SYLLABUS

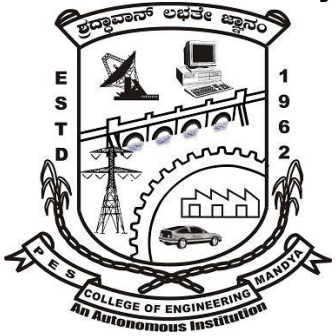
(With effect from 2015-2016 Academic year)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2015-16)

V & VI Semester
Bachelor Degree
in
Information Science and Engineering

Out Come Based Education
with
Choice Based Credit System



P.E.S. College of Engineering,

Mandya - 571 401, Karnataka

(An Autonomous Institution Affiliated to VTU, Belagavi)
Grant -in- Aid Institution
(Government of Karnataka)
Accredited by NBA, New Delhi
Approved by AICTE, New Delhi.

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ
ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ
(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

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Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running Eight undergraduate and Eight Postgraduate programs. It consists of Six M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has recently become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a ‘cafeteria’ type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills and Personality Development modules have been added to the existing curriculum of the academic year 2015-16. Industry Interactions have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are included in all undergraduate programs.

Sri. B.Dinesh Prabhu
Deputy Dean (Academic)
Associate Professor
Dept. of Automobile Engg.

Dr.P S Puttaswamy
Dean (Academic)
Professor
Dept. of Electrical & Electronics Engg

PES College of Engineering

Vision

*"*PESCE shall be a leading institution imparting quality engineering and management education developing creative and socially responsible professionals.*"*

Mission

1. Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.

2. Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.

3. Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.

4. Promote research, product development and industry-institution interaction.

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

About the Department

The Department of Information science and Engineering takes pride in producing quality engineers over the past 14 years. The credit for all the flowery results goes to the highly motivating staff, from whom all students draw inspiration. The Department was started in the year 2000. The present intake of the undergraduate program is 30. The department has well equipped classrooms, computer laboratories with high-end systems, department library and good collection of softwares. Also a research centre is a major credential to our department. We are proud to produce the first PhD student in our college. Faculty members of the department are involved in research activities in different fields such as Medical Image Processing, Pattern Recognition, and Data Mining etc. The department is using Outcome-based education (OBE), which is a recurring education reform model, and it is affiliated to Visvesvaraya Technological University (VTU). The department has achieved good Placement, conducted International /national Conferences and other sponsored short-term courses, workshops, National seminars and symposia. The laboratory facilities and the Internet access are available round the clock to the staff and students of the Information Science and Engineering

Vision

"The department strives to equip our graduates with Knowledge and Skills to contribute significantly to Information Science & Engineering and enhance quality research for the benefit of society".

Mission

M1: To provide students with state of art facilities and tools of Information Science & Engineering to become productive, global citizens and life-long learners.
M2: To prepare students for careers in IT industry, Higher education and Research.
M3: To inculcate leadership qualities among students to make them competent Information Science & Engineering professionals or entrepreneurs.

1.2. State the Program Educational Objectives (PEOs)

Graduates of the program will be able to

PEO1: Establish a productive Information Science & Engineering career in industry, government or academia.

PEO2: Interact with their peers in other disciplines by exhibiting professionalism and team work to contribute to the economic growth of the country.

PEO3: Promote the development of innovative systems and solutions to the problems in Information Science using hardware and software integration.

PEO4: Pursue higher studies in Engineering, Management or Research.

A. List of Program Outcomes (POs)

Engineering Graduates will be able to:

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

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

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

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

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

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

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

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

B. List of Program Specific Outcomes (PSOs)

Information Science & Engineering Graduates will be able to:

PSO1. Analyze, design, develop and test the principles of System software and Database concepts for computer-based systems.

PSO2. Develop computer communication systems and applications for Information security.

PSO3. Apply the knowledge of Information Science and Engineering to solve any software and hardware related problems and to organize, manage and monitor IT Infrastructure.

P.E.S. COLLEGE OF ENGINEERING, MANDYA
(An Autonomous Institution)
SCHEME OF TEACHING AND EXAMINATION
DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

V Semester B.E. (2015-16)

Sl. No.	Course Code	Course Title	Teaching Dept.	Hrs/Week L:T:P:H	Total Credit	Examination Marks		
						CIE	SEE	Total
1.	P15IS51	Data Base Application	IS&E	4:0:0:4	4	50	50	100
2.	P15IS52	Communication Networks-1	IS&E	3:2:0:5	4	50	50	100
3.	P15IS53	C# Programming & .Net	IS&E	4:0:0:4	4	50	50	100
4.	P15IS54	Software Engg.	IS&E	4:0:0:4	4	50	50	100
5.	P15IS55*	Foundation Elective	IS&E	3:0:2:5	3	50	50	100
6.	P15IS56*	Elective -I	IS&E	4:0:0:4	3	50	50	100
7.	P15ISL57	C# Programming & .Net Lab	IS&E	0:1:2:3	1.5	50	50	100
8.	P15ISL58	Data Base Application Lab	IS&E	0:1:2:3	1.5	50	50	100
9.	P15IS59	Industry Visit & Interaction (Certification Course)	IS&E	0:0:2:2	1	50	--	50
10.	P15IS510	Aptitude and Reasoning Development – ADVANCED. (ARDA)	HS&M	2:0:0:2	1	50	50	100
Total					27	500	450	950

List of Electives

Foundation Elective			**Elective - 1**		
Sl. No	Course Code	Course title	Sl. No	Course Code	Course title
1.	P15IS551	Unix system programming	1.	P15IS561	Data mining
2.	P15IS552	Data Science with R	2.	P15IS562	Principles of programming languages
3.	P15IS553	Python Programming	3.	P15IS563	Artificial intelligent
4.	P15IS554	System software	4.	P15IS564	Software Testing

P.E.S. COLLEGE OF ENGINEERING, MANDYA
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SCHEME OF TEACHING AND EXAMINATION
DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

VI Semester B.E. (2015-16)

Sl. No	Course Code	Course Title	Teaching Dept.	Hrs/Week L:T:P:H	Total Credit	Examination Marks		
						CIE	SEE	Total
1.	P15IS61	Object Oriented System Development	IS&E	3:2:0:5	4	50	50	100
2.	P15IS62	Communication Networks-II	IS&E	4:0:0:4	4	50	50	100
3.	P15IS63	Internet of things	IS&E	4:0:0:4	4	50	50	100
4.	P15IS64	Management & Entrepreneurship	IS&E	4:0:0:4	4	50	50	100
5.	P15IS65*	Elective-II	IS&E	4:0:0:4	3	50	50	100
6.	P15IS66*	Elective-III	IS&E	4:0:0:4	3	50	50	100
7.	P15ISL67	N/W Lab	IS&E	0:1:2:3	1.5	50	50	100
8.	P15ISL68	Internet of things Lab	IS&E	0:1:2:3	1.5	50	50	100
9.	P15IS69	Mini Project	IS&E	0:0:2:2	1	50	--	50
10.	P15IS610	Aptitude and Reasoning Development – EXPERT(ARDE)	HS&M	2:0:0:2	1	50	50	100
Total					*27*	*500*	*450*	*950*

List of Electives

Elective-II			**Elective - III**		
Sl. No	Course Code	Course title	Sl. No.	Course Code	Course title
1.	P15IS651	Digital Image Processing	1.	P15IS661	Modern Information Retrieval
2.	P15IS652	Wireless Networks	2.	P15IS662	Storage Area Network
3.	P15IS653	Multimedia computing	3.	P15IS663	J2EE&J2ME
4.	P15IS654	Parallel computing	4.	P15IS664	Principles of Compiler Design

Course Title: Data Base Application			
Course Code: P15IS51	**Semester : V**	**L- T – P - H : 4 – 0– 0 -4**	**Credit : 04**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequisites: Operating System and Computer Organization

Course learning objectives(CLOs)

This course aims to

1. State the importance of DBMS and explain how DBMS is better than traditional File Processing Systems.
2. Analyze the basic structure of Database and recognize the different views of the database.
3. Draw and Investigate Data Flow and Entity Relationship Diagrams.
4. Analyze and use Relational Data Model, while comparing with other data models.
5. Formulate data retrieval queries in SQL and the Relational Algebra and Calculus.
6. Understand and explain the terms like Transaction Processing and Concurrency Control.
7. Understand types of database failure and recovery

Course Content

Introduction

An example: Characteristics of Database approach; Advantages of using DBMS approach; A brief history of database applications; Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment.

Entity-relationship model:

Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two. **10 Hours**

Unit-II

Relational model and relational algebra and basic SQL:

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

SQL:

SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL. Complex Queries, Triggers, Views, And Schema Modification. More complex SQL Retrieval Queries, Specifying constraints as Assertion and Actions as Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Schema Change Statements in SQL; Additional Features of SQL. **12 Hours**

Unit-III

Database design:

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Multi valued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form. **10 Hours**

Unit – IV

Transaction processing concepts:

Introduction to Transaction processing; Transactions and System concepts; Desirable properties of transactions; Characterizing Schedules based on Serializability.

Concurrency control and recovery techniques:

Two-phase locking techniques for concurrency control; concurrency control based on timestamp ordering; recovery concepts; recovery techniques based on deferred update; recovery techniques based on immediate update; shadow paging. **10 Hours**

Unit – V

Database Application Development:

Accessing Databases from Applications, Introduction to JDBC,JDBS classes and Interfaces,SQLJ,stored procedures.

Internet Applications:

Introduction, Internet Concepts,HTML Documents,XML documents, The Three-Tier Application Architectures, The presentation Layer ,The Middle Tier

10 Hours

Text Books:

1. Fundamentals of Database Systems – Elmasri and Navathe, 6th Edition, Addison-Wesley, 2011
2. Database Management Systems – Raghu Ramakrishnan and Johannes Gehrke – 3rd Edition, McGraw-Hill Education(India) Edition 2014.

Reference Books:

1. Data Base System Concepts – Silberschatz, Korth and Sudharshan, 5th Edition, Mc-GrawHill, 2006
2. An Introduction to Database Systems – C.J. Date, A. Kannan, S.Swamynatham, 8th Edition, Pearson Education, 2006.

Course outcomes

At the end of the course the student should be able to

CO 1. Design an ER model for a given example from real world description
CO 2. Design relational models using schema definition and constraints.
(Design ER to relational mapping for a given application)
CO 3.Develop complex queries using SQL to retrieve the required information from database.
CO 4.Apply suitable normal forms to normalize the given database.
CO 5. Determine the roles of concurrency control and recovery techniques in database design.
CO 6. Develop a Data base application.

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	3	1					2		2	2	3	2	3
CO 2	3	2	3	1					2		2		3	2	3
CO 3	3	3	3		2				2		2	2	3	2	3
CO 4	2	2	2						2		2		3	2	2
CO 5	2	1	1										2	1	2
CO 6	3	3	3	3	3						2		3	3	

Course Title: Communication Networks-1			
Course Code: P15IS52	**Semester : V**	**L- T – P - H : 3 – 2– 0 -5**	**Credit : 4**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequisites: Operating System and Computer Organization

Course learning objectives(CLOs)

This course aims to

1. Understand the Data communication system, Networks and Internet.
2. Understand and recognize the OSI model and TCP/IP model, and also explain the layers in each model.
3. Identify the periodic analog signals and nonperiodic digital signals.
4. Discuss the digital-to-digital conversion, digital-to-analog conversion, analog-to-analog conversion and analog-to-digital conversion techniques.
5. Identify the different types of guided media and unguided media.
6. Identify the different error detection and correction techniques handled by Data link layer.
7. Discuss the taxonomy of protocols.
8. Compare High-level Data Link Control protocol and Point-to-Point protocol.
9. Identify the different multiple access techniques and also discuss the internet.
10. Discuss the wireless LANs, connecting LANs, backbone networks and virtual LANs.

Course Content

Unit-I

Overview Of Networks And Physical Layer

Introduction: Data Communications; Networks; The Internet; Layered tasks; The OSI Model and the layers in the OSI model; TCP / IP Protocol Suite; Addressing; **Physical Layer:** Analog and digital signals; periodic analog signals - sine wave, phase, wavelength, time and frequency domain, bandwidth; Digital signals; Transmission impairment; Data rate limits; Performance.

11 Hours

Unit -II

Physical Layer Continued

Digital Transmission and Analog Transmission: Digital-to-Digital conversion; Analog-to-Digital conversion; Transmission modes; Digital-to-Analog conversion; Analog-to-Analog conversion; **Transmission media:** Guided Media: Twisted pair cable, Coaxial cable, Fiber-Optic cable; Unguided media: Radio waves, Microwaves, Infrared waves**.** **11 Hours**

Unit -III

Data Link Layer – 1

Error Detection and Correction: Introduction; Block coding; Linear block codes; Cyclic codes - CRC, polynomials; Checksum; **Data Link Control:** Framing; Flow and Error control; Protocols; Noiseless channels; Noisy channels. **10 Hours**

Unit -IV

Data Link Layer – 2

Data Link Control: HDLC; Point-to-point Protocol - framing, transition phases, Multiplexing, Multilink PPP; **Multiple Access:** Random Access; Controlled Access; Channelization. **Wired LANs:** Ethernet: IEEE standards; Standard Ethernet; Fast Ethernet, Gigabit Ethernet. **10 Hours**

Unit –V

Data Link Layer – 3

Wireless LANs: IEE 802.11: Architecture, MAC Sub layer, Addressing Mechanism; Bluetooth: Architecture, Bluetooth layer, Radio layer, Base band layer; **Connecting LANs:** Connecting devices, Backbone Networks, Virtual LANs. **10 Hours**

Text Book :

1. Behrouz A. Forouzan: Data Communications and Networking, 5th Edition, Tata McGraw-Hill, 2013.

Reference Books :

1. Alberto Leon-Garcia and IndraWidjaja: Communication Networks - Fundamental Concepts and Key architectures, 3rd Edition, Tata McGraw- Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

Course outcomes

At the end of the course the student should be able to

CO 1. Describe the OSI model and TCP/IP model, and also explain the layers in each model.
CO 2. Apply digital transmission techniques to transmit the data digitally.
CO 3. Determine the better error detection and correction technique.
CO 4. Analyze the data link control and media access control related to data link layer.
CO 5. Identify the different wireless LANs and connecting devices.

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	2												2	2
CO 2	2	2	2											3	2
CO 3	2	2	2	2										3	2
CO 4	2	2	2											3	2
CO 5	2	2	2											3	2

Course Title: C# Programming & .Net			
Course Code: P15IS53	**Semester : V**	**L- T – P -H: 4 – 0 – 0 - 4**	**Credit : 4**
Contact period : Lecture: 52 Hrs, Exam:3 hrs		**Weightage: CIE: 50, SEE:50**	
Prerequisites : Object Oriented Programming with Java			

Course Learning Objectives (CLOs)

This course aims to

1. Identify the basic building blocks of .NET.
2. Provide the fundamental concepts of object oriented programming.
3. Implement C# programming and .NET features.
4. Build C# Applications with and without using VS .NET IDE.
5. Design the C# applications to solve real world problems.
6. Analyze the real world problems to solve using object-oriented approach.
7. Learn exception handling and life time of the objects in C#.
8. Understand Interfaces and Collections in C#.
9. Understand .NET Assemblies and Building an Assembly.
10. Implement the advanced concepts of C# programming.

Course Content

Unit - I

The Philosophy of .Net: Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR, CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), The Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform – Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime, A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime.

Building C# Applications: The Role of the Command Line Complier (csc.exe), Building C # Application using csc.exe, Working with csc.exe Response Files,
Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe), Using the Visual Studio .NET IDE, Other Key Aspects of the VS.NET IDE, C# "Preprocessor:" Directives, An Interesting Aside: The System Environment Class. **10 Hours**

Unit - II

C# Language Fundamentals: The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System.Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces.

Object- Oriented Programming With C# - 1: Forms Defining of the C# Class, Definition the "Default Public Interface" of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields. **11 Hours**

Unit - III

Object- Oriented Programming With C# - 2: The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The "Protected" Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between.

Exceptions And Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handing, The System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System. System Exception), Custom Application- Level Exception (System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of "new', The Basics of Garbage Collection, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

Interfaces: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (IEnumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (I Comparable)

11 Hours

Unit - IV

Collections: Exploring the System.Collections Namespace, Building a Custom Container (Retrofitting the Cars Type).

Callback interfaces, delegates, events, and Advanced techniques - 1: Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using) Events., The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer. Using C# Indexer from VB .NET, Overloading operators, The Internal Representation of Overloading Operators, Interacting with Overload Operator from Overloaded- Operator- Challenged Languages. **10 Hours**

Unit - V

ADVANCED TECHNIQUES - 2: Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines.

UNDERSTANDING .NET ASSEMBLES: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly, Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly. **10 Hours**

Text Books:

1. Andrew Troelsen: Pro C# with .NET 3.0, Special Edition, Dream tech Press, India, 2007.
Chapters: 1 to 11 (Upto pp.369).
2. Andrew Troelsen, Phil Japikse: C# 6.0 and the .NET 4.6 Framework, 7th Edition, Apress, 2016
3. E Balaguruswamy: Programming in C#, 3rd edition, Tata McGraw Hill, Reprint 2014.

References:

1. Tom Archer: Inside C#, WP Publishers, 2007.
2. Herbert Schildt: C# The Complete Reference, Tata McGraw Hill.

Course Outcomes

After learning all the units of the course, the student is able to

1. Solve simple problems using C# Language either by using Visual Studio .NET development tool or by using Microsoft .NET SDK.
2. Develop C# programs with well understanding of C# language constructs.
3. Apply exception handling and garbage collection concepts to improve application performance and memory leaks.
4. Design and implement additional features like Callback interfaces, delegates, events, and advanced techniques in C#.
5. Design .NET assemblies for a given problem.

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2		2		3								1		2
CO 2	2		2		3								1	1	2
CO 3	3		2		3									1	3
CO 4	3		2		3								1	1	3
CO 5	3		2		3								1		3

Course Title: Software Engineering			
Course Code: P15IS54	**Semester : V**	**L- T – P - H : 4 – 0 – 0 - 4**	**Credit : 4**
Contact period : Lecture: 52 Hrs, Exam:3 hrs		**Weightage: CIE: 50;SEE:50**	

Course learning objectives

This course aims to

1. Study a body of knowledge relating to Software Engineering, Software reengineering, and maintenance.
2. Understand the principles of large scale software systems, and the processes that are used to build them.
3. Use tools and techniques for producing application software solutions from informal and semi-formal problem specifications;
4. Acquire and develop many valuable skills such as the ability to use computer aided software
5. Evaluate requirements for a software system
6. Apply the process of analysis and design using object oriented approach.
7. Communicate to others the progress of the system development and the contents of the design by means of reports and presentations.
8. Recognize current trends in the area of software engineering
9. Identify the processes, techniques and deliverables that are associated with requirement engineering including system requirement and system modeling

10. Identify the importance of testing in assuring the quality of software with an understanding of managing risks during the progress of the project.

Course contents

Unit-I

Overview, and Requirements

Introduction: FAQ's about software engineering, Professional and ethical responsibility; software process models, process iteration, software specification, software design and implementation, software validation, software evaluation; Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; the software requirements document; requirements engineering processes: feasibility studies, requirements elicitation and analysis, requirement validation and management; system models: context models, behavioral model, data models, object models, CASE workbenches; software prototyping: prototyping in the software process, rapid prototyping techniques, user interface prototyping. **12 Hours**

Unit-II

Software Design

Architectural Design: system structuring, control models, modular decomposition, domain-specific architectures; object oriented design: Objects and Object Classes, An Object-Oriented design process; Design evolution; user interface design: user interface design principles, user interactions, information presentation, user support, interface evolution. **10 Hours**

Unit-III

Critical System, Verification and Validation

Dependability: critical systems, availability and reliability, safety, security; critical system specification: software reliability specification, safety specification, security specification; critical system development: fault tolerance, fault tolerant architectures safe system design; verification and validation: Verification and Validation: Planning; Software inspections; Automated static analysis, clean room software development; software testing: defect testing, integration testing, object oriented testing, testing workbenches. **10 Hours**

Unit-IV

Management

Managing People: limits to thinking, group working, choosing and keeping people, the people capability maturity model; software cost estimation: productivity, estimation techniques, algorithmic cost modeling, project duration and staffing; quality management: quality assurance and standards, quality planning, quality control, software measurement and metrics; process improvement: process and product quality, process analysis and modeling, process measurement, the SEI process capability maturity model. **10 Hours**

Unit- V

Evolution

Legacy Systems: legacy system structures, legacy system design, legacy system assessment; software change: program evolution dynamics, software maintenance, architectural evolution; software Re-engineering: source code translation, reverse engineering, program structure improvement, program modularization, data re-engineering. **10 Hours**

Text book:

1. Software Engineering – Ian Somerville, 8th Edition, Pearson Education, 2007.

Reference books :

1. Software Engineering: A Practitioners Approach - Roger S. Pressman, 7th Edition,McGraw-Hill, 2007.

2. Software Engineering Theory and Practice - Shari Lawrence Pfleeger, Joanne M. Atlee, 3rd Edition, Pearson Education, 2006.
3. Software Engineering Principles and Practice – Waman S Jawadekar, Tata McGraw Hill, 2004
4. Software Engineering – Pankaj Jalote, Tata Mc Graw Hill.

Course outcomes

After learning all the units of the course, the student is able to

CO 1. Demonstrate an understanding of the principles and techniques of Software Engineering
CO2. Analyze the various steps involved in the design process and the different design approaches which include function-oriented design and object-oriented design
CO3. Understand the activities in project management, requirement engineering process and to identify the different types of system models
CO4. Apply the knowledge of design engineering in software development
CO5. Provide an understanding of the principles of software engineering in a broader system context and the notions of software engineering process and management.

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	1	2			1	1						1	1	1
CO 2	2		2			1							1		1
CO 3	2	1									2				1
CO 4	2		2										1		1
CO 5	1	1						1			1		1		1

Course Title: C# Programming & .Net Lab			
Course Code: P15ISL57	**Semester : V**	**L- T – P - H : 0 – 1 –2 - 3**	**Credit: 1.5**
Contact period : Lecture: 39 Hrs, Exam:3 hrs		**Weightage: CIE: 50;SEE:50**	

Prerequisites : C# and .NET (P15IS53)

Course Outcomes

The student is able to

1. Create configuration for a given machine to host the .NET runtime.
2. Develop and debug C# programs with well understanding of C# language constructs either by using VS .NET IDE or Microsoft .NET SDK.
3. Develop and use .NET assemblies.

Contents

1 a) Write a C# program to check whether a number is Palindrome or not.

b) Write a C# program to demonstrate command line arguments processing.

2 a) Write a C# program to find the roots of a Quadratic Equation.

b) Write a C# program to demonstrate Boxing and unBoxing.

3 a) Write a C# program to implement Stack of integers.

b) Write a C# program to demonstrate Operator overloading.

4 a) Write a C# program to find the second largest element in a single dimensional array.

b) Write a C# program to multiply two matrices using Rectangular arrays.

5 a) Write a C# program to find the sum of all the elements present in a jagged array of 3 inner arrays.

b) Design a simple calculator using *switch* statement in C#.

6 a) Demonstrate the use of *virtual* and *override* keyword in C# with a simple Program.

b) Implement Linked Lists in C# using the existing collections name space.

7 a) Write a C# program to demonstrate *abstract* class and *abstract* methods.

b) Write a C# program to build a *class* which implements an existing *interface.*

8 a) Write a C# program to illustrate the use of different properties.

b) Demonstrate arrays of interface types with a C# program.

9 a) Write a C# program to illustrate the creation of a *dll* file and then using it in a program.

b) Write a C# program to illustrate declaring, instantiating, and using a delegate.

Note:

1) In SEE, student has to execute any ***ONE*** full program out of ***NINE*** programs compulsorily.
2) In case of every program, sub-program *a)* has to be executed without using VS .NET IDE and sub-program *b)* has to be executed using VS .NET IDE.

Course Outcomes

After learning all the programs of the course, the student is able to

CO 1. Create configuration for a given machine to host the .NET runtime.

CO 2. Develop and debug C# programs with well understanding of C# language constructs either by using VS .NET IDE or Microsoft .NET SDK.

CO 3. Develop and use .NET assemblies

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	1				1				1						
CO 2	2		2		2				1				1	1	1
CO 3	2		2		2				1				1	1	1

Course Title: Data Base Application Lab			
Course Code: P15ISL58	**Semester : V**	**L- T – P:H : 0- 1- 2 - 3**	**Credit:1.5**
Contact period : **39 Hrs Exam : 3Hrs**		**Weightage**: **CIE:50;SEE:50**	

Prerequisites: Know about SQL, ORACLE and VISUAL BASIC languages

Course learning objectives(CLOs)

This course aims to

1. Provide a strong formal foundation in database concepts, technology and practice to the students.
2. Familiarize the students with the database environments towards an information-oriented data-processing oriented framework.
3. Understand the relational data model and to introduction to systematic database design approaches covering conceptual design, logical design
4. Present the concepts and techniques relating to query processing by SQL engines
5. Develop a database application using any of the commercial application product (DB2, Visual Basic,

PART-A

1. **Consider the Insurance database given below. The primary keys are underlined and the data types are specified:**

PERSON (driver – id #: String, name: string, address: string) CAR (regno: string, model: string, year: int)
ACCIDENT (report-number: int, accd-date: date, location: string)
OWNS (driver-id #:string, Regno:string)
PARTICIPATED (driver-id: string, Regno:string, report-number:int, damage amount:int)

a) Create the above tables by properly specifying the primary keys and the foreign keys.
b) Enter at least five tuples for each relation.
c) Demonstrate how you
   i. Update the damage amount to 25000 for the car with a specific regno in the ACCIDENT table with report number 12.
   ii. Add a new accident to the database.
d) Find the total number of people who owned cars that were involved in accidents in 2008
e) Find the number of accidents in which cars belonging to a specific model were involved.
f) Generate suitable reports.
g) Create suitable front end for querying and displaying the results.

2. **Consider the following relations for an order processing database application in a company**

CUSTOMER (cust #: int , cname: string, city: string)
ORDER (order #: int, odate: date, cust #: int, ord-Amt: int)
ORDER – ITEM (order #: int, item #: int, qty: int)
ITEM (item # : int, unit price: int)
SHIPMENT (order #:int,warehouse#: int, ship-date:date)
WAREHOUSE (warehouse #: int, city: string)

a) Create the above tables by properly specifying the primary keys and the foreign keys
b) Enter at least five tuples for each relation.

c) Produce a listing CUSTNAME ,#ofOrders , AVG_ORDER_AMT, where the middle column is the total numbers of orders by the customer and the last column is the average order amount for that customer.
d) List the order# for orders that were shipped from *all* the warehouses that the company has in a specific city.
e) Demonstrate the deletion of an item from the ITEM table and demonstrate a method of handling the rows in the ORDER_ITEM table that contain this particular item.
f) Generate suitable reports.
g) Create suitable front end for querying and displaying the results.

3. Consider the following database of student enrollment in courses & books adopted for each course:

STUDENT(regno: string, name: string, major: string, bdate:date)
COURSE (course #:int, cname:string, dept:string)
ENROLL (regno:string, course#:int, sem:int, marks:int)
BOOK _ ADOPTION (course# :int, sem:int, book-ISBN:int)
TEXT(book-ISBN:int,book-title:string,publisher:string, author:string)

a) Create the above tables by properly specifying the primary keys and the foreign keys.
b) Enter at least five tuples for each relation.
c) Demonstrate how you add a new text book to the database and make this book be adopted by some department.
d) Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the 'CS' department that use more than two books.
e) List any department that has *all* its adopted books published by a specific publisher.
f) Generate suitable reports.
g) Create suitable front end for querying and displaying the results.

4. The following tables are maintained by a book dealer:

AUTHOR (author-id:int, name:string, city:string, country:string)
PUBLISHER (publisher-id:int, name:string, city:string, country:string)
CATALOG (book-id:int, title:string, author-id:int, publisher-id:int, category-id:int, year:int, price:int)
CATEGORY (category-id:int, description:string)
ORDER-DETAILS (order-no:int, book-id:int, quantity:int)

a) Create the above tables by properly specifying the primary keys and the foreign keys.
b) Enter at least five tuples for each relation.
c) Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
d) Find the author of the book which has maximum sales.
e) Demonstrate how you increase the price of books published by a specific publisher by 10%.
f) Generate suitable reports.
g) Create suitable front end for querying and displaying the results.

5. Consider the following database for a banking enterprise:

BRANCH(branch-name:string,branch-city:string,assets:real)
ACCOUNT(accno:int,branch-name:string,balance:real)
DEPOSITOR(customer-name:string, accno:int)
CUSTOMER(customer-name:string, customer-street:string, customer- city:string)
LOAN(loan-number:int, branch-name:string, amount:real) BORROWER(customer-ame:string, loan-number:int)

a) Create the above tables by properly specifying the primary keys and the foreign keys
b) Enter at least five tuples for each relation
c) Find all the customers who have at least two accounts at the Main branch.
d) Find all the customers who have an account at all the branches located in a specific city.
e) Demonstrate how you delete tuples in ACCOUNT relation at every branch located in a specific city.
f) Generate suitable reports.
g) Create suitable front end for querying and displaying the results.

PART – B

Implement the any project compulsory using DBMS Concepts with suitable front end design

Course Outcomes

After learning all the programs of the course, the student is able to

CO 1: For a Specified Database create the tables by properly specifying the primary keys and the foreign keys.
CO 2: Perform update, alter operations and Create suitable front end for querying and displaying the results.
CO 3: Solve Query for a given Database.
CO 4: understand concept of generating suitable reports.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	1			2				2						2	
CO 2		2							1					1	
CO 3			1		1					1		2		2	
CO 4		2													

Course Title : Aptitude and Reasoning Development - Advanced (ARDA)		
Course Code : P15HU510	**Semester : 5**	**L : T : P : H : 0 : 0 : 2 :2**
Contact Period: Lecture: 32 Hr, Exam: 3 Hr		**Weightage: CIE:50;% SEE:50%**
Prerequisites: Vocabulary builder, Concept of Percentage.		

Course Learning Objectives (CLOs)

This course aims to

1. Describe the importance of reading with comprehension.
2. Explain seven dimensions approach to better reading skills.
3. Explain the purpose, plan and the ways to identify specific details in a paragraph for better comprehension.
4. Formulate easier ways to solve problems of averages.
5. Explain the Application of the technique of alligation while solving weighted average and mixture problems.
6. Describe the concepts of profit, loss, discount, Marked price.
7. Explain the application of percentage in our daily life.
8. Discover different ways to identify the progressions and to compare between AP< GP and HP.
9. Explain the basic concepts in calculating simple interest and compound interest.
10. Differentiate between simple interest and compound interest and describes the importance of compound interest and its behaviour.

Course Content

Unit – I

Reading Comprehension:

Introduction: Read more and more, The process of writing and its relevance to the process of writing, how reading skills are important for aspects other than the reading comprehension questions, the daily reading scheme.

Seven dimension approach to better reading skills:

Developing the ability of understanding vocabulary in context, Ability to identify and understand main ideas, Ability to predict and identify supporting details, Understanding the use of transition and idea organization patterns, Inferences, Identifying purpose and tone, Recognizing and evaluating arguments and their common structures.

Theory of reading comprehension:

Solving RC passages is an exact science, tackling RC on the basis of evaluation of support, All passages have a topic, purpose and a plan, Other things to pick up while reading the passage– The tonality and other software related the author's viewpoint in the passage, specific details and their use in the passage, Types of questions asked in reading comprehension passage. **10 Hours**

Unit – II

Averages and Alligations mixtures:

Average: relevance of average, meaning of average, properties of average, deviation method, concept of weighted average. **Alligation method:** situation where allegation technique, general representation of alligations, the straight line approach, application of weighted average and alligation method in problems involving mixtures. Application of alligation on situation other than mixtures problems.

6 Hours

Unit – III

Profit and Loss: percentage change, original 100 concept effect of percentage increase or decrease in number, effect of successive percentage change, amount of change, comparison of two numbers through percentage and ratio, return to original concept, net percentage change to keep product fixed. Definition of basic terms— cost price, selling price, profit percentage, discount and marked price, solving problems using n/d method, techniques to tackle from standard set of problems, the concept of mark up. Concept of partnership and problems involving partnership. **6 Hours**

Unit IV

Progression:

Arithmetic Progression: sum of given number of terms in an A.P., arithmetic mean, to insert a given number of arithmetic means between two given quantities, nth term of an A.P., finding common difference of an A.P. given 2 terms of an A.P., types of A.P.s– increasing A.P.s and decreasing A.P. s

Geometric: to find, the geometric mean between two given quantities, to insert a given number of geometric means between two given quantities, sum of a number of terms in a G.P. Types of G.P.s— increasing G. P. s type one and two , decreasing G. P. s type one and two.

Harmonic Progression: to find the harmonic mean between two given quantities, theorems related with progressions, solved examples Sample Company questions **6 Hours**

Unit V

Simple Interest and Compound Interest

Concept of time value of money, Terminology pertaining to interest, Relation among Principal, Time, Rate percent per annum and total interest. Compound interest, Depreciation of value, Population, Application of interest in D.I.– The difference between simple annual growth rate and compound annual growth rate. **4 Hours**

Reference books:

1. The Trachtenberg speed system of basic mathematics, published by Rupa publications.
2. CAT Mathematics by AbhijithGuha. published by PHI learning private limited.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal , published by S. Chand private limited.
5. Quantitative aptitude for CAT by Arun Sharma, published by McGraw Hill publication.

Course Outcomes (CO)

After learning all the units of the course, the student is able to:

1. Apply the approach of seven dimension to better reading skills. L2
2. Solve the questions under reading comprehension confidently with higher accuracy than random reading. L4
3. Apply the technique of alligation for effective problem solving. L2
4. Interpret the requirement of different methods of calculating average and apply the right method at right scenario. L4
5. Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest. L5
6. Formulate the equations for summation and other functions for all the kinds of progressions– AP, GP and HP. L1

A. Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply the approach of seven dimension to better reading skills.	L2	-	-	-	-	-	-	-	-	M	-	-	-	-	-
Solve the questions under reading comprehension confidently with higher accuracy than random reading.	L4	-	-	-	-	-	-	M	-	M	-	-	-	-	-
Apply the technique of alligation for effective problem solving.	L2	H	-	-	-	-	-	-	-	-	-	-	-	-	-
Interpret the requirement of different methods of calculating average and apply the right method at right scenario.	L4	M	-	-	-	-	-	-	-	M	-	-	-	-	-
Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest.	L5	H	-	-	-	-	-	-	-	M	-	-	-	-	-

L- Low, M- Moderate, H-High

B. Course Assessment Matrix (CaM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply the approach of seven dimension to better reading skills.	L2	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Solve the questions under reading comprehension confidently with higher accuracy than random reading.	L4	-	-	-	-	-	-	2	-	2	-	-	-	-	-
Apply the technique of alligation for effective problem solving.	L2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Interpret the requirement of different methods of calculating average and apply the right method at right scenario.	L4	2	-	-	-	-	-	-	-	2	-	-	-	-	-
Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest.	L5	3	-	-	-	-	-	-	-	2	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

FOUNDATION ELECTIVE

Course Title : Unix System Programming			
Course Code : P15IS551	**Semester : V**	**L :T: P:H : 3-0-2-5**	**Credit:3**
Contact Period: Lecture: 52 Hr, Exam: 3 Hr		**Weightage: CIE:50; SEE:50**	

Prerequisites:

Basic information about Operating System.

Course Learning Objectives (CLOs)

This course aims to:

1. Learn the main concepts of the UNIX Operating System.
2. Familiar with the UNIX kernel structure and system calls.
3. Understand the basic UNIX commands and utilities are described in detail as are the command line wildcard and redirection facilities.
4. Learn how to write a shell program or shell script.
5. Understand how to manipulate system resources such as files, processes and system information.

Course Content

Unit I

Background and Basic Commands

Brief history, Salient features of a UNIX System, The UNIX Architecture, Internal and External Commands, Command structure, man: Browsing and Manual Pages On-line, cal: The Calendar, date: Displaying and System Date, echo: Displaying a Message, printf: An Alternative to echo, bc: The Calculator, script: Recording Your Session, passwd: Changing Your Password, who, uname: Knowing Your Machine's Characteristics, tty: Knowing Your Terminal, stty: Displaying and Setting Terminal Characteristics.

File systems: The File, The Parent-Child Relationship, The HOME Variable: The Home Directory, pwd: Checking Your Current Directory, cd: Changing the Current Directory, mkdir: Making Directories, rmdir: Removing Directories, Absolute Pathnames, Relative Pathnames, ls: Listing Directory Contents, The UNIX File System.

File handling Commands

cat: Displaying and Creating Files, cp: Copying a File, rm: Deleting Files, mv: Renaming Files, The lp Subsystem: Printing a File, file: Knowing the File Types, wc: Counting Lines, Words and Characters, od: Displaying Data in Octal, cmp: Comparing Two Files, comm command, diff command.

10 Hours

Unit II

FILE Attributes

ls -l: Listing File Attributes, The -d Option: Listing Directory Attributes, File Ownership, File Permissions, chmod: Changing File Permissions, Directory Permissions, Changing File Ownership,File Systems and Inodes, Hard Links, Symbolic Links and ln, umask: Default File and Directory Permissions, Modification and Access Times, find: Locating Files, Converting One File to Other, Compressing Files, gzip, gunzip, tar command.

The Process

Process Basics, ps: Process Status, System Processes, Mechanism of Process Creation, Internal and External Commands, Running Jobs in Background, nice: Job Execution With Low Priority, Killing Processes with Signals, Job Control, at and batch: Execute Later, cron: Running Jobs Periodically, time: Timing Processes.

Simple Filters

The Sample Database, pr: Paginating Files, head: Displaying the Beginning of a File, tail: Displaying the End of a File, cut: Slitting a File Vertically, paste: Pasting Files, sort: Ordering a File, uniq: Locate Repeated and Non repeated Lines, tr: Translating Characters, An Example: Displaying a Word-count List, grep: Searching for a pattern. **11 Hours**

Unit III

SHELL Programming: The Shell's Interpretive Cycle, Pattern Matching The Wild-cards, Escaping and Quoting, Redirection: The Three Standard Files, /dev/null and /dev/tty: Two Special Files, Pipes, tee: Creating a Tee, Command Substitution, Shell Variables, Environment Variables, Aliases (bash and ksh), Command History (bash and ksh). Shell Scripts, read and read-only commands, Using Command Line Arguments, exit and Exit Status of Command, The Logical Operators && and || -Conditional Execution, The if Conditional, Using test and [ ] to Evaluate Expressions, The case Conditional, expr: Computation and String Handling, $0: Calling a Script by Different names, while: Looping, for: Looping with a List, set and shift: Manipulating the Positional Parameters, The here Document (<<), trap: Interrupting a Program, Debugging Shell Scripts with set -x, eval: Evaluating Twice. **10 Hours**

Unit IV

Introduction to Unix System Program: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.

UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs. **11 Hours**

Unit V

UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

Process Control : Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups.

10 Hours

Text Books:

1. UNIX Concepts and Applications by Sumitabha Das, 4 edition, Tata McGraw Hill, 2014.
2. Terrence Chan: UNIX System Programming Using C++, First edition, Prentice Hall India, 2011.
3. W. Richard Stevens: Advanced Programming in the UNIX Environment, Second Edition, Pearson education, 2011

Reference Books:

1. UNIX Operating System, fifth edition**,** Jerry Peek , Pearson education.
2. UNIX and Shell Programming, Behrouz A. Forouzan and Richard F.Gilberg, Thomson, 2011.
3. Unix & Shell Programming, M.G. Venkatesh murthy, Pearson Education, 2011.

Course Outcomes

After learning all the units of the course, the student is able to

1. Describe the architecture and features of UNIX Operating System and distinguish it from other Operating System Demonstrate UNIX commands for file handling and process control L2, L3
2. Write Regular expressions for pattern matching and apply them to various filters for a specific task. L3

3. Analyze a given problem and apply requisite facets of SHELL programming in order to devise a SHELL script to solve the problem. L4, L3
4. Implement the required visual and functional features using the appropriate technologies.
5. Apply UNIX commands to solve common problems.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2			2											
CO 2	1			2					2			2		1	2
CO 3	2			2					2			1		2	
CO 4			1	1	1		2					2			2
CO 5		2		2						1	1	2			2

Course Title: Introduction to Data Science			
Course Code: P15IS552	**Semester : V**	**L- T – P-H : 3 – 0 – 2 – 5**	**Credit:3**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Course learning objectives

This course aims to

1. Describe what Data Science is and the skill sets needed to be a data scientist.
2. Identify probability distributions commonly used as foundations for statistical modeling.
3. Use R to carry out basic statistical modeling and analysis.
4. Explain the significance of exploratory data analysis (EDA) in data science.
5. Describe the Data Science Process and how its components interact.
6. Use APIs and other tools to scrap the Web and collect data.
7. Explain basic machine learning algorithms (Linear Regression, k-Nearest Neighbors (k-NN), k-means, Naive Bayes) for predictive modeling.
8. Describe common approaches used for Feature Generation and for Feature Selection.
9. Explain fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine.
10. Create effective visualization of given data.

Course contents

Unit - I

Introduction: What is Data Science? Big Data and Data Science hype - and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets needed.

Statistical Inference - Populations and samples, Statistical modeling, probability distributions, fitting a model, Intro to R. **10 Hours**

Unit - II

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm).

Three Basic Machine Learning Algorithms - Linear Regression, k-Nearest Neighbors (k-NN), k-means.

10 Hours

Unit - III

One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web.

Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention, Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms, Filters; Wrappers; Decision Trees; Random Forests.

11 Hours

Unit - IV

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.

Mining Social-Network Graphs - Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs.

11 Hours

Unit - V

Data Visualization - Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects, Exercise: create your own visualization of a complex dataset.

Data Science and Ethical Issues - Discussions on privacy, security, ethics, A look back at Data Science, Next-generation data scientists. **10 Hours**

Text Book:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.

Reference Books:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014.
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.

Course outcomes

After learning all the units of the course, the student is able to

CO 1. Fit a model to data.
CO 2. Apply basic tools (plots, graphs, summary statistics) to carry out EDA. Identify Machine Learning Algorithms and to use in applications.
CO 3. Use APIs and other tools to scrap the Web and collect data. Identify basic Feature Generation and Feature Selection algorithms and to use in applications.
CO 4. Build own recommendation system.
CO 5. Create effective visualization of given data (to communicate or persuade).

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	1	1		1										1
CO 2	2	1	1		2										1
CO 3	2	1	1		2										1
CO 4	2	1	2		2										2
CO 5	1	1	2		2										2

Course title: Python Programming			
Course Code:P15IS553	**Semester: V**	**L-T-P-H : 3-0-2-5**	**Credit :3**
Contact Period: Lecture:52 Hrs, Exam:3Hrs		**Weightage: CIE:50%, SEE:50%**	

Prerequisites

Students should have some basic knowledge of object oriented programming

Course Learning Objectives (CLOs)

This course aims to

1. Understand how to use variables in python and differentiate between references and objects
2. Design python scripts to solve problems and manage the flow of control through it
3. Create a list and access their elements and Analyzethe difference between lists and tuples
4. Discuss the fundamental concepts of OOP and Evaluate how to read and write text and binary files
5. Discuss how polymorphism is implemented in python and Define the several kind of relationship between classes

Course Content

Unit – I

Introduction: Python programming language, The first program. **Variables, expressions and statements:** Variables, expressions and statements: Values and types, Variables, Variable names and keywords, Operators and operands, Expressions and statements, Interactive mode and script mode, Order of operations, String operations, Comments. **Functions:** Function calls, Type conversion functions, Math functions, Composition, adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Variables and parameters are local, stack diagrams, Fruitful functions and void functions. **Case study**: interface design **10Hours**

Unit –II

Conditionals and recursion: Modulus operator, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Stack diagrams for recursive functions, Infinite recursion, Keyboard input. **Fruitful functions:** Return values, Incremental development, Composition, Boolean functions, more recursion, Fibonacci example, Checking types. **Iteration:** Multiple assignment, Updating variables, the while statement, Simple repetition (using for

loop)**Strings:** Introduction, function: len, Traversal with a while/for loop, String slices, Strings are immutable, Searching, Looping and counting, String methods, The in operator, String comparison. **Case study**: word play. **11 Hours**

Unit – III

Lists: Introduction, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map, filter and reduce, Deleting elements, Lists and strings, Objects and values. **Dictionaries:** Introduction, Dictionary as a set of counters, Looping and dictionaries, Reverse lookup, Dictionaries and lists, Memos, Global variables, Long integers **Tuples:** Introduction: Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples **Case study**: data structure selection **10Hours**

Unit – IV

Files: Persistence, Reading and writing, Format operator, Filenames and paths, Catching exceptions, Databases, Pickling **Classes and objects:** User-defined types, Attributes, Example: Rectangle, Instances as return values, Objects are mutable, Copying. **11 Hours**

Unit – V

Classes and functions: Time example, Pure functions, Modifiers. **Classes and methods:** Object-oriented features, Printing objects, examples, The init method, The __str__ method, Operator overloading**. Inheritance**: Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams. **10Hours**

Text Book:

Think Python - How to Think Like a Computer Scientist**,** Allen Downey, Green Tea Press, 2nd Edition (2.0.17)

Reference Books:

1. Learning Python**,** Mark Lutz, O'Reilly Media, 5th Ed.
2. Learning Python : B Nagesh Rao, Cyberplus publication

Web Links:

1. **Official Python Documentation:** https://docs.python.org
2. **Full Stack Python:** https://www.fullstackpython.com/
3. **Think Python codebase:** http://thinkpython.com/code

Course Outcomes

On Successful Completion of the Course, the students will be able to:

CO 1. Explain and use elementary constructs in Python such as keywords, expressions and functions.
CO 2. Design simple Python programs using its control structures, iteration structures, functions and strings
CO 3. Discuss and Use Lists, Dictionaries and Tuples in Python for organizing and processing data In python programs
CO 4. Create and manipulate persistent files and databases and create user-defined classes using Python programs.
CO 5. Create user-defined classes, functions, methods and inheritance in Python, instantiate and use them in programs.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2				1										
CO 2	2	2	1												1
CO 3	2	2	2	1											1
CO 4	3	2	2										3		
CO 5	3	2	2	1											1

Course Title : System software			
Course Code : P15IS554	**Semester : V**	**L - T – P-H : 3 - 0 - 2 -5**	**Credit : 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50; SEE:50**	

Prerequisites:

- Assembly language programming
- Data Structure and algorithms
- Basics of computer organization

Course Learning Objectives (CLOs)

This course aims to

1. Understand the basic machine architecture
2. Design various system software's
3. Know the working principle of assemblers, linkers and loaders.
4. Analyze the working principle of macro processor
5. Understand the application of lex and yacc tools for developing lexical analyzers and parsers

Course Content

Unit - I

Machine Architecture:

Introduction to System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples.

CISC machines, RISC machines, comparison of CISC and RISC **9 Hours**

Unit-II

Assemblers:

Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation. Machine Independent Assembler Features - Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Options - One- Pass assembler, Multi-Pass Assembler. **12 Hours**

Unit-III

Loaders and Linkers:

Basic Loader Functions - Design of an Absolute - Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader , Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linking. **10 Hours**

Unit-IV

Microprocessor

Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine- Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters Macro processor Design Options – Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor. **11 Hours**

Unit-V

LEX:

Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand- Written Lexers, Examples of Regular Expressions

YACC : Using YACC - Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse; A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity.

10 Hours

Text Books :

1. System Software - an introduction to system programming Leland. L. Beck,D.Manjula 3rd Edition, reprinted in 2013.
2. John. R. Levine, Mason and Doug Brown:Lex and Yacc, O'Reilly, SPD, Reprint March 2005. chapters 1,2(page 27-42),3(page 51-65)

Reference Book:

1. System Programming and Operating Systems, D M Dhamdhere, TATA McGraw Hill, 2nd Edition.

Course Outcomes

On successful completion of the course the students will be able to

CO 1. Develop assembly level programs for the given machine architecture.
CO 2. Analyze the output of different passes of an assembler.
CO 3. Identify the data structures used in loaders & linkers.
CO 4. Analyze the output of macro processor.
CO 5. Apply LEX and YACC tools to identify tokens and check the syntax of given program.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	2	3										3	1	
CO 2	2	3											3		
CO 3	2	1	2										2		
CO 4	2	3											2		
CO 5	3												2	1	

ELECTIVE-1

Course title: Data Mining			
Course Code: P15IS561	**Semester: V**	**L-T-P-H : 4-0-0-4**	**Credit:3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites: Data Structures, DBMS and Graph Theory.

Course Learning Objectives(CLOs)

This course aims to

1. Explain fundamental concepts of ODS, Data warehouses, OLAP and data cube
2. Outline fundamental concepts of data mining and data pre-processing techniques
3. Analyze algorithms used in association analysis .
4. Compare and Contrast algorithms used in classification and clustering .
5. Summarize the concepts of Web Data Mining .

Course Content

Unit - I

Data Warehousing: Introduction, Operational Data Stores (ODS), Data Warehouses, Design issues, Guidelines for Data Warehouse Implementation, Data Warehouse metadata. Online Analytical Processing(OLAP): Introduction, Characteristics of OLAP systems, motivations for using OLAP, Multidimensional view and Data cube, Data cube implementations, Data cube operations, guidelines for Implementation of OLAP. **10 Hours**

Unit - II

Data Mining: Introduction, Motivating challenges, Origins of data mining, Data mining tasks, Types of data, Data quality, Data preprocessing, Measures of similarity and dissimilarity. **10 Hours**

Unit - III

Association Analysis: Problem definition, frequent itemset generation, Rule generation, Compact representation of frequent itemsets, Alternative method for generating frequent itemset, FP-growth algorithm. **11 Hours**

Unit - IV

Classification: Basics, General approach to solving a classification problem, Decision tree induction, Rule based classifier, Nearest Neighbor classifiers, Bayesian classifier, ANN classifier, SVM classifier.

11 Hours

Unit - V

Cluster analysis: Overview, K-means, Agglomerative Hierarchical clustering, DBSCAN, Web data Mining: Introduction, web mining, web terminology and characteristics, locality and hierarchy in the web, Web content mining, web usage mining, and web structure mining. **10 Hours**

Text Books:

1. Introduction to Data Mining – Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson education 2012.
2. Introduction to Data Mining with case studies – G K Guptha, PHI, 3rd edition 2014.

Reference Books:

1. Data Mining Techniques - Arun K Pujari, Universities press 2009.
2. Data mining concepts and techniques – Jiawei and Micheline Kamber, Morgan Kauffmann publisher. 3rd Edition 2011.

3. Discovering Knowledge in Data: An introduction to Data Mining, Daniel T. Larose, John Wiley, 2nd Edition, 2014

Course Outcomes

After learning all the units of the course, the student is able to,

CO 1. Analyze different data models used in data warehouse.
CO 2. Apply different preprocessing techniques for given data attributes.
CO 3. Analyze different association rules to determine frequent item set.
CO 4. Apply the different classification techniques.
CO 5. Identify different clustering techniques.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3											2		
CO2	3												3		1
CO3		3											2		1
CO4	2	2	3										2		1
CO5	1	1											2		

Course Title: Principles of Programming languages			
Course Code: P15IS562	**Semester : V**	**L- T – P-H :4-0-0-4**	**Credit :3**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequisites: Computer Programming, Formal Languages and Automata Theory

Course learning objectives(CLOs)

This course aims to:

1. Be familiar with the structure and design principles of programming languages.
2. Discuss the skills in analyzing and using the features of programming languages.
3. Recall the preliminary concepts like context-free grammar, Backus-Naur form, Parse trees.
4. Understand the data types of different programming languages.
5. Discuss various logic programming and functional programming languages features.
6. Understand the variable declarations in programming languages, in particular to binding, scope, and substitution of variables.
7. Introduce the power of Python scripting language

Course Content

Unit- I

Preliminary Concepts: Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms– Imperative, Object Oriented, functional Programming , Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments.

Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotational semantics and axiomatic semantics for common programming language features. **11 Hours**

Unit – II

Data types: Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization.

Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, and guarded commands. **11 Hours**

Unit – III

Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub-program names, design issues for functions user defined overloaded operators, co routines **10 Hours**

Unit – IV

Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, design issues, language examples, C++ parameterized ADT, object oriented programming in small talk, C++, Java, C#, Ada 95.

Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads.

Exception handling: Exceptions, exception Propagation, Exception handler in Ada, C++ and Java.

Logic Programming Language: Introduction and overview of logic programming, basic elements of prolog, application of logic programming **10 Hours**

UNIT – V

Functional Programming Languages: Introduction, fundamentals of FPL, LISP, ML, Haskell, application of Functional Programming Languages and comparison of functional and imperative Languages.

Scripting Language: Pragmatics, key concepts, case study: Python- values and types, variables, storage and control, bindings and scope, procedural abstraction, data abstraction, separate compilation, module library. **10 Hours**

Text books:

1. Robert .W. Sebesta, “Concepts of Programming Languages”, 10/e, Pearson Education. -2012

References:

1. B. Tucker, R. E. Noonan, “Programming languages”, 2e, TMH.
2. K. C. Louden, ”Programming Languages”, 2e, 2003.
3. Patric Henry Winston and Paul Horn,” LISP”, Pearson Education.
4. W. F. Clocksin, C. S. Melish, “Programming in Prolog”, 5e, Springer.

Course outcomes

After learning all the units of the course, the student is able to

CO 1. Elaborate the features of attribute grammars and draw parse trees.
CO 2. List out various data types in different programming languages.
CO 3. Tabulate different parameter passing techniques of different programming languages.
CO 4. Apply logic programming concepts by using PROLOG.
CO 5. Apply scripting languages in web design and real-time applications.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	1													
CO 2	3	3													
CO 3		2	1												
CO 4		1	1	1		1							2	2	
CO 5	1		1	1		2							2		

Course Title : Artificial Intelligence			
Course Code : P15IS563	**Semester : V**	**L :T:P:H : 4:0:0:4**	**Credits: 3**
Contact Period: Lecture: 52 Hr, Exam: 3 Hr	**Weightage: CIE:50; SEE:50**		

Prerequisites

The basic knowledge of Computer Science is mandatory. The knowledge of Mathematics, Languages, Science, Mechanical or Electrical engineering is a plus

Course Learning Objectives

This course aims to

1. Describe strong foundation of fundamental concepts in Artificial Intelligence.
2. Demonstrate basic exposition to the goals and methods of Artificial Intelligence.
3. Apply these techniques in applications which involve perception, reasoning and learning.
4. Analyze the problem to determine where it falls with respect to different issues.
5. Explain the inductive learning.

Course Content

Unit I

Intelligent Agents And Searching Methods

Artificial Intelligence: Introduction : What is AI; Foundations of Artificial Intelligence; History of Artificial Intelligence; The state of Art;

Intelligent Agents: Agent and Environments; Good Behavior; The Nature of Environments; The Structure of Agents;

Problem-solving: Problem-solving agent; searching for solution; Uniformed search strategies;

Informed Search and Exploration: Informed search strategies; Heuristic functions; Online Search agents and unknown environment;

Constraint Satisfaction problems: Constraint satisfaction problems; Backtracking search for CSPs;

Adversarial search: Games; optimal decisions in Games; Alpha-Beta pruning;

12 Hours

Unit II

Logic

Logical Agents: Knowledge-based agents**;** The wumpus world; Logic; propositional logic;
Reasoning patterns propositional logic; Effective propositional interference; Agent based on propositional logic;

First-Order Logic: Representation revisited; Syntax and semantics of first order logic; Knowledge engineering in first order logic;

Interference in First-Order Logic: Propositional verses first-order interference; Unification and lifting;

10 Hours

Unit III

Knowledge Representation And Planning

Knowledge Representation: Ontological engineering; Categories and object; Action, situations and events; Mental events and mental objects; The internet shopping world; Reasoning system for categories; Reasoning with default information; Truth maintenance system;

Planning: The planning problems; Planning with state-space search; Planning graphs; Planning with propositional logic . **10 Hours**

Unit IV

Uncertainty

Uncertainty: Acting under uncertainty; Interference using full joint distributions; Independence; Bayes's rile and its use;

Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantic of Bayesian networks; Efficient representation of conditional distribution; Exact interference in Bayesian network

10 Hours

Unit V

Learning

Learning: Forms of learning**;** Inductive learning; Learning decision tree; Ensemble learning; Computational learning theory **10 Hours**

Text Book:

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

References Books:

1. Elaine Rich, Kevin Knight, Shivashankar.B.Nair, "Artificial Intelligence", Tata Mc Graw Hill Publishing Company Limited. Third Edition, 2009.
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
3. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 2002.

Course Outcomes

After learning all the units of the course, the student is able to

CO 1. Analyze the modern view of AI as the study of agents that receive precepts from the environment and perform actions
CO 2. Demonstrate awareness of informed search and exploration methods
CO 3.Demonstrate about AI techniques for knowledge representation, planning and uncertainty management
CO 4. Develop knowledge of decision making and learning methods
CO 5. Implement the use of AI to solve English Communication problems.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2												1	1	1
CO 2	2	2												1	1
CO 3	2	2											1	1	1
CO 4	2	2	2										1	1	1
CO 5	2	2	2												1

Course title: Software Testing			
Course Code: P15ISIS564	**Semester: V**	**L-T-P-H:4-0-0-4**	**Credit:3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites: Software Engineering

Course Learning Objectives

This course aims to,

1. Define a software Testing, and understand its different methods of software testing and Ability to explains what a CFG is and how to construct one.-L1, L2
2. Understand the saturation effect, its impact on software reliability, and ways to overcome its shortcoming and Ability to apply equivalence partition technique for software testing. -L2, L3
3. Understand how boundary value analysis technique used for software testing and Recognize and distinguish basic terms Adequacy Coverage. -L2,L4
4. Understand practical uses and limitations of structural testing and Ability to analyses The data flow to build software testing models.-L2,L4
5. Understand the purpose of defining test adequacy criteria, and their limitation and Understand strategies for ordering construction and testing.-L2

Course Content

Unit I

BASICS OF SOFTWARE TESTING: Human Errors and Testing; Software Quality; Requirements, Behavior and Correctness; Correctness versus Reliability; Testing and Debugging; Test Metrics. Software and Hardware Testing; Testing and Verification; Defect Management; Execution History; Test generation Strategies, Static Testing. Model-Based Testing and Model Checking; Control-Flow Graph; Types of Testing; The Saturation Effect. **10 Hours**

Unit II

TEST GENERATION FROM REQUIREMENTS: Introduction; The Test-Selection Problem; Equivalence Partitioning; Boundary Value Analysis; Category-Partition Method. Cause-Effect Graphing, Test Generation from Predicates. **10 Hours**

Unit III

STRUCTURAL TESTING: Overview; Statement testing; Branch testing; Condition testing, Path testing; Procedure call testing; Comparing structural testing criteria; The infeasibility problem. **DEPENDENCE, DATA FLOW MODELS, AND DATA FLOW TESTING**: Definition-Use pairs; Data flow analysis; Classic analyses; From execution to conservative flow analysis; Data flow analysis with arrays and pointers; Inter-procedural analysis; Overview of data flow testing; Definition Use associations; Data flow testing criteria; Data flow coverage with complex structures; The infeasibility problem.

12 Hours

Unit IV

TEST CASE SELECTION AND ADEQUACY, TEST EXECUTION: Overview; Test specification and cases; Adequacy criteria; Comparing criteria; Overview of test execution; From test case specification to test cases; Scaffolding; Generic versus specific scaffolding; Test oracles; Self-checks as oracles; Capture and replay. **10 Hours**

Unit V

PROCESS: Test and analysis activities within a software process: The quality process; Planning and monitoring; Quality goals; Dependability properties; Analysis; Testing; Improving the process; Organizational factors. Integration and component-based software testing: Overview; Integration testing strategies; Testing components and assemblies. System, Acceptance and Regression Testing: Overview; System testing; Acceptance testing; Usability; Regression testing; Regression test selection techniques; Test case prioritization and selective execution. **10 Hours**

Text books:

1. Foundations of Software Testing - Aditya P Mathur, Pearson Education, 2008.
2. Software Testing and Analysis: Process, Principles and Techniques – Mauro Pezze, Michal Young, John Wiley & Sons, 2008.

Reference Books:

1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2ndEdition, Pearson,2007
2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.

Course Outcomes:

After learning all the units of the course, the student is able to

CO 1. Identify Test cases, Error and fault taxonomies, Levels of testing.

CO 2. Classify different types of testing (Boundary Value Testing, Equivalence Class Testing and Decision Table-Based Testing).

CO 3. Recognize Alternative life - cycle models, recognize Basic concepts for requirements specification, assess context of interaction.

CO 4. Recognize approaches for Test Execution: from test case specifications to test cases, Scaffolding, Generic versus specific scaffolding.

CO 5. Identify and plan strategies to test design specifications document.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	3										2	3		
CO 2	3	3			1							2	3		
CO 3	2	2	3		1							2	3		
CO 4	2	2			1							2	3		
CO 5	2	2	3		1							2	3		

Course Title: Object Oriented System Development			
Course Code: P15IS61	**Semester : VI**	**L- T – P -H: 3-2-0-5**	**Credit:4**
Contact period : 52 Hrs Exam: 3Hrs		**Weightage: : CIE:50; SEE:50**	

Prerequisites:
A good understanding of object oriented technologies and a basic understanding of analysis and design.

Course learning Objectives (CLO's)

This course aims to

1. Describe Unified Modeling Language (UML) notations, the concepts and notations involved in OO modeling.
2. Explain the models for Object Oriented System Development.
3. Analyze and Design a solution to the real world problem.
4. Understand the basics of how to prepare OO models.
5. Apply the design patterns to solve problems.
6. Apply software metrics to the improve software design.

Course Content

Unit - I

Introduction, Modeling Concepts, Class Modeling And Advanced Class Modeling: What is Object Orientation? What is OO development? OO themes; ***Modeling as Design Technique****:* Modeling; Abstraction; The three models.

Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models.

Advanced Class Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages. **11 Hours**

Unit - II

State Modeling, Advanced State Modeling, And Interaction Modeling: **State Modeling**: Events, States, Transitions and Conditions; State diagrams; State diagram behavior.

Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models;

Interaction Modeling: Use case models; Sequence models; Activity models.

Advanced Interaction Modeling: Use case relationships; Procedural sequence models; Special constructs for activity models**.** **10 Hours**

Unit - III

System conception, domain analysis, application analysis:

System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain Interaction model; Iterating the analysis

Application Analysis: Application interaction model; Application class model; Application state model; Adding operations. **10 Hours**

Unit - IV

System Design, Class Design:

System design: Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. **11 Hours**

Unit - V

Design Patterns: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber, Management Patterns: Command processor; View handler.

Metrics: Product quality metrics; In-process quality metrics; Metrics for software maintenance; Design and complexity metrics; Productivity metrics; Quality and quality management metrics; Lessons learned for OO projects. **10 Hours**

Text Books

1.Object-Oriented Modeling and Design with UML - Michael Blaha, James Rumbaugh , 2nd Edition, Pearson Education.
2.Pattern-Oriented Software Architecture, A System of Patterns: Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal:, Volume 1, John Wiley and Sons.
3.Metrics and Models in Software Quality Engineering, Stephan H. Kan:, 2nd Edition, Pearson.

Reference Books

1. Object-Oriented Analysis and Design with Applications – Grady Booch et al, 3rd edition, Pearson education.
2. Object-Oriented Analysis, Design, and Implementation, Brahma Dathan, Sarnath Ramnath, Universities Press.
3. Software Metrics: A Rigorous Approach, Fenton N. E., S. L. Pfleeger, 2nd Edition, Cengage Learning.

Course Outcomes

After learning all the units of the course, the student is able to

CO 1. Describe the object oriented modeling concepts and class model.
CO 2. Apply state model and interaction model with UML notations to solve problems.
CO 3. Analyze to build domain and application model.
CO 4. Design the solutions for real world problems.
CO 5. Apply design patterns to solve real world problems and also use metrics to evaluate the designed software.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	3	1											2
CO 2	3	2	3	2											2
CO 3	3	3	3	2						1					2
CO 4	2	3	2	3						2	1				2
CO 5	2	2	3	3						1			1		2

Course Title: Communication Networks-II			
Course Code: P15IS62	**Semester : VI**	**L- T – P –H : 4 – 0 – 0-4**	**Credit : 4**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequisites: Data communication

Course learning objectives (CLOs)

This course aims to

1. Explain the operation of the components of a SOHO wireless edge router including, DHCP, NAT/PAT, Routing function, Switching function and relationship to wireless access point.
2. Compare and contrast distance-vector and link-state routing algorithms.
3. Describe how DNS works in the global internet including caching and root servers.
4. Describe applications of symmetric encryption, asymmetric encryption and one-way hash to authentication, non-repudiation, integrity and confidentiality.
5. Explain how TCP's byte-stream sliding window is related to a traditional packet-based sliding window algorithm.

Course Content

Unit-I

Network Layer - 1

Network Layer: introduction to network layer, switching, packet switching at network layer, network layer services; **IPv4 addresses:** introduction, classful addressing, classless addressing, special addresses, NAT; **Internet protocol version 4:** Introduction, Datagram, Fragmentation, Options, Checksum, IP over ATM, Security. **Address Resolution Protocol:** Address Mapping, the ARP Protocol. **10 Hours**

Unit-II

Network Layer - 2

Mobile IP: Addressing, Agents, Three phases, Inefficiency in Mobile IP; **Unicast routing protocols:** Introduction, Intra- and – Inter- Domain Routing, Distance vector routing, RIP, Link State Routing, OSPF, Path Vector Routing, and BGP. **Multicasting and Multicast Routing Protocols:** Introduction, Multicast Address, IGMP, Multicast Routing, routing Protocols. **10 Hours**

Unit-III

Transport Layer

Introduction to Transport layer: Transport-layer services, Transport-Layer Protocols; **User Datagram Protocol (UDP):** Introduction, User Datagram, UDP Services, UDP Applications; **Transmission control protocol (TCP) :** TCP Services, TCP Features, Segment, a TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, Congestion Control, TCP Timers; **Stream Control Transmission Protocol (SCTP):** Introduction, SCTP Services SCTP Features, Packet Format, An SCTP Association, State Transition Diagram, Flow Control, Error Control, Congestion Control. **12 Hours**

Unit - IV

Application Layer

Introduction to the Application Layer: Client-Server paradigm, Peer-to-Peer paradigm. **Host Configuration:** Introduction, DHCP Operation, Configuration. **Domain Name System:** Need for DNS, Name space, DNS in the Internet, Resolution, DNS Messages, Types of records. **Remote Login:** TELNET, SSH. **File Transfer:** FTP, TFTP. **World Wide Web and HTTP:** Architecture, Web Documents, HTTP. **Electronic Mail:** Architecture, User Agent, Message Transfer Agent, Message Access Agent, MIME. **10 Hours**

Unit - V

IPv6 and Network security

IPv6: Introduction, Address Space Allocation, Global Unicast Addresses, Auto configuration, renumbering. **IPv6 Protocol:** introduction, Packet format, transmission from IPv4 to IPv6; **Cryptography and network Security:** Introduction, Traditional Ciphers, Modern Ciphers, Asymmetric-Key Ciphers, Message Integrity, Message Authentication, Digital Signature, Entity Authentication, Key Management. **10 Hours**

Text Books:

1. Behrouz A. Forouzan: "TCP/IP Protocol Suite" Fourth Edition Tata McGraw-Hill, 2010

Reference Books:

1. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach, 5th edition, Addison-Wesley, 2009. (unit-II)
2. Alberto Leon-Garcia and Indra Widjaja: Communication Networks – Fundamental Concepts and Key architectures, 2nd Edition, Tata McGraw-Hill, 2004.

Course Outcomes

After learning all the units of the course, the student is able to

CO 1.Understand network layer routing algorithms and the congestion control algorithms. And implement the routing protocols.

CO 2.Compare various routing algorithms like distance vector, link state, hierarchical & multicast routing, and understand the concept of fragmentation. Use different protocols to achieve Address mapping, Error reporting, unicast routing and multicasting

CO 3.Differentiate between TCP & UDP, and understand the services provided by them like flow control, congestion control etc.

CO 4.Understand and recognize the importance of application layer and the working of protocols like HTTP, FTP and DNS. Identify the different types of multimedia and analyze the quality of service provided by them.

CO 5.Identify and solve the problems associated with transition from IPV4 to IPV6. understand the factors driving the need for network security

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2		1		2									1	1
CO 2	3	2	3		2										
CO 3	2	1	3		2										
CO 4	2	1	3		2									1	2
CO 5	3	2	1		2									1	2

Course Title: Internet of things			
Course Code: P15IS63	**Semester : VI**	**L- T – P –H : 4 – 0 – 0-4**	**Credit : 4**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequites:

1. Computer Networks
2. Wireless Networks

Course learning objectives(CLOs)

This course aims to

1. Understand what Internet of Things is.
2. Apply the applications of IOT in the different environment
3. Make use of different IoT Standards.
4. Understand the Radio Frequency Identification Technology.
5. Apply IoT on different areas.

Course Content

Unit – I

INTRODUCTION TO INTERNET OF THINGS: What is the Internet of Things?: Overview and Motivations, Examples of Applications, IPv6 Role, Area of Development and Standardization, Scope of Present Investigation. **Internet of Things Definitions and Frameworks:** IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. **Internet of Things Application Examples:** Overview, Smart metering, Advanced Metering Infrastructure, e-Health, Body Area Networks. **10 Hours**

Unit –II

EXAMPLES, FUNDAMENTAL AND KEY TECHNOLOGIES OF IOT: Internet of Things Application Examples: City Automation, Automotive applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive surveillance, Ring of steel, Control application examples, Myriad other applications. F**undamental IoT mechanisms and Key technologies:** Identification of IoT Objects and Services, Structural Aspects of the IoT: Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture. Key IoT Technologies: Device Intelligence,

Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology. **12 Hours**

Unit –III

EVOLVING IOT STANDARDS: IoT standards: Overview and Approaches, IETF IPv6 Routing Protocol for RPL Roll, Constrained Application Protocol (CoAP), Representation State Transfer (REST), ETSI M2M, Third-Generation Partnership Project, CENELEC, IETF IPv6 Over Lowpower WPAN, ZigBee IP (ZIP), IP in Smart Objects (IPSO), Appendix 5.A: SCADA system. **10 Hours**

Unit – IV

RADIO FREQUENCY IDENTIFICATION TECHNOLOGY: Radio Frequency Identification Technology Overview Introduction, Principals of RFID, Components of RFID system,Reader, RFID tag, RFID Middleware, RFID Applications and Related Research Issues: introduction, Concepts and Terminology, Radio Frequency Identification, Transpoder classes, standards, RFID system architecture, other related technologies, RFID applications, logistic and supply chain, production, monitoring and maintenance, product safety,quality and information, access control and tracking and tracing of individuals, ongoing research projects, hardware issues, protocols. Wireless Sensor Networks Technology and Overview: the node, communication, computation, sensing, energy, networking nodes, MAC, multi-hop routing, securing communication. **10 Hours**

Unit –V

KEY APPLICATIONS OF THE INTERNET OF THINGS: The Smart Grid: Introduction, Marginal cost of Electricity, Managing Demand, Demand response for Transmission System Operators, Case study: RTE in France, Opportunity of Smart Distributed Energy Management, Demand Response: The Big Picture, Conclusion: Business case of Demand Response and Demand Shifting. **Electric Vehicle Charging:** Charging standards overview, use cases. **10 Hours**

Text Books:

1. Daniel Minoli , " Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications " , ISBN: 978–81–265–5823–0 , Wiley Publications, 2016.
2. "The Internet Of Things: Connecting Objects to Web", ISBN: 9788126566839, Wiley Publications,2017
3. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things: Key Applications and Protocols", ISBN: 978–81–265–5765–3,Wiley Publications, 2015.

Reference Books:

1. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978 – 1 – 84821 - 140 - 7, Willy Publications
2. Daniel Kellmereit, Daniel Obodovski, " The Silent Intelligence: The Internet of Things ",. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 989973700, ISBN-13: 978-0989973700.
3. Fang Zhaho, Leonidas Guibas, " Wireless Sensor Network: An information processing approach ",Elsevier, ISBN: 978-81-8147-642-5
4. Bernd Scholz - Reiter, Flori an Michahelles , " Architecting the Internet of Things " , ISBN 978 – 3 – 642 – 19156 - 5 e - ISBN 978 – 3 – 642 – 19157 - 2, Springer

Course outcomes

After learning all the units of the course, the student is able to

CO 1. Understand the Internet of Things.
CO 2. Describe key technologies in Internet of Things
CO 3. Analyze the different IoT standards.
CO 4. Understand the RFID technology.
CO 5. Explain the different applications of IoT.

Couse Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	2		2						2				
CO 2	3	3	2		2					2	2				
CO 3	2	2	3							3				2	
CO 4	2	3	2		2					2			2	3	
CO 5	3		3		2					3			2	3	3

Course Title: Management and Entrepreneurship			
Course Code: P15IS64	**Semester : VI**	**L- T – P-H : 4 – 0 – 0-4**	**Credit :4**
Contact period : 52 Hrs, Exam:3 hrs		**Weightage: CIE: 50, SEE:50**	

Course learning objectives(CLOs)

This course aims to

1. Understand the roles and functions of management.
2. Analyze the evolution of management from classical approach to modern approach.
3. Differentiate between strategic planning and tactical planning.
4. Explain the recruitment and selection process.
5. Compare formal and informal communication.
6. Identify the new control techniques.
7. Explain the role of entrepreneurs in the economic development of the nation.
8. Identify the contents of the project report.
9. Understand the different Industry Policy Resolutions.
10. Understand the rules, policies and working criteria by visiting small scale industry.

Course Content

Unit-I

Management

Nature and Functions of Management : Importance and definition of management, management functions, roles of a manager, levels of management, managerial skills, management and administration , management – a science or art or profession, professional management versus family management. **Development of Management Thought:** Early classical approaches, Neo classical approaches, modern approaches. **10 Hours**

Unit-II

Planning: Importance of planning, forms and types of plans, steps in planning, limitations of planning, making planning effective, planning skills. Decision making: Types of decisions, steps in Rational decision making, rationality in decision making, environment of decision making. **Organisation:** Process of organizing, span of management, principles of organising, Departmentalisation, committees, teams. Staffing: Manpower planning, recruitment and selection process. **11 Hours**

Unit-III

Direction: Requirements of effective direction, giving orders, motivation. Communication: Purposes of communication, formal communication, forms of communication, informal communication, barriers to communication. Leadership: characteristics of leadership, functions of leader.

Control: Steps in control process, need for control, types of control methods, essentials of effective control system, new control techniques. **10 Hours**

Unit-IV

Entrepreneurship: Introduction, Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur, Entrepreneurship, Evolution of Entrepreneurship, Development of Entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship – its Barriers, women entrepreneurs, Entrepreneurship Development Programme. Preparation of project: meaning of project, project identification, project selection, project report need and significance, contents of project report, project formulation**.** **10 Hours**

Unit-V

Small Scale Industry: Definition, Characteristics, Need and rationale, Objectives, Scope, role and advantages of SSI, steps to start an SSI, Different Industry Policy Resolutions (IPRs) of S.S.I, Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I., WTO/GATT, supporting Agencies of Government for S.S.I, Ancillary Industry and Tiny Industry. Institutional Support: State level institutions, Central Government institutions. **Case Study:** Students in batch has to visit the nearest SSI and finally submit a report. **11 Hours**

Text Book :

1 Principles of Management, P C Tripathi, P N Reddy, 5th edition, TataMcGraw Hill, 2012.
2 Management and Entrepreneurship, N V R Naidu, T Krishna Rao, I K International Publishing House Pvt. Ltd., 2010.

Reference Books :

1. Dynamics of Entrepreneurial Development & Management - Vasant Desai, Himalaya Publishing House, 2007.
2. Management Fundamental Concepts, Application, Skill Development - Robert Lusier - Thomson, 2007.

Course outcomes

After learning all the units, the student is able to

CO 1. Understand the evolution of management from classical approach to modern approach.
CO 2. Explain the steps in planning and steps in selection process.
CO 3. Identify the direction and control techniques.
CO 4. Compare Entrepreneur and Intrapreneur.
CO 5. Analyze the government support for small scale industry.

Couse Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1			3	2		3	3	2	1						
CO 2			3	3		3	3	3	2						
CO 3		1	2	3	2	3		3	1	1					
CO 4		1	3	2	2	2		3	2	3	2				
CO 5			3			3	1	3	3						

Course Title: Networks Laboratory			
Course Code: P15ISL67	**Semester : VI**	**L- T – P - H : 0 –1–2 -3**	**Credit: 1.5**
Contact period : 39 Hrs, Exam: 3 Hrs		**Weightage: CIE:50 SEE:50**	

Prerequisites: Computer Networks and C/C++.

Course Learning Objectives

This course aims to

1. Write C/C++ code to implement network related concepts.
2. Design/Develop network scenarios and analyze its performance by specifying parameters using QualNet simulator.

Course Contents

PART - A

The following experiments shall be conducted using C/C++

1. Write a program for error detection using CRC-CCITT (16-bits).
2. Write a program for frame sorting technique used in buffers.
3. Write a program to generate Hamming Code for error detection and correction.
4. Write a program for congestion control using Leaky bucket algorithm.
5. Write a program for simple RSA algorithm to encrypt and decrypt the data.
6. Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file, if present.
7. Implement the above program using FIFOs as IPC channels.

PART - B

The following experiments shall be conducted using QualNet simulator

1. Design a star topology for LAN using hub or switch or both by taking at least five nodes and analyze the statistics.
2. Design a mesh topology for five nodes and analyze the TCP, UDP statistics and FIFO queuing mechanism.
3. Develop a scenario for wired network and implement VOIP and analyze the statistics.
4. Design a scenario to integrate wired network and wireless network using Wi-Fi infrastructure mode and analyze the statistics.
5. Develop a scenario for WIMAX using standard 802.16. Analyze the statistics.
6. Design a scenario for wireless sensor networks (total 9 devices). Analyze the Zigbee battery model along with the statistics.
7. Develop a scenario for MANET in wireless networks. Consider 7 devices and show the mobility for all the devices and analyze the statistics.

Note: Student is required to solve one problem from PART-A and one problem from PART-B.

Course Outcomes

After learning all the programs of the course, the student is able to

CO 1. Write C/C++ code to implement network related concepts

CO 2. Design/Develop network scenarios and analyze its performance by specifying parameters using QualNet simulator

Couse Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	1				1				1					2	1
CO 2	2				2				1					2	1

Course Title: Internet of Things lab			
Course Code: P15ISL68	**Semester : VI**	**L- T – P-H : 0 – 1 – 2 - 3**	**Credit :1.5**
Contact period :39 Hrs, Exam:3 hrs		**Weightage: CIE: 50, SEE:50**	

Course Learning Objective

1. Design applications using Arduino and Raspberry pi
2. Design an applications using cloud services

List of programs

1. To design and implement Traffic Light Controller
2. To design and program smart Light system
3. To design and implement ON/OFF the light based on human presence in the room
4. To design and implement smart irrigation system
5. To design and implement color recognizing system
6. To design and implement Fire alert system
7. To design and implement Remote Controller
8. To design and implement obstacle detection system
9. To design and implement identification system
10. To design and implement Home automation system using Bluetooth
11. To design and implement weather monitoring system using Wifi and Datasparkfun cloud

Course Outcome

After learning all the programs of the course, the student is able to

CO 1. Design basic applications using Arduino

CO 2. Design different advanced applications using Raspberry pi

CO 3. Implementing an application using cloud services and security

Couse Articulation Matrix

CO's	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	3			2								2	2
CO 2	3	3	3	2		2								2	
CO 3	3	3	2											3	2

Course Title : Aptitude and Reasoning Development - EXPERT (ARDE)		
Course Code : P15HU610	**Semester : 6**	**L : T : P : H - 0 : 0 : 2 : 2**
Contact Period: Lecture: 32 Hr, Exam: 3 Hr	**Weightage: CIE:50%; SEE:50%**	
Prerequisites : Number system, Concept of percentage, Analytical reasoning-2.		

Course Learning Objectives (CLOs)

This course aims to

1. Explain different types of functions, representation of different functions on the graphs.
2. Describe the properties of quadratic equations and application of quadratic equations.
3. Demonstrates the principle of counting.
4. Differentiates between permutation and combination and solve problems conceptually.
5. Predict the probabilities in different scenarios and its application in our day-to-day life.
6. Evaluate the cause and effect of the statements logically.
7. Recognize different ways in which a statement can be strengthened or weakened.
8. Explain the criticality of data sufficiency chapter., universal methodology to solve any problem.
9. Analyse the data in a bar graph , pie chart and tabular column and line graph and the combination of these graphs.
10. Compare the data in different format and understand the difference between them

Course Content

Unit – I

Functions and Quadratic equations:

Functions: Basic methods of representing functions– Analytical representation, tabular representation, graphical representation of functions. Even and odd functions, Inverse of a function, Shifting of graph. Representation of standard set of equations. Methodology to tackle inverse functions. Graphical process for solving inequalities, graphical view of logarithmic function.

Quadratic equations: Theory, properties of quadratic equations and their roots, the sign of quadratic equation, Equations in more than one variable. Simultaneous equations, number of solutions of the simultaneous equations. **6 Hours**

Unit – II

Permutation and Combination: Understanding the difference between the permutation and combination, Rules of Counting-rule of addition, rule of multiplication, factorial function, Concept of step arrangement, Permutation of things when some of them are identical, Concept of 2^n, Arrangement in a circle.

Probability: Single event probability, multi event probability, independent events and dependent events, mutually exclusive events, non-mutually exclusive events, combination method for finding the outcomes. **8 Hours**

Unit – III

Analytical reasoning 3: Punchline: Introduction, format of the problem, An analysis, Does a suggested statement qualify as a punchline?. If a given statement fits as a punchline, what is its idea or wavelength?, The complete method of solving a punchline problem, Solved examples, conclusion, Sample company questions.

Strengthening and Weakening arguments: Format of the problem, An analysis, Suggested methods, solved examples, conclusion, sample company questions.

Cause and Effect : Cause and Effect—A theoretical discussion, Immediate cause, Principal cause, A quick check– Cause always antecedent. The strategy for solution. **6 Hours**

Unit IV

Data Sufficiency: Introduction, answer choices in data sufficiency, tips to solve data sufficiency problems, directions of questions, classification of sections in data sufficiency– Number system, Algebra, series and sequence, logical, geometry and mensuration, arithmetic. **6 Hours**

Unit V

Data Interpretation: Approach to interpretation - simple arithmetic, rules for comparing fractions, Calculating (approximation) fractions, short cut ways to find the percentages, Classification of data– Tables, Bar graph, line graph, Cumulative bar graph, Pie graph, Combination of graphs. Combination of table and graphs **6 Hours**

Reference Books:

1. "The Trachtenberg speed system of basic mathematics, published by Rupa publications.
2. CAT Mathematics by AbhijithGuha. published by PHI learning private limited.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal , published by S. Chand private limited.
5. Quantitative aptitude for CAT by Arun Sharma, published by McGraw Hill publication.
6. Analytical reasoning by M.K Pandey BSC PUBLISHING.CO.PVT.LTD

Course Outcomes (CO)

After learning all the units of the course, the student is able to:

1. Graphically represent the functions and analyze it. L5
2. Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them. L6
3. Effective solve the problems of permutation and combination. L4
4. Predict different possibilities by the principle of probability. L3
5. Interpret the data given in the graphical format and infer the results. L5
6. Analyze the statement critically and solve the questions from verbal logic section. L5

A. Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Graphically represent the functions and analyze it.	L5	M	-	-	-	M	-	-	-	-	-	-	-	-	-
Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them.	L6	M	-	-	-	-	-	-	-	-	-	-	-	-	-
Effective solve the problems of permutation and combination.	L4	H	-	-	-	M	-	-	-	M	-	-	-	-	-
Predict different possibilities by the principle of probability.	L3	H	-	-	-	-	-	-	-	M	-	-	-	-	-
Interpret the data given in the graphical format and infer the results.	L5	M	-	-	-	-	-	-	-	-	-	-	-	-	-

L- Low, M- Moderate, H-High

B. Course Assessment Matrix (CaM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Graphically represent the functions and analyze it.	L5	M	-	-	-	M	-	-	-	-	-	-	-	-	-
Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them.	L6	M	-	-	-	-	-	-	-	-	-	-	-	-	-
Effective solve the problems of permutation and combination.	L4	H	-	-	-	M	-	-	-	M	-	-	-	-	-
Predict different possibilities by the principle of probability.	L3	H	-	-	-	-	-	-	-	M	-	-	-	-	-
Interpret the data given in the graphical format and infer the results.	L5	M	-	-	-	-	-	-	-	-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

ELECTIVE – II

Course Title : Digital Image Processing			
Course Code: P15IS651	Semester : VI	L:T:P: H - 4 : 0 : 0 : 4	Credits: 3
Contact Period : Lecture :52 Hr, Exam: 3Hr		Weightage :CIE:50% SEE:50%	

Course Learning Objectives (CLOs)

This course aims to

1. To understand the image fundamentals.
2. To understand the mathematical transforms necessary for image processing and to study the image enhancement techniques.
3. To understand the image degradation/restoration model and different noise models.
4. To understand the uses of pseudo colors and to study the image compression models.
5. To understand Morphological Image Processing and the image segmentation.

Course Content

Unit – I

Digital Image Fundamentals: What is Digital Image Processing, fundamental Steps in Digital Image Processing, Components of an Image processing system, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations. **10 Hours**

Unit – II

Image Enhancement in Spatial domain: Some Basic Gray Level Trans– formations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations.

Image Enhancement In Frequency Domain: Introduction to the Fourier transform, smoothing frequency domain filters, sharpening frequency domain filters. **11 Hours**

Unit – III

Image Restoration: Model of image degradation/restoration process, noise models, Restoration in the Presence of Noise, Only– Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position– Invariant Degradations, inverse filtering, minimum mean square error (Weiner) Filtering **11 Hours**

Unit – IV

Color Image Processing: Color fundamentals, color models, pseudo color Image processing, basics of full color image processing, color transformations.

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory **10 Hours**

Unit – V

Morphological Image Processing: Dilation and Erosion, opening and closing, Some Morphological algorithms.

Image Segmentation

Detection of discontinuities, Edge Linking and Boundary Detection, Thresholding, Region– Based Segmentation. **10 Hours**

Text book:

1. "Digital Image Processing", Rafael C. Gonzalez and Richard E. Woods Pearson Education, 2009, 3rd edition.

Reference books:

1. "Fundamentals of Digital Image Processing", Anil K. Jain, Pearson Edition, 2001.
2. "Digital Image Processing", S. Jayaraman and others.

Course Outcomes

After learning all the units of the course, the student is able to

1. Describe the various steps in image processing.
2. Develop the suitable filters for image enhancement.
3. Analyze the image degradation restoration model and noise models.
4. Apply the color image processing techniques.
5. Develop the algorithms for image segmentation and Morphological image processing.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	2			2				1			1	2	1	2
CO 2	2	2	2	2	2				1			1	2	1	2
CO 3	2	2	2	2	2				1			1	2	1	2
CO 4	2	2	2	2	2				1			1	2	1	2
CO 5	2	2	2	2	2				1			1	2	1	2
CO 6	2	2			2				1			1	2	1	2

Course Title: Wireless Sensor Networks			
Course Code: P15IS652	**Semester : VI**	**L - T – P – H :4-0-0-4**	**Credit : 3**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequisites: Computer Networks

Course Learning Objectives

This course aims to

1. An appreciation for the types of applications for which wireless sensor networks are intended and types of technical solutions that are required both in hardware and in networking technologies.

2. Get an understanding of some of the fundamental trade off's regarding transmission robustness and energy consumption and how these are effected the power consumption properties of transceiver components.

3. Key aspects is content based addressing where not nodes are network interface but data is addressed. Content based addressing can be integrated with data centric routing and is also a key enables of in-network processing.

4. Introduction to the time synchronization problem in general and discuss the specifics of wireless sensor networks.

5. Discuss mechanism for routing and forwarding when the destination of a packet is identified by a unique node identifier, by a set of such identifier are when all the nodes in the network shall receive a packet.

Course Contents

Unit 1

Introduction: Definition of Wireless Sensor Networks (WSNs), difference between the adhoc and sensor n/ws, challenges for WSN and applications of WSN. Single node architecture: Hardware components, energy consumption in sensor nodes, brief study of operating systems like TinyOS and NesC. Ntework architecture: Network scenarios, QOS parameters, design principles of WSN and the interfaces.

10 Hours

Unit 2

Communication Protocols: Physicallayer protocols - Introduction, Wireless channel and communication fundamentals, Physical layer & transceiver design considerations in WSNs. MAC layer protocolsFundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol, IEEE 802.11 and Bluetooth. **12 Hours**

Unit 3

Link layer protocols: Fundamentals: Tasks and requirements, Error control, Framing, Link management. Naming and addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses, Distributed assignment of locally unique addresses, Content-based and geographic addressing. **10 Hours**

Unit 4

Time synchronization: Introduction to the time synchronization problem, Protocols based on sender/receiver synchronization, Protocols based on receiver/receiver synchronization. Localization and Positioning: Properties of positioning, possible approaches, Mathematical basics for the lateration problem, Single-hop localization, Positioning in multi-hop environments, Impact of anchor placement.

10 Hours

Unit 5

Routing Protocols: The many faces of forwarding and routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing for Mobile nodes.

10 Hours

Text Books:

1. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Reference Books:

1. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

Course outcomes

At the end of the course the students should be able to:

CO 1. Explain the hardware and software components of wireless sensor networks. (PO2).
CO 2. Summarize the fundamentals of MAC protocols. (PO2, PO4, PO5)
CO 3. Recognize the important tasks of Link layer addressing and naming schemes in WSNs (PO1, PO2, PO4, PO5).
CO 4.Identify the time synchronization problems and understand the principal design trade-offs For positioning nodes in the network. (PO1, PO2, PO5)
CO 5. Compare the different mechanisms available for routing in the network. (PO1, PO2, PO4)
CO 6. Devise new applications for WSNs. (PO1, PO2, PO4)

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1		3												3	2
CO 2		2		2	2									3	2
CO 3	2	3		2	2									3	2
CO 4	3	3			2									3	2
CO 5	2	3		2										3	2
CO 6	2	3		2										3	2

Course Title: Multimedia Computing			
Course Code: P13IS653	**Semester : VI**	**L- T – P -H: 4 – 0 – 0-4**	**Credit : 3**
Contact period : Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE: 50, SEE:50**	

Course Learning Objectives (CLOs)

This course aims to

1. Describe the components of multimedia systems, the technologies used for multimedia system, and storage management of multimedia system.
2. Identify applications of multimedia systems.
3. Describe the computerized graphic and images and their respective properties.
4. Explain different compression methods used for audio and video signals.
5. Describe the basic optical technology.
6. Explain different type of currently available content analysis techniques and large number of file and data formats.

Course Content

Unit I

Introduction, Media and Data Streams, Audio Technology

Introduction: Multimedia Element, Multimedia Applications, Multimedia Systems Architecture, Evolving Technologies for Multimedia Systems, Defining objects for Multimedia systems, Multimedia data Interface standards, the need for data compression, Multimedia Databases.

Media: Perception media, Represent media, Presentation media, Storage media, Characterizing Continuous media data streams.

Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics, Audio representation on Computers, Three dimensional sound projection, Music and MIDI standards, Speech signals, Speech Output, Speech Input, Speech Transmission. **10 Hours**

Unit II

Graphics and Images, Video Technology, Computer-Based Animation

Graphics and Images**:** Capturing Graphics and Images, Computer Assisted Graphics and Image Processing, Reconstructing Images, Graphics and Image output Options.

Basics, Television System, Digitalization of video Signals, Digital Television.

Computer-Based Animation: Basic Concepts, Specification of Animations, Methods of Controlling Animation, Virtual Reality Modeling Language. **11 Hours**

Unit III

Data Compression

Storage Space, Coding Requirements, Source, Entropy and Hybrid Coding, Basic Compression Techniques, JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT-base Mode, Lossless Mode, Hierarchical Mode. H.261(Px64) and H.263: Image Preparation, Coding Algorithm, Data Stream, H.263+ and H.263L, MPEG: Video Encoding, Audio Encoding, Data Stream, MPEG-2,MPEG-4, MPEG-7,Fractal Compression. **10 Hours**

Unit IV

Optical Storage Media

History of Optical Storage, Basic Technology, Video Discs and Other WORMs, Compact Disc Digital Audio, Compact Disc Read Only Memory, CD-ROM Extended Architecture, Further CD-ROM Based Developments, Compact Disc Recordable, Compact Disc Magneto-Optical, Compact Disc Read/Write, Digital Versatile Disc. **10 Hours**

Unit V

Content Analysis, Data and File Format standards

Content Analysis: Simple Vs. Complex Features, Analysis of Individual Images, Analysis of Image Sequences, Audio Analysis, Applications.

Data and File Format standards: Rich Text Format, TIFF File Format, Resource Interchange File Format [RIFF], MIDI File Format. TWAIN. **11 Hours**

Text Books:

1. Multimedia Fundamentals: Vol 1- Media Coding and Content Processing – Ralf Steinmetz, Klara Narstedt, 2nd Edition, Pearson Education / PHI, 2011.
2. Multimedia Systems Design - Prabhat K. Andleigh, Kiran Thakrar, PHI, 2013.

Reference Books:

1. Multimedia Communication: Applications, Networks, Protocols and Standards-Fred Halsal, Pearson, 2013
2. Introduction to Data Compression- Khalid Sayood, Fourth Edition, Elsevier Inc, 2013

Course Outcome

After learning all the units of the course, the student is able to

CO 1**.** Identify the basic requirements of multimedia system.
CO 2. Identify properties, formats and standards to represent graphics and images, video and animations.
CO 3. Apply different compression techniques for audio and video data.
CO 4. Identify the efficient optical storage media for a given scenario.
CO 5. Demonstrate content analysis techniques and various data and file formats standards to represent data.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	1											1		
CO 2	2	2	2										1	2	
CO 3	2	3	2										2		2
CO 4	2	2	2										1	1	1
CO 5	2	2	2										2	2	1

Course Title : Parallel Computing			
Course Code : P15IS654	**Semester : VI**	**L :T:P:H : 4:0:0:4**	**Credits: 3**
Contact Period: Lecture: 52 Hr, Exam: 3 Hr		**Weightage: CIE:50; SEE:50**	

Prerequisites: Programming Language.

Course Description: This course introduces you to the foundations of parallel computing including the principles of parallel algorithm design, analytical modelling of parallel programs, and programming models for shared- and distributed-memory systems, parallel computer architectures, along with numerical and non-numerical algorithms for parallel systems.

Course Learning Objectives (CLOs)

This course aims to:

1. To study the scalability and clustering issues and the technology necessary for them.
2. To understand the technologies enabling parallel computing.
3. To study the different types of interconnection networks.
4. To study the different parallel programming models.
5. To study the software support needed for shared memory programming.

Course Content

Unit 1

Introduction to Parallel Computing: Thinking in Parallel, Parallelism Vs. Concurrency, Types and levels of parallelism, Different grains of parallelism, Introduction to parallelization and vectorization: Data dependencies, SIMD technology, Definition of thread and process, Parallel programming models, Decomposition methodologies for parallel program development, The message passing paradigm ,load balancing issues for parallel programs, PRAM computational model, Flynn's Taxonomy, current issues in parallel processing, Parallel Processing speedup issues: including Amdahl's and Gustafason's Laws.

10 Hours

Unit 2

Heterogeneous Architectures: Motivation for Heterogeneous Computing, Introduction to heterogeneous architectures- GPU in particular Modern GPU architecture. Introduction to GPU computing (general purpose computation on GPU), GPU architecture case studies: NVIDIA Fermi Tesla C2050/Kepler K20, languages for parallel computing, including: MPI and OpenMP Parallel Programming. **10 Hours**

Unit 3

Introduction to CUDA programming Compute Unified Device Architecture (CUDA): CUDA Architecture, CUDA programming model, execution model, thread organization: Concept of grid, block and thread, thread index generation, warp; memory model: Introduction to global, shared, local memories, usage of cache, texture cache, constant memory, memory banks and bank conflicts. CUDA structure, API and library (CUDPP, CUBALS, FFT etc.) details. CUDA example programs (Vector dot product, Matrix multiplication (with the usage of tiling and shared memory). **10Hours**

Unit 4

Multicore Programming with OpenMP: Fundamentals of Shared Memory Programming, Basic OpenMP concepts, PARALLEL directive, data scoping rules, basic OpenMP constructs/directives/calls,

examples, parallelizing an existing code using OpenMP, More advanced OpenMP directives and functions, OpenMP performance issues. **10 Hours**

Unit 5

Problem solving using GPUs: Single vs double precision, solving a problem that involves Vectors, Matrices, Binomial coefficients, Bernstein coefficients and etc. Instructor will choose the problems from several domains with which students are already aware.

Optimizations and Tools: Memory coalescing, Reduction operation using prefix sum example. Usage of shared memory optimally, Performance issues in algorithmsdeciding parallelization of a part of algorithm and selecting the highest parallelism, Need of profilers and analyzers, Introduction to CUDA Tools: MemCheck, Command line & Visual Profilers. **12 Hours**

TEXT BOOKS:

1. AnanthGrama, Anshal Gupta, GreogeKarypis, Vipin Kumar, "Introduction to Parallel Computing",Second Edition,(Pearson Publication)
2. David B. Kirk and Wen-mei W. Hwu, "Programming Massively Parallel Processors: A Hands-On Approach", Second Edition(MK-Morgan Kaufmann Publication)
3. Parallel Programming in C with MPI and OpenMP by Michael J. Quinn, Tata McGrawHill Edition
4. Advanced computer architecture by Kai Hwong, Tata McGraw-Hill Edition, 2001

REFERENCE BOOKS

1. Jason Sanders and Edward Kandrot,"CUDA by Example: An Introduction to General-Purpose GPU Programming",2010.

Course Outcomes

After completing this course, students will able to:

CO 1. Awareness of the GPU architecture and its programming.
CO 2. Design parallel programs for GPU.
CO 3. Design & develop OpenMP and CUDA programs.
CO 4. Analyze and apply various parallel algorithms
CO 5. Capable to optimize algorithms for better performance.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	2							3			3			
CO 2	2	2													
CO 3	2	2													
CO 4	2	2													
CO 5	2	2							3			3			

Course Title: Modern Information Retrieval			
Course Code: P15IS661	**Semester : VI**	**L- T – P -H: 4 – 0 – 0-4**	**Credit: 3**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequisites: The student should have undergone the course on programming language, database.

Course learning objectives

This course aims to

1. Understand the difficulty of representing and retrieving documents.
2. Understand the latest technologies for linking, describing and searching the Web.
3. Understand the relationship between IR, hypermedia, and semantic models.
4. Be familiar with classical techniques of Information Retrieval, and the additional techniques employed by Web search engines sufficient to understand how Web search engines work and how they could be improved.
5. Be familiar with techniques for conveying the meaning of documents or hypermedia content, for example, metadata, thesauri, and classification taxonomies – sufficient to understand their application to the "semantic Web".
6. Be familiar with the fundamentals of hypermedia systems sufficient to know how to develop a good Web hypermedia and why a Web site is good or bad.
7. Implement techniques for the preprocessing needed for information retrieval systems.
8. Develop a simple information retrieval system.

Course contents

Unit - I

Information Retrieval and Modeling

Introduction: Information versus data retrieval, information retrieval at the center of stage; basic concepts: user task, logical view of the documents; past present and future: early development, information retrieval in the library, the web and digital libraries; the retrieval process.

Modeling: A taxonomy of IR models; classic IR: Basic Concepts, Boolean model, vector model, probabilistic model, fuzzy set model, extended Boolean model, neural network model. **10 Hours**

Unit - II

Retrieval Evaluation, Query Language and Operation

Introduction; retrieval performance evaluation, reference collection, keyword-based querying pattern matching, structural queries, query protocol, user relevance feedback, automatic local analysis, automatic global analysis, metadata, text, markup language, multimedia. **10 Hours**

Unit - III

Text Operation, Indexing and Searching

Introduction, document preprocessing, document clustering, text compression, inverted files, other indices for text, Boolean queries, sequential searching, pattern matching, structural queries, compression

12 Hours

Unit - IV

Parallel and Distributed IR and Multimedia IR

Introduction, parallel IR, distributed IR, data modeling, query language, spatial access methods, a generic multimedia indexing approach, one dimensional time series, two dimensional color images.

10 Hours

Unit - V

Searching the Web

Introduction, challenges, characterizing the web, search engines browsing, metasearchers, finding the needle in the haystack, searching using hyperlinks. **10 Hours**

Text Books:

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto: Modern Information Retrieval, First edition, Pearson Education, 2011.

Reference Book:

1. William B Frakes, Ricardo Baeza Yates: Information Retrieval Data Structures and Algorithms, First edition, Pearson Education, 2009.
2. C.J. van Rijsbergen: Information Retrieval, Second Edition, Butterworth-Heinemann.

Course outcomes

After learning all the units of the course, the student is able to

CO 1. Compare data & information retrieval systems and apply appropriate information retrieval model for given problem.
CO 2. Evaluate retrieval performance of given model.
CO 3. Develop techniques for the preprocessing/clustering needed for information retrieval systems
CO 4. Differentiate between parallel IR and distributed IR.
CO 5. Develop a simple information retrieval system.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2		2												1
CO 2	2			1											
CO 3	2		2												1
CO 4	1		1												
CO 5	2		1												1

Course Title: Storage Area Network			
Course Code: P15IS663	**Sem: VI**	**L-T-P-H: 4:0:0:4**	**Credits - 3**
Contact Period: Lecture: 52 Hrs., Exam: 3 Hrs		**Weightage: CIE:50; SEE:50**	

Prerequisites : Operating system and Communication Network.

Course Learning Objectives

The course aims to:

1. Identify the need for performance evaluation and the metrics used for it.
2. Realize strong virtualization concepts.
3. Develop techniques for evaluating policies for LUN masking, file systems.
4. Explain how data centre's maintain using remote mirroring concepts.
5. Design storage configurations that effectively meet scalability, security, resilience, and availability requirements.

Unit I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

10 Hours

Unit II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

10 Hours

Unit III

Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

Unit IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

Unit V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary.

10 Hours

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2015.
2. 1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.

Reference Books:

1. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
2. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Course Outcomes

The students shall able to:

CO 1. Describe the fundamentals of storage centric and server centric systems
CO 2. Analyze the metrics used for Designing storage area networks
CO 3. Explain the RAID concepts
CO 4. Explain strong virtualization concepts.
CO 5. Apply the techniques used for data maintenance.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2												2	2	1
CO 2	2												2	1	2
CO 3	2	3											1	1	1
CO 4	2	2	2										1	1	1
CO 5	2	2	2										2	2	2

Course Title: J2EE & J2ME			
Course Code: P13IS663	**Semester : VI**	**L - T – P-H : 4-0-0-4**	**Credit : 3**
Contact period : Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50 SEE:50**	

Prerequisites : Object Oriented Programming with Java

Course Learning Objectives

This course aims to

1. Analyze the real world problems to solve using object-oriented approach.
2. Develop Java applications to solve real world problems.
3. Create applets to solve real world problems.
4. Implement Multi-Threading and Event Handing concepts.
5. Design GUIs using Swings.
6. Implement JDBC Concept.
7. Develop client server applications using Servlets and JSPs.
8. Implement RMI Concept.
9. Implement Enterprise Java Beans Concept.
10. Develop Mobile applications using J2ME.

Course Content

Unit – I

Applets, Multi-Threaded Programming, Event Handling: The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase();

Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. **11 Hours**

Unit – II

Swings, Java 2 Enterprise Edition Overview, Database Access: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.

Overview of J2EE and J2SE, The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. **11 Hours**

Unit – III

Servlets, Jsp: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects. **10 Hours**

Unit – IV

Rmi, Enterprise Java Beans: Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side. Enterprise java Beans; Deployment Descriptors; Session Java Bean, Entity Java Bean; Message-Driven Bean; The JAR File. **10 Hours**

Unit – V

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

10 Hours

Text Books:

1. Java - The Complete Reference – Herbert Schildt, 7th Edition, Tata McGraw Hill, 2007.
2. J2EE - The Complete Reference – James Keogh, Tata McGraw Hill, 2007.
3. Mobile Computing, Technology, Applications and Service Creation - Dr. Ashok Talukder, Ms Roopa Yavagal, Mr. Hasan Ahmed, 2nd Edition, Tata McGraw Hill, 2010.

References:

1. Introduction to JAVA Programming – Y. Daniel Liang, 6th Edition, Pearson Education, 2007.
2. The J2EE Tutorial – Stephanie Bodoff et al, 2nd Edition, Pearson Education.
3. Mobile and Wireless Design Essentials - Martyn Mallik, Wiley.

***Course* Outcomes**

After learning all the units of the course, the student is able to

CO 1**.** Recognize the object oriented concepts & apply them to create java applications.
CO 2.Demonstrate java applications with applets, threads and event handling concepts.
CO 3. Develop GUI applications with the help of swings.
CO 4. Develop client server applications with JDBC, Servelts, JSP, RMI and EJB concepts.
CO 5. Develop program for CLDC, MIDP let model and security concerns.

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	2												2
CO 2	3	2			2										
CO 3	3	2	2		2										
CO 4	3	3	2		2								3	2	
CO 5	2													2	

Course Title: Principles of Compiler Design			
Course Code: P15IS664	**Semester : VI**	**L- T – P -H: 4 – 0 – 0 -4**	**Credit :3**
Contact period : Lecture: 52 Hr, Exam:3 hr		**Weightage: CIE: 50, SEE:50**	

Prerequisites: The student should have undergone the course on System Software, have knowledge about finite automata and any one programming language**.**

Course learning objectives

This course aims to

1. Describe the various phases of a compiler, software tools to build compiler and know the technique used to implement lexical analyzer.
2. Apply an algorithm for top down parsing.
3. Apply an algorithm for bottom-up parsing.
4. Create a syntax-directed definition and explain the role of a semantic analyzer and type checking.
5. Apply the transformation of abstract syntax tree to intermediate code.
6. Analyze various issues in allocation strategies and design of code generator.
7. Implement the phases for set of instructions.
8. Apply the knowledge of LEX tool & YACC tool to develop a scanner & parser.
9. Design & conduct experiments for Intermediate Code Generation in compiler.
10. Acquire the knowledge of modern compiler & its features.
11. Learn & Use the new tools and technologies used for designing a compiler

Course contents

Unit– I

Language processors; The structure of a Compiler; Language processors; The evolution of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics. Lexical analysis: The Role of Lexical Analyzer;
Input Buffering; Specifications of Tokens; Recognition of Tokens. **10 Hours**

Unit – II

Syntax Analysis – 1: Introduction; Context-free Grammars; Writing a Grammar. Recursive decent parsing, FIRST set, FOLLOW set, LL(1) Grammar, Non-recursive predictive parsing, Error recovery in predictive parsing. **10 Hours**

Unit – III

Syntax Analysis – 2: Reduction, Handle pruning, Shift reduce parsing, Conflicts during shift reduce parsing, Introduction to LR Parsing: Simple LR; LR parsing algorithm, Constructing SLR parsing tables, Constructing SLR parsing tables, Using ambiguous grammars; Parser Generators. **10 Hours**

Unit – IV

Syntax-Directed Translation and Intermediate Code Generation Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Syntax-directed translation schemes.

Intermediate Code Generation: Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch statements; Procedure calls. **11 Hours**

Unit - V

Run-Time Environments and Code Generation Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

Code Generation: Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator.

11 Hours

Text Books:

1. Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2011.

Reference Books:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 2009.
2. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 2009.
3. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning, 2011.

Course outcomes

After learning all the units of the course, the student is able to

CO 1. Identify the tools used in various phases of compiler.

CO 2. Apply different top down parsing techniques for context free grammar.

CO 3. Apply different bottom up parsing techniques for context free grammar.

CO 4. Develop syntax directed definition and convert the abstract syntax tree to intermediate code.

CO 5. Analyze different code generation techniques for code optimization

Course Articulation Matrix

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	1	1										1		
CO 2	3												2		
CO 3	3												2		
CO 4	2	2	3										2		
CO 5	2	2	3										2		