WileyPublishing, 2011.
4. Sandeep Bhowmik “Cloud Computing” Cambridge Publishing, 2017

Reference Books:

1. Morgan Kaufmann, ‘*Distributed and Cloud Computing*’, 1st edition, 2011.
2. Gautam Shroff,’ *Enterprise Cloud Computing*’, Cambridge, 2010.
3. Ronald Krutz and Russell Dean Vines, ‘*Cloud Security*’, 1st Edition, Wiley, 2010.

Course outcomes: At the end of the course, the student will be able to

CO 1	Develop and deploy cloud application using popular cloud platforms,
CO 2	Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and building private cloud.
CO 3	Explain and identify the techniques of big data analysis in cloud.
CO 4	Identify the technological drivers of cloud computing paradigm.
CO 5	Identify the security issues in cloud computing
CO 6	Develop cloud services using popular cloud platforms

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course category	L-T-P	Credits
CS4145	Computer Vision	PEC	3-0-0	3

Course Learning Objectives:

Students undergoing this course are expected to:

1. To review image processing techniques for computer vision
2. To understand Image Homographies
3. To understand Scale Invariant Feature Transform and its applications
4. To understand Camera Model (Intrinsic and Extrinsic Parameters) and Epipolar geometry
5. To understand motion analysis
6. To study some applications of computer vision algorithms

Course Content:

Unit- I: **(5 Contact Hours)**

Introduction to Computer vision, Review of Linear Algebra, Review of Probability, Introduction to OPENCV/Matlab.

Unit- II: **(6 Contact Hours)**

Basic relations b/w pixels, Linear filters, Convolutions and correlation, Finite difference filters, Smoothing filters, box filter, Guassian image noise model, Gaussian smoothing filter,Gradients and Edge detection,canny edge detector, Smoothing and differentiation, Prewitt filter, sobel filter, Derivative of Gaussian filter, Types of edges: step, ramp, ridge. , canny edge detector.

Unit - III: **(8 Contact Hours)**

Harris corner detection, feature matching, Image mappings, Planar Hymnographies, Similarity transformations, Affine transformations, warping images, SIFT, RANSAC, creating panoramas.

Unit - IV: **(10 Contact Hours)**

Correspondence problem, correspondence matching, Camera model, Pinhole camera model, camera calibration, Augmented reality, Epipolar geometry, Epipoles, Epipolar lines, Conjugate Epipolar lines, computing with cameras and 3D structures, Multiple view reconstruction, Stereo images , recover depth from two images, geometry of simple stereo system, stereo disparity, Image pyramids, Camera projection: (Extrinsics and Intrinsics parameters),

Unit - V: (**8 Contact Hours)**

Optical flow, Flow estimation, Brightness constancy equation, computing optic flow, Horn Shunck and Lucas Kanade Algorithms, Pyramids, Video change detection, Background subtraction, frame differencing, Adaptive Background subtraction, Presistant frame differencing, Appearance based tracking, Video tracking : Mean-shift and Lucas-kanade tracking .

Unit -VI: **(8 Contact Hours)**

Image clustering and classification, k-means clustering, Hierarchical clustering, spectral clustering, Image segmentation, Graph cuts, Segmentation using clusters, variational methods, Visual tracking, Intro to Deep learning.

Learning resources

Text Books:

1. D. Forsyth and J. Ponce, “Computer Vision - A modern approach”, McGraw-Hill.

Reference Books:

1. Richard Szeliski ,“Computer Vision: Algorithms and Applications”
2. Fisher et al , “Dictionary of Computer Vision and Image Processing”
3. Simon J.D. Prince, “Computer Vision: Models, Learning, and Inference”

Web References:

1. University of Central Florida, Sept 2012, “Computer Vision” https://www.youtube.com/watch?v=715uLCHt4jE&list=PLd3hlSJsX_Imk_BPmB_H3AQjFKZS9XgZm
2. University of Pennsylvania, FALL 2007, “ Introduction to Computer Vision”,
   a. http://www.cse.psu.edu/~rtc12/
3. Stanford University, Fall 2016-17, “ Computer Vision : Foundations and Applications”
4. http://vision.stanford.edu/teaching/cs131_fall1617/schedule.html

Course outcomes: At the end of the course, the student will be able to

CO 1	identify basic concepts, terminology, theories, models and methods in the field of computer vision
CO 2	describe basic methods of computer vision related to multi-scale representation, edge detection
CO 3	detection of other primitives, stereo, motion and object recognition,
CO 4	suggest a design of a computer vision system for a specific problem

Assessment Method:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	**Course Name**	**Course Category**	**L-T-P**	**Credits**
CS4146	**Optimization Techniques**	**PEC**	**3-0-0**	**3**

Course Learning Objectives:

1. To define an objective function and constraint functions in terms of design variables, And then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with Constraints.
3. To explain linear programming technique to an optimization problem, define slack And surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to Determine Simplex method.
5. To study and explain nonlinear programming techniques, unconstrained or
6. Constrained, and define exterior and interior penalty functions for optimization problems.
7. To explain Dynamic programming technique as a powerful tool for making a Sequence of interrelated decisions.

Course Content:

UNIT – I **(8 Contact hours)**

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

UNIT – II **(8 Contact hours)**

Classical Optimization Techniques : Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – III **(8 Contact hours)**

Linear Programming : Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm – Duality in Linear Programming – Dual Simplex method.

UNIT – IV **(7 Contact hours)**

Transportation Problem : Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.

UNIT – V **(7 Contact hours)**

Nonlinear Programming: Un constrained cases – One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method – Univariate method, Powell’s method and steepest descent method.

Constrained cases – Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT – VI **(7 Contact hours)**

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution – examples illustrating the tabular method of solution.

Learning resources

Text books:

1. S.S.Rao - “Engineering optimization : Theory and practice”, New Age International (P) Limited, 3rd edition, 1998.
2. H.S. Kasene & K.D. Kumar “Introductory Operations Research” , Springer (India), Pvt. LTd.

Reference Books

1. K.V. Mital and C. Mohan -“Optimization Methods in Operations Research and systems Analysis” , New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Dr. S.D.Sharma, Kedarnath, Ramnath & Co -Operations Research

3. G. Hadley "Operations Research : An Introduction" – by H.A.Taha,PHI pvt. Ltd., 6th edition Linear Programming.

Course outcomes: At the end of the course, the student will be able to

CO 1	State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem
CO 2	Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
CO 3	Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions
CO 4	Solve transportation and assignment problem by using Linear programming Simplex method.
CO 5	Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.
CO 6	Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

For Theory courses only:

<table>
<tr><td colspan="2"><b>Course Nature</b></td><td colspan="3"><b>Theory</b></td></tr>
<tr><td colspan="5"><b>Assessment Method</b></td></tr>
<tr><td>Assessment Tool</td><td>Weekly tests</td><td>Monthly tests</td><td>End Semester Test</td><td>Total</td></tr>
<tr><td>Weightage (%)</td><td>10%</td><td>30%</td><td>60%</td><td>100%</td></tr>
</table>

****

Course code	Course name	Course Category	L-T-P	Credits
CS4158	Artificial Intelligence	PEC	3-0-0	3

Course Learning Objectives:

1. Definitions of Artificial Intelligence, Different Perspectives, Historical background
2. To understand those elements constituting problems and learn to solve it by various searching techniques
3. To understand those formal methods for representing the knowledge and the process of inference to derive new representations of the knowledge to deduce what to do
4. To understand the notion of planning in AI and some techniques in the classical planning system
5. To understand the notion of uncertainty and some of probabilistic reasoning methods to deduce inferences under uncertainty
6. To understand some of those mechanisms by which an AI system can improve it's behavior through its experience

UNIT I: (3 Hours)

Introduction to Artificial Intelligence- Definition & Foundations of Artificial Intelligence; History of AI; Applications of AI; Intelligent Agents – Agents & Environments, Concept of

Rationality, Structure of Agents, Types of Agents

Unit II: (12 Hours)

Solving Problems by Searching – Problem Solving Agents, Uninformed Search Strategies, Informed/Heuristic Search Strategies, Heuristic Functions, Adversarial Search – Games, Optimal Decisions in Games, Alpha- Beta Pruning, Stochastic Games;

UNIT III **(3 Hours)**

Constraint Satisfaction Problem – Definition, Constraint Propagation, Back Tracking Search & Local Search for CSPs

UNIT IV: (12 Hours)

Learning from Examples – Forms of Learning; Supervised Learning; Decision Trees, Regression & Classification with Linear Models; Artificial Neural Networks, Support Vector Machines, Ensemble Learning, Practical Machine Learning, Intro. to Reinforcement Learning

UNIT V (6 Hours)

Knowledge Presentation & Inference – Knowledge based Agents, Propositional Logic, First-Order Logic, Inference Rules, Theorem Proving by Resolution, Forward & Backward Chaining

Classical Planning – Definition, Forward (Progression) Search and Backward (Regression) Search, Hierarchical Planning, Multi Agent Planning

UNIT VI **(9 Hours)**

Planning under Uncertainty – Introduction to Probability Theory, Bayes Theory & its use, Bayesian Networks, Hidden Markov Models, Markov Decision Processes, Value Iteration, Policy Iteration, Partially Observable MDPS.

Text Books:

1. Stuart Russel and Peter Norvid, “ Artificial Intelligence : A Modern Approach”, Pearson Education, 3rd Edition

References:

1. Elaine Rich, Kevin Knight and Shiva Shankar B.Nair, “ Artificial Intelligence”, McGraw Hill Education, 3rd Edition
2. Dan W. Patterson, “ Introduction to Artificial Intelligence and Expert Systems”, PHI Learning, 2012

Web References

1. Berkley University, “Artificial Intelligence”, https://courses.edx.org/courses/BerkeleyX/CS188.1x-4/1T2015/course/
2. MIT, “Artificial Intelligence”, FALL 2010 https://www.youtube.com/playlist?list=PLUl4u3cNGP63gFHB6xb-kVBiQHYe_4hSi
3. “Introduction to Artificial Intelligence”, https://classroom.udacity.com/courses/cs271

Course Outcomes: At the end of this course, the student should be able to

CO 1	Identify problems that are amendable to solution by AI methods
CO 2	Identify appropriate AI methods to solve a given problem
CO 3	Formalise a given problem in the language / framework of different AI methods
CO 4	Implement basic AI algorithms
CO 5	Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

LIST OF PROFESSIONAL ELECTIVES COURSE(PEC)

ELECTIVE GROUP-6

Course Code	Course Name	Course Category	LTP	Credits
CS4148	Software Reliability Engineering	PEC	3-0-0	3

Course Learning Objectives:

1. Develop realistic software reliability requirements for your software, products and/or systems
2. Enhance your skills to create software development specifications using robust software reliability approaches and methods
3. Perform software failure mode and reliability analyses
4. Make recommendations to implement cost-optimized software reliability strategies
5. Collect and analyze your software test data

6. Determine the “best” software reliability model and framework

Course Content:

UNIT-1 **(10 Contact hours)**

Introduction to Software Reliability, Error, Fault and failure, Reliability Theoretical Concepts and Notations, Metrics, Important Probability Distributions, Basic statistics.

UNIT-2 **(7 Contact hours)**

Elements of Software Reliability Modeling, Classification of the Existing Models,

UNIT-3 **(6 Contact hours)**

Deterministic models, Data Based Software Reliability Models

UNIT-4 **(8 Contact hours)**

Metric Based Software Reliability Models, Architecture Based Software Reliability

Unit-5 **(9 Contact hours)**

Operational Profile, Developing operational profile, Testing and Estimating operational profile

UNIT-6 **(9 Contact hours)**

Acceptance Testing and Model Selection Criteria, Cost Models and Determination of Optimal Release Time

Learning Resources:

Text Book:

1. Hoang Pham, ‘*System Software Reliability, (Springer Series in Reliability Engineering)*’
2. Min Xie, ‘*Software Reliability Modeling, World Scientific*’
3. J.D Musa, ‘*Software Reliability; Measurement, Prediction, Application, TMH*’
4. A.K Pandey and N K Goyal, ‘*Early Software Reliability Prediction- Studiesin Fuzziness and Soft Computing, Springer*’

Reference Books:

1. Min Xie, ‘*Software Reliability Modeling, World Scientific*’
2. J.D Musa, ‘*Software Reliability; Measurement, Prediction, Application, TMH*’
3. A.K Pandey and N K Goyal, ‘*Early Software Reliability Prediction- Studiesin Fuzziness and Soft Computing, Springer*’

Web Resources:

1. https://www.scribd.com/document/82318155/Reliability-Engineering-Notes

2. https://pdfs.semanticscholar.org/9e8e/bffabba60a5c58ed796e988e91335ba726b2.pdf
3. https://slideplayer.com/slide/4922909/
4. Primary Producer: IIT Bombay, December 2009

   https://nptel.ac.in/courses/112101005/downloads/Module_5_Lecture_3_final.

Course Outcomes: At the end of the course the students will be able to

CO1	Knows the process and basic activities of software reliability engineering, causes of failure appearance, software reliability metrics and models, methods for ensuring, evaluation and enhancing of software reliability.
CO2	Is able to detect, to analyze and to evaluate software faults, failures and errors using appropriate CASE tools.
CO3	Is able to implement different software reliability models and to evaluate the reliability of developed tool using different methods and tools.
CO4	Is able to select an appropriate reliability model, to collect necessary data during testing, to perform an evaluation of software reliability and in case of necessity to enhance reliability.
CO5	To understand the software reliability and its various model
CO6	To understand the metrics used for software reliability and maintainability

Assessment Method:

Course Nature	**Theory**			
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	LTP	Credits
CS4149	**AD-HOC SENSOR NETWORKS**	**PEC**	**3-0-0**	**3**

Course Objectives

1. To make the student understand the concepts of MOBILE AD HOC NETWORKS (Manets) as well as Wireless Sensor Networks (WSN), their characteristics, novel applications, and technical challenges.
2. To understand the issues and solutions of various layers of Manets, namely MAC layer, Network Layer & Transport Layer in Manets and WSN
3. To understand the platforms and protocols used in Manets and WSN.

4. To make the student take up further research as part of his higher studies

Course Outcomes

1. Able to think and develop new applications in Manets and WSN.
2. .Able to take any new technical issue related to these new thrust areas and come up with a solution(s).
3. Able to develop algorithms/protocols for Manets and WSN.

Course Content:

UNIT I: **(8 Contact hours)**

Introduction to Ad Hoc Networks: Characteristics of MANETs, applications of MANETs, and challenges of MANETs. Routing in MANETs: Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms, Position based routing algorithms.

UNIT II: **(7 Contact hours)**

Data Transmission: Broadcast storm problem, Broadcasting, Multicasting and Geocasting.

UNIT III: **(7 Contact hours)**

TCP over Ad Hoc: TCP protocol overview, TCP and MANETs, and Solutions for TCP over Ad hoc.

UNIT IV: **(7 Contact hours)**

Basics of Wireless Sensors and Applications: Applications, Classification of sensor networks, Architecture of sensor networks, Physical layer, MAC layer, Link layer.

UNIT V: **(8 Contact hours)**

Data Retrieval in Sensor Networks: Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, and Sensor Networks and mobile robots.

UNIT VI: **(8 Contact hours)**

Security: Security in ad hoc networks, Key management, Secure routing, Cooperation in MANETs, and Intrusion detection systems. Sensor Network Platforms and Tools: Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms, TinyOS, NS-2 and TOSSIM.

Text book:

1. Ad hoc and Sensor Networks – Theory and Applications, by Carlos Cordeiro and Dharma P. Agrawal, World Scientific Publications, March 2006, ISBN 981-256-681-

Reference Books:

1. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science ISBN: 978-1-55860-914-3, (Morgan Kauffman)

Web Resources:

1. IIIT Karagpur Wireless Ad-hoc Networks :NPTEL Lectures

https://nptel.ac.in/courses/106105160/

For Theory courses only:

Course Nature	**Theory**			
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	LTP	Credits
CS4150	**BIO-METRIC SECURITY**	**PEC**	**3-0-0**	**3**

Course Educational Objective:

1. To provide students with understanding of biometrics, biometric equipment and standards applied to security.

Course Content:

UNIT-I **(8 Contact hours)**

Biometrics- Introduction- benefits of biometrics over traditional authentication systems - benefitsof biometrics in identification systems-selecting a biometric for a system – Applications - Key.biometric terms and processes - biometric matching methods -Accuracy in biometric systems.

UNIT-II **(8 Contact hours)**

Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern.

UNIT-III **(8 Contact hours)**

Technical description – characteristics - strengths – weaknesses – deployment - Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics.

UNIT-IV **(7 Contact hours)**

Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.

UNIT-V **(7 Contact hours)**

signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.

UNIT-VI **(7 Contact hours)**

Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens – executive decision - implementation plan.

Course Outcomes:

1. 1.Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2. 2.Understand and analyze biometric systems at the component level and be able to analyze and design basic biometric system applications.
3. 3.Be able to work effectively in teams and express their work and ideas orally and in writing.
4. 4.Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
5. 5.Understand various Biometric security issues.

TEXT BOOKS:

1. 1.Samir Nanavathi, Michel Thieme, and Raj Nanavathi : "Biometrics-Identity verification in a network", 1st Edition, Wiley Eastern, 2002.
2. 2.John Chirillo and Scott Blaul : "Implementing Biometric Security", 1st Edition, Wiley Eastern Publication, 2005.

REFERENCES:

John Berger: "Biometrics for Network Security", 1st Edition, Prentice Hall, 2004.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total

Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	LTP	Credits
CS4151	**Human Computer Interaction**	**PEC**	**3-0-0**	**3**

Course Objective:

1. The Main Objective is the student to think constructively and analytically about how to design and evaluate interactive technologies.
2. Student can clearly understand the importance of the user interface design.
3. IT give an introduction to the key areas, approaches and developments in the field.
4. Basically, the course will introduce them to key areas, theoretical frameworks, approaches and major developments in HCI.
5. The main objective is to get student to think constructively and analytically about how to design and evaluate interactive technologies.

Course Content:

UNIT-I: Introduction and Graphical User Interface (9 Contact hours)

Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface

UNIT-II: Design Process (7 Contact hours)

Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.

UNIT-III: Screen Designing (9 Contact hours)

Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT-IV: Windows (7 Contact hours)

New and Navigation schemes selection of window, selection of devices based and screen based controls.

UNIT-V: Components (7 Contact hours)

Text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT-VI: Software Tools and Interaction Devices (7 Contact hours)

Specification methods, interface – Building Tools; Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

Text Books:

1. Wilbert O Galitz,”*The essential guide to user interface design*”, Wiley DreamaTech.
2. Ben Shneidermann ,”*Designing the user interface”,* Pearson Education Asia 3rd Edition,.

References:

1. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg *“Human – Computer Interaction”*, Pearson, Third Edition.
2. Prece, Rogers, Sharps ,*“Interaction Design”* ,Wiley Dreamtech , Third Edition.
3. Soren Lauesen ,*“User Interface Design”*,Pearson Education.

Web resources:

1. Dr. Samit Bhattacharya , Dept. of Computer Science and Engineering, IIT Guwahati URL: http://nptel.ac.in/courses/106103115

Course outcomes: At the end of the course, the student will be able to

CO 1	Explain the capabilities of the both humans and computers from the view point of human Information processing
CO 2	Describe typical human-computer Interaction (HCI) models styles and various historic HCI paradigms.
CO 3	Apply an interactive design process and universal design principles to designing HCI system.
CO 4	Describe and use HCI design principles, standards and guidelines.
CO 5	Analyze and identify user models ,user support ,socio-organizational issues, and stakeholder requirements of HCI system.
CO 6	Design tasks and dialogs of relevant HCI system based on task analysis and dialog design.

Assessment Method

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

LIST OF PROFESSIONAL ELECTIVES COURSE (PEC)

Elective group-7

Course Code	Course Name	Course Category	L-T-P	Credits
CS4252	Service Oriented Architecture	PEC	3-0-0	3

OBJECTIVES:

1. To learn fundamentals of XML
2. To provide an overview of Service Oriented Architecture and Web services and their importance
3. To learn web services standards and technologies
4. To learn service oriented analysis and design for developing SOA based applications

Course Content:

UNIT I XML **(8 Contact hours)**

XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery.

UNIT II Service Oriented Architecture (Soa) Basics **(9 Contact hours)**

Characteristics of SOA, Benefits of SOA , Comparing SOA with Client-Server and Distributed architectures — Principles of Service Orientation – Service layers

UNIT III Web Services (Ws) And Standards **(8 Contact hours)**

Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography

UNIT IV Web Services Extensions **(9 Contact hours)**

WS-Addressing – WS-ReliableMessaging – WS-Policy – WS-Coordination – WS -Transactions – WS-Security – Examples

UNIT V Service Oriented Analysis And Design **(7 Contact hours)**

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines — Service design – Business process design – Case Study

UNIT VI **(7 Contact hours)**

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC).

Course Outcomes:Upon Successful Completion Of This Course, The Students Will Be Able To:

1. Understand XML technologies
2. Understand service orientation, benefits of SOA
3. Understand web services and WS standards

4. Use web services extensions to develop solutions
5. Understand and apply service modeling, service oriented analysis and design for application development.

TEXTBOOKS:

1. Thomas Erl, ― Service Oriented Architecture: Concepts, Technology, and Design, Pearson Education, 2005
2. Sandeep Chatterjee and James Webber, ―Developing Enterprise Web Services: An Architect's Guide, Prentice Hall, 2004

REFERENCES:

1. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, ―Java Web Services Architecture, Elsevier, 2003.
2. Ron Schmelzer et al. ― XML and Web Services, Pearson Education, 2002.
3. Frank P.Coyle, ―XML, Web Services and the Data Revolution, Pearson Education, 2002

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS4253	Internet of Things	PEC	3-0-0	3

Course Learning Objectives

1. To assess the vision and introduction of IoT.
2. To Understand IoT Market perspective.
3. To Implement Data and Knowledge Management and use of Devices in IoT
4. Technology
5. To Understand State of the Art - IoT Architecture.
6. To classify Real World IoT Design Constraints, Industrial Automation in IoT.

Course Content:

Unit – I:Introduction to the Internet of Things (7 Contact hours)

What is the IoT and why is it important? , M2M., Elements of an IoT ecosystem, Technology drivers, Business drivers, Typical IoT applications, trends and implications.

Unit –II: Technologies behind the Internet of Things. (9 Contact hours)

- RFID + NFC - Wireless networks + WSN - RTLS + GPS - Agents + Multiagent systems.

Unit –III:Sensors and sensor nodes (5 Contact hours)

Sensing devices, Sensor modules, nodes and systems.

Unit –IV:Connectivity and networks (8 Contact hours)

Wireless technologies for the IoT, Edge connectivity and protocols, IoT design methodoly.

Unit –V:Analytics and application (9 Contact hours)

Signal processing, real-time and local analytics, Databases, cloud analytics and applications.

Unit –VI: Developing IoT (4 Contact hours)

IoT Design methodology,IoT physical devices-Raspberry specifications Pi 3 specifications.

Learning resources

Text book:

1. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016
2. Keysight Technologies, “The Internet of Things: Enabling Technologies and Solutions for
3. Design and Test”, Application Note, 2016.

Reference Books:

1. Charles Bell, “Beginning Sensor Networks with Arduino and Raspberry Pi”, Apress, 2013.

2. D. Evans, "The Internet of Things: How the Next Evolution of the Internet Is Changing
3. Everything", Cisco Internet Business Solutions Group, 2011
4. McKinsey&Company, "The Internet of Things: Mapping the value beyond the hype", McKinsey Global Institute, 2015
5. European Alliance for Innovation (EAI), "Internet of Things: Exploring the potential", Innovation Academy Magazine, Issue No. 03, 2015
6. Digital Greenwich, "Greenwich Smart City Strategy", 2015
7. ITU and Cisco, "Harnessing the Internet of Things for Global Development", A contribution to the UN broadband commission for sustainable development

Web resources:
https://onlinecourses.nptel.ac.in/noc17_cs22/preview
https://coursesedx.org/courses/course-v1:ColumbiaX+DS103x+1T2017/course/

Course outcomes: At the end of the course, the student will be able to

CO 1	Learns the definition and usage of the term “The Internet of Things” in different contexts.
CO 2	Understand where the IoT concept fits within the broader ICT industry and possible future trends.
CO 3	Appreciate the role of big data, cloud computing and data analytics in a typical IoT system.
CO 4	Differentiates between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.
CO 5	Designs a simple IoT system comprising sensors, edge devices, wireless network connections anddata analytics capabilities
CO 6	Learns the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.

For Theory courses only:

<table>
<tr><th colspan="2">Course Nature</th><th colspan="3">Theory</th></tr>
<tr><th colspan="5">Assessment Method</th></tr>
<tr><td>Assessment Tool</td><td>Weekly tests</td><td>Monthly tests</td><td>End Semester Test</td><td>Total</td></tr>
<tr><td>Weightage (%)</td><td>10%</td><td>30%</td><td>60%</td><td>100%</td></tr>
</table>

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS4254	Cyber Security	PEC	3-0-0	3

Course Learning Objectives:

1. To discuss basics of Information Security, related terminologies and the legal aspects.
2. To list assets and discuss the policies, standard and business continuity in an organization.
3. To illustrate risk assessment and explain the need of authentication and authorization.
4. To discuss firewall, IDS and various networking tools.
5. To explain the vulnerabilities present in the system, web and mobile environment.
6. To discuss the importance of physical security and the ways to maintain information security in any organization.

Course Content:

Unit - I **(8 Contact hours)**

History of Information Security, Understanding security, CNSS security model, Security in SDLC, Types of threats and attacks, Principles of Information Security, Laws and Ethics for Information Security, Introduction to IT ACT, International Laws and Legal bodies.

Unit - II **(8 Contact hours)**

Asset, Asset classification, Understanding the basics of Information Security Policy, Standards and Practices, Types of Policies, Policy development process, ISO 27001, Business Continuity Planning, Disaster Recovery, Maintaining Backups.

Unit - III **(8 Contact hours)**

Identification, Assessment, Analysis, Control of Risk, Quantitative vs Qualitative Risk Management, FAIR approach to risk assessment, NIST Risk management framework, Authentication vs Authorization, Types of authentication, Understanding different types of Access Controls(ACLs, RBAC, RUBAC etc.).

Unit - IV **(8 Contact hours)**

Overview of Firewalls, VPNs, DMZs, IDS, IPS, Honeypots, Detection methods, various network analysis tools.

Unit - V **(8 Contact hours)**

OS security, OWASP Top 10 web application security vulnerabilities, Mobile Devices risks, OWASP Top 10 mobile application security vulnerabilities.

Unit – VI **(5 Contact hours)**

Physical Vulnerability Assessment, Securing Assets, Physical Intrusion Detection, Procedures and Methods to maintain the implemented information Security.

Learning resources

Text book:

1. Whitman, Michael E., and Herbert J. Mattord, *‘Principles of Information Security’*, Cengage Learning India Private Limited, 5th edition

Reference Books:

1. Mark Rhodes and Ousley, *‘Information Security: The Complete Reference’*, McGraw-Hill Education; 2nd edition.
2. Stuart McClure , Joel Scambray and George Kurtz, *‘Hacking Exposed 7’*, McGraw-Hill Education; 7th edition.

Course outcomes: At the end of the course, the student will be able to

CO 1	Analyze any organization for information security loopholes.
CO 2	Create and implement information security policies for any organization.
CO 3	Create and maintain information asset register.
CO 4	Implement Information Security framework for an organization.
CO 5	Identify the Information security risk, estimate its severity and recommend solutions.
CO 6	Test any application (system, web and mobile) for the technical risks.

Assessment Method:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS4255	Robotics	PEC	3-0-0	3

Course Learning Objectives:

students should be able to

1. To simulate the robot functions and joint movements.
2. Graphic animation sequences for robot movement.
3. Velocity, acceleration analysis of joint and linkages.
4. The basics and the latest technology of sensors used in robotics.
5. The different sensing variables
6. Robot vision system

Course Content:

UNIT I (Introduction to Robotics) (7 Contact hours)

What is robot and robotics, already designed robots, Manual and Autonomous robots, Different types of industrial ARM robots, and arm design, Coordinate transformations for more motor moments, Electrical connections of different boards and modules: How to connect closed circuit, digital and analog pins connections.

UNIT II (Robotic Principles) (7 Contact hours)

Robotic functions Geometrical commands, Edit commands. Selecting robot views, standard Robot part, using the parts in a simulation.

UNIT III (Robotic Motion) (7 Contact hours)

Types of motion, velocity and acceleration, Types of simulation motion Harmonic motion, parabolic motion, uniform motion velocity and acceleration analysis for robots.

UNIT IV (Actuators and sensors) (7 Contact hours)

Introduction to Arduino, Actuators, Sensors, Wired and wireless communication, I/O communication through USB cable, Bluetooth HC05, RF modules, DTMF module, Xbee modules.

UNIT V (Robotics Simulation) (8 Contact hours)

Simulation packages, Loading the simulation, Simulation editors, delay, Resume commands. Slide commands, program flow control. Robot motion control, Analysis of robot elements, Robotic linkages.

UNIT VI (Basic robots and Raspberry pi) (10 Contact hours)

Line follower: Line follower robot design and control with Arduino board, Obstacles avoider: Obstacle avoider robot with IR sensors and Arduino board, Mobile controller:

Mobile controller robot with DTMF module and HC05 module, Introduction to Raspberry pi: What is raspberry and differences between Arduino and raspberry pi, Applications of robotics.

Learning resources:

Text book:

1. Robotics for engineers by Yoram Koren
2. John J. Craig - *Introduction to Robotics: Mechanics and Control, Pearson, Upper Saddle River*, NJ, 2005.
3. Marco Schwartz - *Internet of Things with Arduino Cookbook.*
4. P.A. Janaki Raman, *Robotics and Image Processing an Introduction*, Tata Mc Graw Hill Publishing company Ltd., 1995.
5. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, *Robotics Engineering an Integrated Approach*, Phi Learning., 2009.
6. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, *Industrial Robotics, Technology programming and Application*s, Tata McGraw-Hill Education, 2011.

Reference Books:

1. Myke Predko, "*Programming Robot Controllers*" – McGrawHill, 1st edition, 2003.

2. Murphy Robin R," *Introduction to AI Robotics*", MIT Press, 2000.

3. Siegwart R and Nourbakhsh I.R, "*Introduction to Autonomous mobile Robots*", Prentice Hall India, 2005.

Web resources:

https://ieeexplore.ieee.org/document/833572/ by K Taylor - 2000
https://www.iste.org/explore/articleDetail?articleid=846&category=In-the.Nov 1, 2016
www.ieee-ras.org/...resources.../educational-material-in-robotics-and-automation2015 - SyRoTek - System for **robotic** e-learning

Course outcomes: At the end of the course, the student will be able to

CO 1	knowledge of programming and algorithms, as well as systems development techniques
CO 2	knowledge of digital technology that forms the basis for designing computers and embedded systems.
CO 3	knowledge about electronics and sensors that form the basis for machine launching.
CO 4	knowledge of mathematics required for electronics, programming and robotics.
CO 5	knowledge about the management and analysis of robotics systems.
CO 6	knowledge of how machines can interpret surroundings, act intelligently

	and adapt.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	Course Name	Course Category	L-T-P	Credits
CS4256	**Computer Forensics**	**PEC**	**3-0-0**	**3**

Course Learning Objectives:

1. To discuss basics of computer forensics, types and role of data backup.
2. To illustrate the procedure of evidence collection and data seizure.
3. To inspect network, identify crime and review a case.
4. To choose appropriate forensics tool to perform investigation.
5. To examine mobile phones and inspect windows and Dos for evidence gathering.
6. To illustrate the guidelines for writing reports and responsibilities of expert witness.

Course Content:

Unit - I **(8 Contact hours)**

Computer Forensics Fundamentals: What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement, Computer Forensic Technology, Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined, Data Back-up and Recovery, The Role of Back-up in Data Recovery, The Data-Recovery Solution.

Unit - II **(8 Contact hours)**

Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene, Computer Evidence Processing Steps, Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication, Practical Consideration, Practical Implementation.

Unit - III **(8 Contact hours)**

Computer Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions.

Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

Unit - IV **(8 Contact hours)**

Current Computer Forensic tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Unit - V **(8 Contact hours)**

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

Unit – VI **(5 Contact hours)**

Report writing and Expert witness: Importance of reports, guidelines to write reports, using tools to generate reports, guidelines for expert witness and testifying in court, ethical responsibilities in expert testimony.

Learning resources

Text book:

1. Amelia Phillips and Bill Nelson, *‘Guide to Computer Forensics and Investigations’*, Cengage Learning India Private Limited, 4th edition.

Reference Books:

1. John R. Vacca, *‘Computer Forensics: Computer Crime Scene Investigation’*, Charles River Media, 2nd edition.
2. Eoghan Casey, *‘Handbook of Digital Forensics and Investigation’*,Academic Press, 1st edition.

Course outcomes: At the end of the course, the student will be able to

CO 1	Examine any device and recover data from it.
CO 2	Analyze any device for collecting evidence and helping the law officials in prosecuting a person for any crime committed.
CO 3	Demonstrate the use of various forensic tools for conducting investigation.

For Theory courses only:

Course Nature	**Theory**

Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

LIST OF OPEN ELECTIVES (OEC)

Course code	Course Name	Course Category	L-T-P	Credits
CSXX61	Object Oriented Programing through JAVA	OEC	3-0-0	3

Course Learning Objectives:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.,
2. Understanding the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc. and exception handling mechanisms.
3. Understand the principles of inheritance, packages and interfaces.
4. Understand the principles of Multithreading and Event handling mechanisms.

Course Content:

Unit 1: **(7.5 Contat hours)**

Introduction: OO Programming, Introduction to java, Key features, Fundamentals of Objects and Classes, Access Specifiers, data types, dynamic initialization, scope and life time, operators, Conditional Statements, control structures, arrays, type conversion and casting.

Unit II: **(7.5 Contact hours)**

Classes and Objects : Concepts, methods, constructors, usage of static, access control, this key word, garbage collection, overloading, parameter passing mechanisms, nested classes and inner classes.

Strings: Exploring the String class, String buffer class, Command-line arguments. Library: StringTokenizer, Random class, Wrapper classes.

Unit III: **(10 Contact Hours)**

OOPS Concepts: Basic concepts, Inheritance, usage of super key word, method overriding, final methods and classes, abstract classes, Polymorphism: dynamic method dispatch, Static method dispatch.

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces. Encapsulation: Abstraction. Creating User defined Data Structures: Array of Objects, User defined Linked List

Unit IV: **(6 Contact hours)**

File Handling: Streams, File class, File streams. File Reader, File Writer, Buffered Reader, Buffered Writer, String Tokenizer Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes.

Unit V: **(6 Contact hours)**

Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages. Multithreading : Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups.

Unit VI: **(8 Contact hours)**

Event Handling: Introduction to Event Handling, AWT Components, windows, Layout Managers, Event handling model of AWT, Adapter classes, Menu, Menu bar. Swing-I – swings introduction, JFrame, JPanel and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons. Combo boxes, Action Listeners.

Learning Resources

Text books:

1. Herbert Schildt, “The Complete Reference Java”, TMH Publishing Company Ltd, 9th Edition.
2. Cay Horstmann, “Big Java”, John Wiley and Sons, 2nd Edition

Reference Books:

1. Allen B. Downey, “Think Java; How to Think Like a Computer Scientist”, Paper Back, 1stEdition
2. David J. Eck, Hobart and William Smith Colleges, “Introduction to Programming Using Java” Published by Paper Back
3. H.M.Dietel and P.J.Dietel “Java How to Program”, Sixth Edition, Pearson Education/PHI

Web resources:

1. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
2. https://www.tutorialspoint.com/java/
3. https://www.javatpoint.com/java-tutorial
4. http://mooc.fi/courses/2013/programming-part-1/material.html
5. http://math.hws.edu/javanotes

Course Outcomes: At the end of the course, the student will be able to

CO 1	Explain OOP Principles and Write Basic Java Programs.
CO 2	Defining Classes and Objects. Identify classes, objects, members of a class and relationships among them needed for a specific problem
CO 3	To be able to write Java Programs to demonstrate method overloading and Demonstrate the concepts of polymorphism and inheritance. Discuss method overriding V/s method overloading.
CO 4	Explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language
CO 5	To be able to write Java Programs to demonstrate Packages and Threading concepts.
CO 6	Discuss and Demonstrate the AWT Concepts and develop the AWT Applications.

Assessment Method

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course code	Course name	Course Category	L-T-P	Credits
CSXX62	Database Management Systems	OEC	3-0-0	3

Course Learning Objectives:

1. To Understand the role of a database management system in an organization.
2. To Understand the basics of ER Diagram, Relational model and Relational Algebra.
3. To Understand basic database concepts, including the structure and operation of the relational data model.
4. To Construct simple and moderately advanced database queries using Structured Query Language (SQL).
5. To Understand and successfully apply logical database design principles, including E-R diagrams and database normalization.
6. To Understand the concept of a database transaction and related database facilities.

Course Content:

Unit I **(8 Contact hours)**

Introduction to database systems, File System vs. Database Systems, Database system structure, Views of data in a database system, Data models and Database languages.

Introduction to Entity-Relationship data model, Elements of an ER model, Constructing ER diagrams, Modelling of constraints, Reduction of ER diagrams to tables.

Unit II **(6 Contact Hours)**

Basics of relational model, ER diagrams to relational design, Relational algebra: Simple operations and extended operations, writing relational algebra expressions for queries, Introduction to tuple relational calculus and writing basic queries using tuple calculus

Unit III **(9 Contact Hours)**

Basic structure of SQL queries, Writing simple queries, Complex queries and nested Subqueries in SQL, Aggregate functions in SQL, Effect of NULL values on result, Defining a Relational Schema, View definitions and constraints, types of keys.

Unit IV **(7 Contact hours)**

Features of Good Relational Designs, Atomic Domains and First Normal Form, Problems encountered in bad schema design, Motivation for normal forms, Dependency theory-functional dependencies, Armstrong’s Axioms for FD, Closure of a set of FD’s, Minimal

Cover, Definition of 1NF, 2NF, 3NF and BCNF, Decomposition and desirable properties of them, Algorithms for 3NF and BCNF normalization.

Unit V **(6 Contact hours)**

Storing data in disk and files and the memory hierarchy, RAID, Disk space management, Buffer manager, File organization and indexes.

Unit VI **(9 Contact hours)**

Transaction concept, ACID properties, Concurrency in a DBMS, Serializability and Recoverability, Concurrency control Protocols (lock-based and time-stamp based)

Text Books

1. Silberschatatz, H. F. Korth and S. Sudarshan, Database System Concepts, 5/e, McGraw Hill,2006
2. R. Ramakrishnan and J. Gehrke, Database System Concepts, 3/e, McGraw Hill, 2003

Reference Books

1. Ramez Elmasri, Shamkant B. Navathe , Fundamentals of Database (7th Edition), Paperback, 2007
2. Theorey T J, Database Modeling & Design, 2/e, Morgan Kaufmann Publishers, 1994.
3. H. GarciaMolina, J. D. Ullman and J. Widom, Database Systems The Complete Book, 1/e, Pearson Education, 2007

Web resources:

Department of CS&E, IIT M, "Introduction to Database Sytems and Design", https://nptel.ac.in/courses/106106095/

Indian Institute of Technology, Kharagpur, " Database Management Systems", https://nptel.ac.in/courses/106105175/

Course outcomes: At the end of the course, the student will be able to

CO 1	Demonstrate the basic elements of a relational database management system,
CO 2	Ability to identify the data models for relevant problems.
CO 3	Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data.
CO 4	Apply normalization for the development of application software
CO 5	Ability to learn about Disk Management, Buffer management
CO 6	Ability learn about transaction management

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****

Course Code	**Course Name**	**Course Category**	**L-T-P**	**Credits**
CSXX65	**Digital Image Processing**	**OEC**	**3-0-0**	**3**

Course Objectives:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To analyze images in the frequency domain using various transforms.
4. To study image restoration procedures.
5. To study Image Compression and Segmentation used in digital image processing.
6. To study image feature extraction methods.

Course Content:

UNIT I **(9 Contact hours)**

Digital image fundamentals – Electromagnetic spectrum and imaging, Image acquisition, image formation. Digitization-sampling and quantization, Resolution-pixel, gray scale, spatial, basic relationship between pixels, Distance measure, Mathematical operations on image, Geometrical and spatial transformation.

UNIT II **(12 Contact hours)**

Intensity transformation and spatial filtering: Image enhancement, log transformation, Gamma transformation, Histogram processing, Histogram matching, Special filtering- spatial correlation and convolution, generating spatial filter mask, mage smoothing, Image sharpening-Laplacian filter, Highboost filter. Edge detection- gradient filter, Morphological image processing-erosion, Dilation, opening and closing operations, Boundary extraction, Hole Filling, Extraction of connected components, Thinning, and thickening, Gray-scale morphology (optional)

UNIT III **(9 Contact hours)**

Image Restoration-Noise model, Restoration-Mean filter, Geometric filter, median filter, adaptive filter, band pass filter, Notch filter, least mean square filters. Color fundamental-RGB color model, CMY color model, HSI color model. Converting RGB to HSI and vice-versa.

UNIT IV **(9 Contact hours)**

Filtering in Frequency domain-Preliminary concept: Fourier series, Fourier transform, convolution, Sampling, DFT, Enhancement in frequency domain, low pass filter, high pass filter. Computing IDFT from DFT.

UNIT V **(12 Contact hours)**

Image compression fundamental, coding, temporal and spatial redundancy, Error-free (Lossless) and Lossy compression. Image segmentation, Point-line-edge detection. Image gradients operator, canny edge detection, Edge linking and boundary detection, local processing, thresholding, variable thresholding, Region Growing, Texture Segmentation; Region oriented segmentation.

UNIT VI **(9 Contact hours)**

Feature Extraction: Edges – Canny, Sobel; Line detectors, Corners - Harris, Orentation Histogram, SIFT, SURF, Scale-Space Analysis- Image Pyramids, Haar transform.

Textbooks:

1. Digital Image processing – R.C. Gonzalez & R.E. Woods, Addison Wesley/ Pearson education, 3rd edition.
2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, PHI Learning 2009.
3. Milan Soanka, Vaclav Hlavac and Roger Boyle, Digital Image Processing and Computer Vision, Cengage Learning.

References:

1.Fundamentals of Digital Image processing – A.K.Jain , PHI

Course Outcomes:

1. Be able to apply, design and implement solutions for digital image processing problems.
2. Be able to discuss the strengths and limitations of DIP applications in solving problems with both professional peers and lay clients.

For Theory courses only:

Course Nature		**Theory**		
Assessment Method				
Assessment Tool	Weekly tests	Monthly tests	End Semester Test	Total
Weightage (%)	10%	30%	60%	100%

****