Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology

Vidyanagari, Baramati, Dist. – Pune 413133
An Autonomous Institute Approved by AICTE and affiliated to SPPU,Pune

Department of Computer Engineering

VPKBIET

Curriculum Structure and Syllabus of T. Y. B. Tech Computer Engineering (Course 2023)

With effective from Academic Year 2025-26

INSTITUTE VISION AND MISSION

VISION

To achieve Academic Excellence through Persistent and Synergic Collaborations amongst all Stakeholders.

MISSION

1. To ensure holistic development of students as lifelong learners and problem solvers through value based quality education.

2. To motivate faculty to attain the state-of-the-art knowledge and wisdom in their domain and be a facilitator towards co- creation of knowledge

3. To frame and deploy conducive and empowering policies for multifaceted growth of students, faculty and staff to make them contributors towards excellence.

4. To partner with industry for mutually beneficial relations to generate employable and deployable workforce.

5. To fulfill the aspirations of alumni, parents, society, region and nation at large by generating technically competent.

DEPARTMENT VISION AND MISSION

VISION

To achieve excellence in the field of Computer Engineering with consistent and collaborative efforts of every individual

MISSION

1. To develop students with fundamental advanced tools and technologies to work as skilled Computer professionals with ethical values.

2. To promote faculty for higher education and expose them to current trends to enrich educational quality.

3. To provide appropriate environment with required resources to achieve academic excellence.

4. To develop hand-in-hand relations with industries for catering institute-industry needs.

5. To apply collaborative efforts to make students competent to provide solutions to social problems.

Program Specific Outcomes (PSO)

PSO1: Professional Skills

- The ability to understand, analyse and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying.

PSO2: Problem-Solving Skills

- The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO3: Successful Career and Entrepreneurship

- The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

Program Educational Objectives (PEO)

1. Students will be able to apply the fundamentals, domain knowledge and modern technology of computer engineering to a provide effective and innovative solutions to engineering problems

2. Students will be able to solve societal challenging and multidisciplinary problems applying suitable resources

3. Students will be able to work as competent professional as an individual and a team member

Program Outcomes (POs)

Learners are expected to know and 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 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 Skills	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 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.



Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology
Board of Studies : Computer Engineering

Syllabus: Third Year (TY B. Tech.) Computer Engineering
w.e.f. AY:2025-2026 (2023 Pattern)

SEMESTER-V

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits				
		TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	OR	TUT	Total
CO23301	Theory of Computation	3	-	1	10	30	60	30	-	-	130	3	-	-	1	4
CO23302	Computer Networks	3	2	-	10	30	60	-	30	-	130	3	1	-	-	4
CO23303	Program Elective Course-I	3	2	-	10	30	60	-	-	30	130	3	1	-	-	4
CO23052	Multi-disciplinary minor	2	2	-	20	20	50	20	-	-	110	2	1	-	-	3
HS23301	Universal Human Values and Professional Ethics	2	-	-	10	-	60	-	-	-	70	2	-	-	-	2
OE230XX	Open Elective	2	-	-	-	-	50	-	-	-	50	2	-	-	-	2
CO23304	Community Engineering. Project/Field Project	-	4	-	10	-	-	30	-	30	70		2	-	-	2
HS23302	Constitution of India	1	-	-	-	-	GR	-	-	-	GR	-	-	-	-	AU
Total		15	10	1	70	110	340	80	30	60	690	15	5	0	1	21

Code	Program Elective-I
CO23303A	Web Technology
CO23303B	Artificial Intelligence
CO23303C	Internet of Things

TH: Theory PR : Practical TUT : Tutorial CAA : Continuous Activity Assessment , ISE : In Semester Examination , ESE : End Semester Examination TW : Term-Work , OR : Oral ,GR: Grade, AU: Audit Course

Dept. Autonomy Coordinator
Mr. M. D. Shelar

Academic Coordinator
Dr. P. M. Paithane

Head of Department
Dr. G. J. Chhajed

Dean Autonomy
Dr. C. B. Nayak

Dean Academic
Dr. S. M. Bhosle

Principal
Dr. S. B. Lande

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Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

SEMESTER-VI

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits				
		TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	OR	TUT	Total
CO23311	Machine Learning	3	2	-	10	30	60	-	30	-	130	3	1	-	-	4
CO23312	Program Elective Course-II	3	2	-	10	30	60	-	-	30	130	3	1	-	-	4
CO23313	Program Elective Course-III	3	2	-	10	30	60	-	-	30	130	3	1	-	-	4
MD230XX	Multi-disciplinary minor	2	2	-	20	20	50	20	-	-	110	2	1	-	-	3
HS23311	Environmental Studies	2	-	-	10	-	60	-	-	-	70	2	-	-	-	2
OE230XX	Open Elective	2	-	-	-	-	50	-	-	-	50	2	-	-	-	2
CO23314	Java Programming	-	4	-	10	-	-	30	30	-	70	-	2	-	-	2
HS23312	Democracy, Election, and Governance	1	-	-	-	-	GR	-	-	-	GR	-	-	-	-	AU
Total		15	12	-	70	110	340	50	60	60	690	15	6	-	-	21

Code	Program Elective-II
CO23312A	Cloud Computing
CO23312B	Compilers
CO23312C	Image Processing

Code	Program Elective-III
CO23313A	Business Intelligence
CO23313B	Object Oriented Modeling and Design
CO23313C	Software Testing and Quality Assurance

TH: Theory PR : Practical TUT : Tutorial CAA : Continuous Activity Assessment , ISE : In Semester Examination , ESE : End Semester Examination TW : Term-Work , OR : Oral ,GR: Grade, AU: Audit Course

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Semester I

CO23301 : Theory of Computation

Teaching Scheme		Credit: 04	Examination Scheme	
TH	03 Hrs/Week		CAA:	10 Mark
TUT	01 Hrs/Week	TH Credit :03 PR Credit :01	In Semester:	30 Mark
			End Semester:	60 Mark
			Term work:	30 Mark

Prerequisite: Discrete Mathematics, Problem solving knowledge

Course Objective:

- To make students understand the concept of language.
- To make students aware about the representation of languages in Computer.
- To make students compatible to construct Grammar, PDA's and Turing Machine
- To introduce students to the complexity word along with problem classes.

Course Outcomes:

CO1: **Design** of finite automata for the formal language.
CO2: **Construction** of regular expression for the regular language and design it's equivalent FA.
CO3: **Design** context free grammar, apply simplification and generate context free language.
CO4 : **Construct** Pushdown Automaton model for the Context Free Language
CO5: **Design** of Turing Machine for the computational problems.
CO6: **Understand** the different classes of problem and NP-completeness

Course Activity (Any one):

- Writing Context free grammar for any Indian language simple statement.
- Study of Scanner and Parser Tools eg. Lex or Yacc
- Design parser for checking expression syntax
- Preparation of charts describing Regular Expression operators and algebraic laws of RE

Course Contents

Mapping of Course Outcomes for Unit I	CO1	
UNIT I	**Introduction to Language and Finite Automata**	**07 Hours**

Strings and languages: Symbol, Alphabet, String/Word. Formal Language – Definition.
Finite Automata (FA): An informal picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language, Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA and inter-conversion.
Moore and Mealy machines –Definition, Design, Inter-conversion.

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Regular Expressions**	**07 Hours**

Introduction, Operators of RE, Precedence of operators, Algebraic laws for RE,
Language to Regular Expressions, Conversions: RE to NFA, DFA, DFA to RE using Arden's theorem, State elimination method, Pumping Lemma for Regular languages, Closure and Decision properties of Regular languages

Mapping of Course Outcomes for Unit III	CO3

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UNIT III	Context Free Language	07 Hours
Introduction to Grammar, Chomsky Hierarchy, formal definition of Context Free Grammar, Sentential form, Derivation and Parse Tree, Ambiguous Grammar, Context Free Language (CFL), writing grammar for language. **Simplification of CFG, Normal Forms**: Chomsky Normal Form and Greibach Normal Form, Closure properties of CFL, Decision properties of CFL		
Mapping of Course Outcomes for Unit IV	**CO4**	
UNIT IV	**Pushdown Automata (PDA)**	**07 Hours**
Introduction to PDA, Formal definition of PDA, Acceptance of PDA by final state and empty stack. Non-deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs. CFL's, Top-down parser, Bottom-up parser		
Mapping of Course Outcomes for Unit V	**CO5**	
UNIT V	**Turing Machines (TM)**	**07 Hours**
Turing Machine Model, Formal definition of Turing Machines, Acceptance by Turing Machines, Design of TM, Description of TM, Techniques for TM Construction, Computing function with Turing Machine, **Variants of Turing Machines**: Multi-tape Turing machines, Nondeterministic Turing machines, **Halting Problem** of Turing Machine, Halting vs. Looping, Turing unrecognizable language		
Mapping of Course Outcomes for Unit VI	**CO6**	
UNIT VI	**Computability and Complexity Theory**	**06 Hours**
Computability Theory: Decidable Problems and Un-decidable Problems, tractable, intractable problem, Post correspondence problem **Reducibility**: Undecidable Problems that is recursively enumerable, A Simple Un-decidable problem **Complexity Classes**: Time and Space Measures, The Class P, The Class NP, NP-completeness, NP-complete, NP-hard problem.		

Books and Other Resources

Text Books:

1. Vivek Kulkarni, "Theory of Computation", Oxford University Press, ISBN 0-19-808458
2. K. L. P. Mishra, N. Chandrasekaran , "Theory of Computer Science :Automata, Languages and Computation, 3rd Edition, Prentice-Hall India, ISBN-81-203-2968-6

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman,"Introduction to Automata Theory Languages and Computation", Addison-Wesley, ISBN 0-201-44124-1
2. John Martin, "Introduction to Languages and The Theory of Computation", 2nd Edition, McGrawHill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5

NPTEL Course:

1. https://onlinecourses.nptel.ac.in/noc25_cs70/preview
2. https://archive.nptel.ac.in/courses/106/104/106104028/

Guidelines for Term Work Assessment : Term-work will be awarded on following parameters

- Timely submission of tutorial assignments
- Assessment marks awarded to each tutorial
- Theory and Tutorial attendance
- Performance in internal tests and in-semester examination



Tutorial Assignment
Tutorials will be based on the basic concepts covered in five units which includes Mathematical preliminaries (sets, relations, functions, logic), Regular languages and finite automata (DFA, NFA, Regular Expressions), Context-free languages and pushdown automata (CFG, PDA), Turing Machines and decidability. **Guidelines** • Instructor must frame maximum three tutorials on each unit. • Tutorial must include equivalent theory and computational examples. • Case study for the Time complexity and computational problems, NP-Completeness



CO23302 : Computer Networks

Teaching Scheme:	Credit: 04	Examination Scheme:
TH: 03 Hrs/Week PR: 02 Hrs/Week	TH Credit :03 PR Credit :01	CAA: 10Mark In Semester : 30Mark End Semester : 60 Mark Practical : 30 Mark

Prerequisite: Students are expected to have a good understanding of Discrete Mathematics.

Course Objective:

- To understand the fundamental concepts of networking standards, protocols and technologies.
- To understand knowledge of data link layer architecture
- To learn the basics of networking address and routing algorithms used in networks..
- To learn different layer protocols in the protocol stacks
- To understand modern network architectures with respect to design and performance

Course Outcomes:

1. Demonstrate the concepts of data communication at the physical layer and compare ISO - OSI model with TCP/IP model.
2. Elaborate the error control mechanism and medium access control sublayer of data link layer
3. Design the network using IP addressing and subnetting / supernetting schemes
4. Analyze transport layer protocols and congestion control algorithms.
5. Illustrate the role of the application layer with its protocol.
6. Describe the role of Artificial Intelligence in Networking

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

1. Mini Project
2. Survey Report
3. Industry Visit
4. Seminar
5. Research Paper

Course Contents

Mapping of Course Outcomes for Unit I		CO1
UNIT I	**Introduction to Computer Network**	**07 Hours**

Introduction: Goals and applications of networks, Categories of networks, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components.

Physical Layer: Network topology design, Types of connections, Transmission media, Line Coding- Manchester and Differential Manchester, Network performance, Switching techniques

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Data Link Layer and Medium Access Control Sublayer**	**08 Hours**

Introduction and Design Issues, Flow and Error Control, Techniques for Error Detection and Correction, Parity Bits, Hamming Code(11/12-bits) and CRC. Simplex, Stop and Wait, Sliding Window Protocol.
Random Access Protocols (ALOHA, CSMA, CSMA/CD, CSMA/CA).
Introduction to Ethernet IEEE 802.3, IEEE 802.11 a/b/g/n, IEEE 802.15 Standards

Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Network Layer**	**08 Hours**

Network Layer: Point-to-point networks, IP Protocol: Classes of IP (Network Addressing), IPv4, IPv6, subnetting, Network Address Translation (NAT).
Basic internetworking (CIDR, ARP, RARP, DHCP, ICMP,IGMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms.
Routing in MANET: AODV, DSR, Mobile IP

Mapping of Course Outcomes for Unit IV	CO4	
UNIT IV	**Transport Layer**	**07 Hours**

Transport Layer: Process-to-process delivery, Transport layer protocols with Header format (UDP, TCP and SCTP), Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.
Socket Programming: TCP and UDP Connection

Mapping of Course Outcomes for Unit V	CO5	
UNIT V	**Application Layer**	**06 Hours**

HyperText Transport Protocol (HTTP), Cookies, Simple Mail Transport Protocol (SMTP),MIME, POP3, File Transfer Protocol (FTP).
Introduction to various Types of Servers, Dynamic Host Configuration Protocol (DHCP): Header, Working, Domain Name Server (DNS): Working, Proxy Server: Need and Significance, working.

Mapping of Course Outcomes for Unit VI	CO6	
UNIT VI	**Artificial Intelligence in Networking**	**06 Hours**

Distributed Computing Network, Necessity of Artificial Intelligence in Networking, Artificial Intelligence Network Challenges and Solution, Load Balancing using AI, AI datacenter Network, AI Cluster Network, AI GPU Network, Artificial Intelligence tool used in Networking.
Case Study: Banking Application Networking , Education Institute Networking, Network Provider for Small city

Books and Other Resources

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Text Books:

1. Behrouz Forouzan, "Data Communication and Networking", McGraw Hill
2. Andrew Tanenbaum "Computer Networks", Prentice Hall.

Reference Books:

1. William Stallings, "Data and Computer Communication", Pearson.
2. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.
3. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann
4. W. A. Shay, "Understanding Communications and Networks", Cengage Learning.
5. D. Comer, "Computer Networks and Internets", Pearson.
6. Behrouz Forouzan, "TCP/IP Protocol Suite", McGraw Hill.

Guidelines for Practical Examination:

Problem statements will be formed based on assignments and performance will be evaluated by the Internal and External Examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation..

Guidelines for Laboratory Conduction: Use of open source software is encouraged. Based on the concepts learned. Operating System recommended: - 64-bit Open source Linux or its derivative Programming

Tools recommended: - C, C++,Java, Python, Wireshark, Packet Tracer, Juniper, Arista

Practical Assignments

1. Demonstrate the different types of topologies and types of transmission media by using a packet tracer tool.
2. Demonstrate transfer of a packet from LAN 1(wired LAN) to LAN2(wireless LAN) using switch or router and basic networking commands like ipconfig, netstat, trace, traceroute, lookup, ping.
3. Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC
4. Write a program to simulate Go Back N and Selective Repeat Modes of Sliding Window Protocol in Peer-to-Peer mode.
5. Write a program to demonstrate subnetting and find subnet masks and analyze IP addressing using Wireshark tool.
6. Write a program to implement link state/ Distance vector/Kruskal's minimum spanning tree routing protocol to find a suitable path for transmission.

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7. Use a packet tracer tool for configuration of 3 router network using one of the following protocol RIP/OSPF/BGP

8. Write a program using TCP socket for wired network for the following:
   a. Say Hello to Each other
   b. File Transfer
   c. Calculator

9. Write a program for DNS lookup. Given an IP address as input, it should return URL and vice-versa

10. Demonstrate configuration of DHCP Server and Firewall using packet tracer tool.



CO23303A : Web Technology

Teaching Scheme:	Credit: 04	Examination Scheme:
TH: 03 Hrs/Week	TH Credit :03	CAA: 10 Mark
PR: 02 Hrs/Week	OR Credit :01	In Semester: 30 Mark
		End Semester: 60 Mark
		Term Work : 30 Mark

Prerequisite: Students Database Management Systems, Computer Networks

Course Objective:

- To learn the fundamentals of web essentials and markup languages
- To use the Client side technologies in web development
- To use the Server side technologies in web development
- To understand the web services and frameworks

Course Outcomes:

1. Implement and analyze behavior of web pages using HTML and CSS
2. Apply the client side technologies for web development
3. Analyze the concepts of Servlet and JSP
4. Analyze the Web services and frameworks
5. Apply the server side technologies for web development
6. Create the effective web applications for business functionalities using latest web development platforms

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

1. Web Technology Mini Project
2. Survey on uses of web Technologies with emerging technology presentation
3. Industry Visit
4. Seminar
5. Research Paper in Web programming domain

Course Contents

Mapping of Course Outcomes for Unit I		CO1
UNIT I	**Web Essentials and Mark-up language- HTML**	**07 Hours**

The Internet, basic internet protocols, the World Wide Web, HTTP Request message, HTTP response message, web clients, web servers.HTML: Introduction, history and versions.HTML elements: headings, paragraphs, line break, colors and fonts, links, frames, lists, tables, images and forms, Difference between HTML and HTML5. CSS: Introduction to Style Sheet, CSS features, CSS core syntax, Style sheets and HTML, Style rule cascading and inheritance, text properties. Bootstrap.

Mapping of Course Outcomes for Unit II		CO2
UNIT II	**Client Side Technologies: JavaScript and DOM**	**07 Hours**

JavaScript: Introduction to JavaScript, JavaScript in perspective, basic syntax, variables and data types, statements, operators, literals, functions, objects, arrays, built in objects, JavaScript debuggers. **DOM:**

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Introduction to Document Object Model, DOM history and levels, intrinsic event handling, modifying element style, the document tree, DOM event handling, jQuery

Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Java Servlets and XML**	**07 Hours**

Servlet: Servlet architecture overview, A "Hello World" servlet, Servlets generating dynamic content, Servlet life cycle, parameter data, sessions, cookies, URL rewriting, other Servlet capabilities, data storage, Servlets concurrency, databases (MySQL) and Java Servlets. **XML**: XML documents and vocabularies, XML declaration, XML Namespaces, DOM based XML processing, transforming XML documents, DTD: Schema, elements, attributes. **AJAX**: Introduction, Working of AJAX.

Mapping of Course Outcomes for Unit IV	CO4	
UNIT IV	**JSP and Web Services**	**07Hours**

JSP: Introduction to Java Server Pages, JSP and Servlets, running JSP applications, Basic JSP, JavaBeans classes and JSP, Support for the Model-View-Controller paradigm, JSP related technologies. **Web Services**: Web Service concepts, Writing a Java Web Service, Writing a Java web service client, Describing Web Services: WSDL, Communicating Object data: SOAP. **Struts**: Overview, architecture, configuration, actions, interceptors, result types, validations, localization, exception handling, annotations.

Mapping of Course Outcomes for Unit V	CO5	
UNIT V	**Server Side Scripting Languages**	**07 Hours**

PHP: Introduction to PHP, uses of PHP, general syntactic characteristics, Primitives, operations and expressions, output, control statements, arrays, functions, pattern matching, form handling, files, cookies, session tracking, using MySQL with PHP, WAP and WML. **Introduction to ASP.NET**: Overview of the .NET Framework, Overview of C#, Introduction to ASP.NET, ASP.NET Controls, Web Services. Overview of Node JS.

Mapping of Course Outcomes for Unit VI	CO6	
UNIT VI	**AngularJS, ReactJS**	**07 Hours**

Introduction To AngularJS : Features, Angular Application Architecture, Data Binding, Directives, Template Routing, Angular Forms, Services,
Introduction to ReactJS : ReactJSLibrary & directory , React Components , Build a simple React component , Component composition , styling , Routing to create single page app , Hooks, States , Redux , React Bootstrap , Introduction to EJB.

Books and Other Resources

Text Books:

1. Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035
2. Robert W. Sebesta," Programming the World Wide Web", 4th Edition, Pearson education, 2008

Reference Books:

1. Marty Hall, Larry Brown, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.

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Edition, Pearson Education, 2006, ISBN 978-0131752429.

3. Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India, 2006.
4. Xue Bai et al, "The web Warrior Guide to Web Programming", Thomson, 2003.

e-Books:

1. https://www.w3.org/html/
2. HTML, The Complete Reference http://www.htmlref.com/
3. http://w3schools.org/
4. http://php.net/
5. https://jquery.com/
6. http://www.tutorialspoint.com/css/

Guidelines for Term Work Assessment:

Term work assessment will be based on overall performance of Laboratory assignments performed by a students. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, efficient codes, and punctuality.

Guidelines for Practical Examination:

Problem statements will be formed based on assignments and performance will be evaluated by Internal and External Examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation..

Guidelines for Laboratory Conduction :

Use of open source software is encouraged. Based on the concepts learned.
Operating System recommended:- 64-bit Open source Linux or its derivative Programming
Mini project should be implemented by the students in a group of 2-3 students.

Practical Assignments

1. Case study: Before coding of the website, planning is important, students should visit different websites (Min. 5) for the different client projects and note down the evaluation results for these websites, either good website or bad website in following format: From the evaluation, students should learn and conclude different website design issues, which should be considered while developing a website

2. Implement a web page index.htm for any client website (e.g., a restaurant website project) using following:
   a. HTML syntax: heading tags, basic tags and attributes, frames, tables, images, lists, links for text and images, forms etc.
   b. Use of Internal CSS, Inline CSS, External CSS

3. Design the XML document to store the information of the employees of any business organization and demonstrate the use of:
   a) DTD
   b) XML Schema And display the content in (e.g., tabular format) by using CSS/XSL.

4. Implement an application in Java Script using following:
   a) Design UI of application using HTML, CSS etc.



b) Include Java script validation

c) Use of prompt and alert window using Java Script

e.g., Design and implement a simple calculator using Java Script for operations like addition, multiplication, subtraction, division, square of number etc.

5. Implement the sample program demonstrating the use of Servlet.
   e.g., Create a database table ebookshop (book_id, book_title, book_author, book_price, quantity) using database like Oracle/MySQL etc. and display (use SQL select query) the table content using servlet.

6. Implement the program demonstrating the use of JSP.
   e.g., Create a database table students_info (stud_id, stud_name, class, division, city) using database like Oracle/MySQL etc. and display (use SQL select query) the table content using JSP.

7. Build a dynamic web application using PHP and MySQL.
   a. Create database tables in MySQL and create connection with PHP.
   b. Create the add, update, delete and retrieve functions in the PHP web app interacting with MySQL database

8. Design an application using Angular JS.
   e.g., Design registration (first name, last name, username, password) and login page using Angular JS.

9. Design and implement a business interface with necessary business logic for any web application using EJB. e.g., Design and implement the web application logic for deposit and withdraw amount transactions using EJB.

10. Mini Project: Design and implement a dynamic web application for any business functionality by using web development technologies that you have learnt in the above given assignments



CO23303B : Artificial Intelligence

Teaching Scheme:	Credit: 04	Examination Scheme:
TH: 03 Hrs/Week	TH Credit :03	CAA: 10 Mark
PR: 02 Hrs/Week	PR Credit :01	In Semester: 30 Mark
		End Semester: 60 Mark
		Oral : 30 Mark

Prerequisite: Programming and Problem solving, Data Structures and Algorithms

Course Objective:

- To understand the concept of Artificial Intelligence (AI) in the form of various Intellectual tasks
- To understand Problem Solving using various peculiar search strategies for AI
- To understand multi-agent environment in competitive environment
- To acquaint with the fundamentals of knowledge and reasoning
- To devise plan of action to achieve goals as a critical part of AI
- To develop a mind to solve real world problems unconventionally with optimality

Course Outcomes:

1. Identify and apply suitable Intelligent agents for various AI applications
2. Build smart system using different informed search / uninformed search or heuristic approaches
3. Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem
4. Apply the suitable algorithms to solve AI problems
5. Implement ideas underlying modern logical inference systems
6. Represent complex problems with expressive yet carefully constrained language of representation

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

1. Implement a AI Model
2. AI in Games – Implement a Simple Game AI
3. AI Ethics and Bias Case Study
4. Industry Visit
5. Research and Presentation on AI Trends

Course Contents

Mapping of Course Outcomes for Unit I		CO1
UNIT I	**Introduction**	**07 Hours**

Introduction to Artificial Intelligence, Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risks and Benefits of AI, Intelligent Agents, Agents and Environments, Good Behavior: Concept of Rationality, Nature of Environments, Structure of Agents

Mapping of Course Outcomes for Unit II		CO2
UNIT II	**Problem-solving**	**07 Hours**

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Solving Problems by Searching, Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions, Search in Complex Environments, Local Search and Optimization Problems.

Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Adversarial Search and Games**	**07 Hours**

Game Theory, Optimal Decisions in Games, Heuristic Alpha–Beta Tree Search, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction Problems (CSP), Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs.

Mapping of Course Outcomes for Unit IV	CO4	
UNIT IV	**Knowledge**	**07Hours**

Logical Agents, Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic, First-Order Logic, Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.

Mapping of Course Outcomes for Unit V	CO5	
UNIT V	**Reasoning**	**07 Hours**

Inference in First-Order Logic, Propositional vs. First-Order Inference, Unification and First-Order Inference, Forward Chaining, Backward Chaining, Resolution, Knowledge Representation, Ontological Engineering. Categories and Objects, Events, Mental Objects and Modal Logic, Reasoning Systems for Categories, Reasoning with Default Information

Mapping of Course Outcomes for Unit VI	CO6	
UNIT VI	**Planning**	**07 Hours**

Automated Planning, Classical Planning, Algorithms for Classical Planning, Heuristics for Planning, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Time, Schedules, and Resources, Analysis of Planning Approaches, Limits of AI, Ethics of AI, Future of AI, AI Components, AI Architectures.

Books and Other Resources

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third edition, Pearson, 2003, ISBN :10: 0136042597
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education(India), 2013, ISBN : 978-1-25-902998-1
3. Elaine Rich, Kevin Knight and Nair, "Artificial Intelligence", TMH, ISBN-978-0-07- 008770-5

Reference Books:

1. Nilsson Nils J , "Artificial Intelligence: A new Synthesis", Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4
2. Patrick Henry Winston, "Artificial Intelligence", Addison-Wesley Publishing Company, ISBN: 0-201-53377-4
3. Andries P. Engelbrecht-Computational Intelligence: An Introduction, 2nd Edition-Wiley India-

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ISBN: 978-0-470-51250-0
4. Dr. Lavika Goel, "Artificial Intelligence: Concepts and Applications", Wiley publication, ISBN: 9788126519934
5. Dr. Nilakshi Jain, "Artificial Intelligence, As per AICTE: Making a System Intelligent", Wiley publication, ISBN: 9788126579945

e-Book :

1. https://cs.calvin.edu/courses/cs/344/kvlinden/resources/AIMA-3rd-edition.pdf
2. https://www.cin.ufpe.br/~tfl2/artificial-intelligence-modern-approach.9780131038059.25368.pdf
3. http://aima.cs.berkeley.edu/

MOOCs Courses link:

1. https://nptel.ac.in/courses/106/102/106102220/
2. https://nptel.ac.in/courses/106/105/106105077/
3. https://nptel.ac.in/courses/106/105/106105078/
4. https://nptel.ac.in/courses/106/105/106105079/

Guidelines for Term Work Assessment:

Term work assessment will be based on overall performance of Laboratory assignments performed by a students. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, efficient codes, and punctuality.

Guidelines for Practical Examination:

Problem statements will be formed based on assignments and performance will be evaluated by Internal and External Examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation..

Guidelines for Laboratory Conduction:

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended :- 64-bit Windows OS and Linux

Programming tools recommended: - Python with latest version, Anaconda, Jupyter Nootbook, Visual Studio, Pycharm etc.

Practical Assignments

1. Implement depth first search algorithm and Breadth First Search algorithm, Use an undirected graph and develop a recursive algorithm for searching all the vertices of a graph or tree data structure.
2. Implement **Breadth-First Search (BFS)** for an **8-puzzle game**.
3. Implement A star Algorithm for any game search problem.
4. Develop an elementary catboat for any suitable customer interaction application.

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5. Implement a solution for a Constraint Satisfaction Problem (CSP) using Branch and Bound and Backtracking for n-queens problem.
6. Implement any one of the following Expert System
   I. Information management
   II. Hospitals and medical facilities
   III. Help desks management
   IV. Employee performance evaluation
   V. Stock market trading
   VI. Airline scheduling and cargo schedules etc.



CO23303C: Internet of Things

Teaching Scheme:	Credit: 04	Examination Scheme:
TH: 03 Hrs/Week	TH Credit :01	CAA: 10 Mark
PR: 02 Hrs/Week	PR Credit :01	In Semester: 30 Mark
		End Semester: 60 Mark
		Oral : 30 Mark

Prerequisites Courses: Digital Electronics and Logic Design

Companion Course, if any: - Internet of Things Laboratory

Course Objectives:

- To understand fundamentals of Internet of Things (IoT) and Embedded Systems
- To learn advances in Embedded Systems and IoT
- To learn methodologies for IoT application development
- To learn the IoT protocols, cloud platforms and security issues in IoT
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples.

Course Outcomes:

On completion of the course, learner will be able to–

1. Understand the fundamentals and need of Embedded Systems for the Internet of Things
2. Apply IoT enabling technologies for developing IoT systems
3. Apply design methodology for designing and implementing IoT applications
4. Analyze IoT protocols for making IoT devices communication
5. Design cloud based IoT systems
6. Design and Develop secured IoT applications

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activities for course coordinator

1. Mini Project (Arduino UNO/ Raspberry Pi)
2. Industry Visit
3. Seminar
4. Research Paper in Embedded system and internet of things domain

Course Contents

Unit I **Introduction to Embedded Systems** **(07 Hours)**

Definition, Characteristics of Embedded System, Real time systems, Real time tasks. **Processor basics**: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.

Unit II **Introduction to IOT** **(07 Hours)**

Introduction to Internet of Things (IoT): Definition, Characteristics of IoT, Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks. **Physical Design of IoT**: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog / Digital Conversion. **Logical Design of IoT**: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT.

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Unit III	IoT: Design Methodology	(07 Hours)
IoT Design Methodology: Steps, Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT Communication Models and IoT Communication APIs, Sensor Networks, Four pillars of IoT: M2M, SCADA, WSN, RFID.		
Unit IV	**IoT: Protocols**	**(07 Hours)**
Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Zigbee Architecture. **IP based Protocols**: MQTT (Secure), 6LoWPAN, LoRa.		
Unit V	**IoT: Cloud Platforms**	**(07 Hours)**
Software Defined Networking, Introduction to Cloud Storage Models, Communication API. **WAMP**: Auto Bahn for IoT, Xively Cloud for IoT. **Python Web Application Framework**: Django Architecture and application development with Django, Amazon Web Services for IoT, Sky Net IoT Messaging Platform, RESTful Web Service		
Unit VI	**Security in IoT**	**(07 Hours)**
Introduction, Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling. **Key elements of IoT Security**: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications, Lightweight cryptography.		

Learning Resources

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.
2. Lyla B. Das, "Embedded Systems: An Integrated Approach" Pearson , ISBN: 9332511675, 9789332511675
3. Olivier Hersent, David Boswarthick, and Omar Elloumi, —The Internet of Things: Key Applications and Protocols, Wiley Publications
4. Vijay Madisetti and Arshdeep Bahga, —Internet of Things (A Hands-On-Approach), 1st Edition, VPT, 2014.

Reference Books:

1. Sriram V. Iyer, Pankaj Gupta, "Embedded Real-time Systems Programming", Tata McGraw-Hill, ISBN: 13: 9780070482845
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Charles Crowell, "IoT-Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT", ISBN-13: 979-8613100194
4. David Etter, "IoT Security: Practical guide book", amazon kindle Page numbers, source ISBN: 1540335011.
5. Brian Russell, Drew Van Duren, "Practical Internet of Things Security", Second Edition Packt Publishing, ISBN: 9781788625821
6. Dr. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, "Internet of Things", Wiley publication, 2nd Edition, ISBN: 9789388991018

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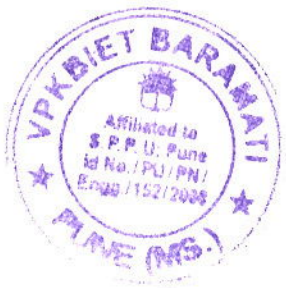
eBooks :

- https://www.iotforall.com/ebooks/an-introduction-to-iot
- https://www.qorvo.com/design-hub/ebooks/internet-of-things-for-dummies

MOOCs Courses link

- https://nptel.ac.in/courses/106/105/106105166/
- https://www.udemy.com/course/a-complete-course-on-an-iot-system-design-and-development/
- https://www.coursera.org/learn/iot

https://nptel.ac.in/courses/108/108/108108098/



HS23301 Universal Human Values and Professional Ethics			
Teaching Scheme	**Credit: 02**	**Examination Scheme**	
TH 02 Hrs/Week		CAA:	10 Mark
		End Semester:	60 Mark
	TH Credit :02	Total	70 Mark

Course Objective:

This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education professional ethics to the young enquiring minds

Course Outcomes:

At the end of the course, students will be able

CO1: To become more aware of themselves, aspirations in life, happiness and prosperity

CO2: To handle problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: To become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

CO4: To develop harmony with nature

CO5: To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Course Contents

Mapping of Course Outcomes for Unit I		**CO1 CO2**
UNIT I	**Introduction to Value Education**	**05 Hours**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Mapping of Course Outcomes for Unit II		**CO3**
UNIT II	**Harmony in the Human Being**	**05 Hours**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

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Mapping of Course Outcomes for Unit III		CO4
UNIT III	**Harmony in the Family and Society**	**05 Hours**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Mapping of Course Outcomes for Unit IV		CO5
UNIT IV	**Harmony in the Nature/Existence**	**05 Hours**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Mapping of Course Outcomes for Unit V		CO6
UNIT V	**Implications of the Holistic Understanding – a Look at Professional Ethics**	**05 Hours**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Books and Other Resources

Text Books:

3. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
4. The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
5. Professional Ethics and Human Values, Premvir Kapoor, Khanna Book Publishing

Reference Books:

3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
5. The Story of Stuff (Book).
6. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
7. Small is Beautiful - E. F Schumacher.
8. Slow is Beautiful - Cecile Andrews
9. Economy of Permanence - J C Kumarappa
10. Rediscovering India - by Dharampal
11. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
12. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972
13. Limits to Growth – Club of Rome's report, Universe Books.
14. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
15. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
16. A N Tripathy, 2003, Human Values, New Age International Publishers.
17. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.

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18. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
19. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
20. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
21. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Value Education Websites:

- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Ms. Rohini Naik
Course Coordinator

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Dean Autonomy

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Principal
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CO23304: Community Engagement Project

Teaching Scheme:	Credit: 02	Examination Scheme:
PR:04 Hrs/Week		**CAA : 10 Mark** Termwork:30 Marks Oral : 30 Marks

Prerequisite: Students should have prior knowledge of

1. Basic understanding of social and ethical responsibilities
2. Teamwork and communication skills acquired in prior coursework or group activities
3. Familiarity with problem-solving methodologies and project planning
4. Conversation in local language

Companion Course :

1. CEP is an experiential learning approach that combines education, learning, community development, and meaningful community service.
2. The project involves students in community development and service activities and applies the experience to personal and academic development.
3. The targeted contribution of college students to the village/local development will benefit the community.
4. The college has an opportunity to help students become more socially conscious and responsible while simultaneously becoming a socially conscious organization.

Course Objective:

1. To understand social and technological problems in local communities.
2. To develop awareness about the application of computer engineering in society.
3. To provide practical exposure through community interaction and fieldwork.
4. To develop solutions using appropriate computer engineering technologies.
5. To promote teamwork, leadership, and social responsibility.

Course Outcomes:

On completion of this course students will be able to

1. Identify community issues and formulate appropriate project objectives.
2. Conduct community surveys and analyze the requirements of beneficiaries.
3. Design suitable technology-based solutions for identified problems.
4. Implement and demonstrate solutions using appropriate computer engineering technologies.
5. Evaluate the effectiveness and social impact of implemented solutions.

Course Contents

Preamble:

Community Engagement Project (CEP) is an experiential learning approach designed to provide students with opportunities to develop technical knowledge, practical skills, social responsibility, and problem-solving abilities through active engagement with local communities. It enables students to identify, understand, and address authentic social, technological, and environmental challenges faced by communities by applying the concepts and technologies of computer engineering.

The Community Engagement Project goes beyond conventional classroom learning by encouraging students to interact with community members, identify real-life problems, analyze community needs and develop

appropriate technology-based solutions or conduct socially beneficial activities. It emphasizes learning by doing through meaningful participation, collaboration and practical implementation.

Community Engagement Project (CEP) requires regular mentoring and guidance by faculty throughout the semester for the successful completion of activities and project tasks undertaken by students. Students shall work in batches, with each batch divided into sub-groups of 3 to 4 students. Each group shall identify a relevant community problem and surveys, interact with beneficiaries, and undertake suitable activities such as digital literacy, cybersecurity awareness, technology-based solutions, social awareness programmers or community-oriented applications.

The selected community engagement activities and project work shall be carried out throughout the semester under the supervision of assigned faculty mentors. Faculty members involved in CEP shall provide regular guidance, monitor student progress and evaluate project outcomes. Credits for Community Engagement Project shall be awarded based on continuous internal assessment, active community participation, project implementation, documentation, presentation and evaluation at the end of the semester.

Group Structure:
Working in supervisor/mentor monitored groups; the students plan, manage, and complete a task/project/activity which addresses the stated problem.

1. There should be a team/group of 3-4 students
2. A supervisor/mentor teacher assigned to individual groups

Selection of Community Engagement Project / Problem:
The community-based project-oriented learning model is recommended for the Community Engagement Project (CEP). The process begins with identifying real-life problems or challenges faced by local communities, villages, schools, NGOs or other social organizations. Students shall interact with community members, conduct surveys and identify problems that can be addressed through the application of Computer engineering knowledge and technologies.

The identified problems may be social, educational, environmental, technical, agricultural or healthcare-related. Students shall analyse the selected problem and propose suitable solutions using Computer engineering concepts such as programming, web development, mobile applications, database management, Artificial intelligence, IoT and cybersecurity.

The selected project should address a genuine community need and provide practical social benefits. An interdisciplinary approach may be adopted wherever required for analysing and solving the identified problems.

Students are encouraged to use appropriate technologies to investigate community issues, collaborate with stakeholders, analyse collected data, develop solutions and present their outcomes. Activities may include solving real-life community problems, conducting digital literacy and cybersecurity awareness programmes, developing community-oriented software applications, field visits, surveys, case studies and preparation of project reports.

Suggestive list of topics under Community Engagement Project

Community Engagement Projects should focus on specific local issues in the students' nearby areas, and students are expected to carry them out with involvement, commitment, responsibility and accountability.

Mentors may assign a student or a group of students any of the following or any **Community problems**

Health and Wellness

- Health and hygiene of school students, homemakers and the elderly
- Health interventions and awareness programmes
- Healthcare awareness programmes and their impact
- Traditional and modern healthcare methods
- Incidence of diabetes and other chronic diseases
- Blood groups and blood levels
- Yoga awareness and practice

Food and Nutrition

- Food habits
- Herbal remedies and nutrition
- Food adulteration
- Chemicals in daily life

Environment and Agriculture

- Water facilities and drinking water availability
- Air, noise and water pollution
- Plantation and soil conservation
- Horticulture
- Organic farming
- Renewable energy and solar systems

Youth and Society

- Use and misuse of mobile phones
- Career orientation of youth
- Women's education and empowerment
- Music and dance

Guidelines for TW Assessment (40 Marks)

1. Problem Identification and Research (7 Marks)

- 4 Marks: Clear, relevant problem statement supported by surveys and literature.
- 3 Marks: Effective research, including community input and background information.

2. Design and Concept Development (7 Marks)

- 4 Marks: Use of UML/ER/DFD design tools for concept visualization.
- 3 Marks: Practicality in terms of cost effective feasibility and sustainability.

3. Prototyping and Testing (7 Marks)

- 4 Marks: Testing methods, results, and prototype improvements.
- 3 Marks: Documentation of prototyping process (photos, notes).

4. Implementation and Community Engagement (7 Marks)

- 4 Marks: Successful deployment with community interaction, training, and feedback.
- 3 Marks: Modifications based on community feedback.

5. Documentation , Report Writing and IPR/Publication (7 Marks)

- 4 Marks: Clear, organized, and accurate project report with proper citations
- 3 Mark: IPR/Publications.

6. Presentation and Communication (5 Marks)

- 3 Marks: Clear and engaging presentation to stakeholders

Guidelines for OR Assessment (30 Marks)

1. Presentation Structure (10 Marks)

- Clarity & Organization (5 Marks): Clear structure, logical flow from problem to solution.
- Logical Flow (5 Marks): Well-organized content, smooth progression through key points.

2. Technical Understanding (8 Marks)

- Engineering Concepts (4 Marks): Demonstrates deep understanding of applied technology and engineering principles.
- Problem-Solving (4 Marks): Clear explanation of solution and engineering approach.

3. Design & Prototyping (6 Marks)

- Design Explanation (3 Marks): Clear explanation of software design process.
- Prototype/Model Explanation (3 Marks): Functionality and testing outcomes of the prototype.

4. Community Engagement (4 Marks)

- Community Involvement (2 Marks): Explains community feedback and participation.
- Impact (2 Marks): Describes the solution's impact on the community.

5. Response to Questions (2 Marks)

- Confidence & Accuracy (2 Marks): Clear, confident, and accurate answers

Prof. Dr. M. D. Shelar

Dr. G. I. Chhajed

HOD-Comp. Dr. A. M. Jagtap

HS23302 Constitution of India

Teaching Scheme	Credit: Non Credit Audit Course	Examination Scheme	
TH 01 Hrs/Week	TH Credit :NIL	CAA :	NIL
		End Semester:	NIL
		Total	NIL

Course Objective:

The primary objectives of this course are to:

- Familiarize students with the salient features, structure, and significance of the Constitution, including the principles enshrined in the Preamble.
- Provide an understanding of fundamental rights and duties, their scope, significance, and role in ensuring justice, equality, and freedom in a democratic society
- Explain the concept of Directive Principles of State Policy (DPSP) and their role in governance, emphasizing their interrelationship with Fundamental Rights.
- Analyze emergency provisions and constitutional amendments, discussing their implications on Indian democracy and governance.
- Encourage a comparative understanding of the Indian Constitution with other constitutions worldwide, fostering awareness of global governance models.

Course Outcomes:

At the end of the course, students will be able

CO1: Describe the salient features and basic structure doctrine of the Constitution and Interpret the values enshrined in the Preamble

CO2: Comprehend Fundamental Rights and Duties of Indian Citizens

CO3: Analyze the Role of Directive Principles of State Policy (DPSP) in Governance

Course Contents

Mapping of Course Outcomes for Unit I	CO1	
UNIT I	**Introduction to the Constitution of India**	**05 Hours**

Historical Perspective and Making of the Indian Constitution, Salient Features of the Constitution, Preamble and its Significance, Basic Structure of the Constitution

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Fundamental Rights and Duties**	**04 Hours**

Fundamental Rights: Meaning, Scope, and Significance, Right to Equality, Freedom, Protection from Exploitation, Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Fundamental Duties of Indian Citizens

Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Directive Principles and Governance**	**04 Hours**

Directive Principles of State Policy: Meaning and Purpose, Relationship between Fundamental Rights and Directive Principles, Role of Directive Principles in Policy Formulation, Comparison with Other Constitutions

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Books and Other Resources
Text and Reference Books: 6. M. Laxmikanth, Indian Polity, McGraw Hill Education, 6th Edition, 2020. 7. D.D. Basu, Introduction to the Constitution of India, LexisNexis, 25th Edition, 2021. 8. Subhash Kashyap, Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust, 2019. 9. J.N. Pandey, The Constitutional Law of India, Central Law Agency, 2020. 10. Bare Act, Constitution of India, Government of India Publications.
Evaluation and Assessment Since this is an audit course, there is a mandatory internal evaluation which can be based on the following: • Assignments & Reports– Writing about a constitutional provision or case study. • Quiz/MCQs – To test basic understanding of the Constitution. • Group Discussion/Presentation – On relevant topics like Fundamental Rights or Constitutional Amendments

Dr. A. B. Patil
Course Coordinator

Prof R. K. Shastri
BOS Chairman HSS

Dr. C. B. Nayak
Dean Autonomy

Dr. S. M. Bhosle
Dean Academic

Dr. S. B. Lande
Principal

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PUNE (MS.)

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baram
Vidyanagari, Baramati-413133

Semester II

CO23311 : Machine Learning

Teaching Scheme:	Credit: 04	Examination Scheme:	
TH: 03 Hrs/Week	TH Credit :03	CAA:	10 Mark
PR: 02 Hrs/Week	PR Credit :01	In Semester:	30 Mark
		End Semester:	60 Mark
		Practical:	30 Mark

Prerequisite: Programming and Problem Solving (CO23101)
Data Analytics and Visualization Lab (CO23205)

Course Objective:

- To understand the need for Machine learning
- To understand computational statistics in Data Science
- To study and understand regression and classification methods
- To understand the need for multi-class classifiers.
- To learn the working of clustering algorithms
- To learn fundamental neural network algorithms.

Course Outcomes:

On completion of the course, student will be able to–

1. Understand the fundamentals of machine learning and data science.
2. Apply data preprocessing and feature selection techniques.
3. Apply regression techniques and evaluation metrics to build and optimize predictive models.
4. Apply classification algorithms and evaluation metrics to develop and assess predictive models.
5. Apply clustering techniques and association rule mining to analyze patterns and relationships in data.
6. Design a neural network for solving engineering problems.

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

6. Mini Project based on Machine learning
7. Quiz
8. Industry Visit
9. Seminar
10. Research paper

Course Contents

Mapping of Course Outcomes for Unit I	CO1	
UNIT I	**Introduction Machine Learning**	**07 Hours**

Introduction to Machine learning and data science, Life cycle of machine learning, ML vs AI vs Data Science. Types of learning: Supervised, Unsupervised, and semi-supervised, reinforcement learning techniques, **Types of Data** in statistics and machine learning, Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models. Important Elements of Machine Learning: Data formats, Learnability

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Feature Engineering and Statistical Measures**	**07 Hours**

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Concept of Feature, preprocessing of data: Normalization and Scaling, Standardization, Managing missing values, Statistical Measures: Measures of Central Tendency: length, count-based, Mean, Median, Mode, Mid-range, Measures of Dispersion: Range, Variance, Mean Deviation, Standard Deviation, Introduction to Dimensionality Reduction, Principal Component Analysis (PCA), Feature Extraction: Kernel PCA, Local Binary Pattern. Introduction to various Feature Selection Techniques: Sequential Forward Selection, Sequential Backward Selection, Basics and need of hypothesis and hypothesis testing.

Mapping of Course Outcomes for Unit III	**CO3**

UNIT III	**Supervised Regression**	**07 Hours**

Introduction to Regression, Regression Assumptions and Conditions, Bias, Variance, Trade-off, Generalization, Under fitting, Over fitting, Linear Regression, Regularization Techniques : Ridge and Lasso Regression, Logistic Regression, Evaluation Metrics for Regression Models: MSE, RMSE, MAE, R^2 Score, Gradient Descent in Regression, Regression with Categorical Variables (One-Hot Encoding, Dummy Variables), Implementation Using Python.

Mapping of Course Outcomes for Unit IV	**CO4**

UNIT IV	**Supervised Classification**	**07 Hours**

Introduction classification, K-nearest neighbor, Naïve Bayes, Support vector machine, Decision Tree, Random Forest, Ensemble Learning: Bagging, Boosting : XGBoost, Adaboost and Stacking, Binary-vs-Multiclass Classification, Balanced and Imbalanced Multiclass Classification Problems, Variants of Multiclass Classification: One-vs-One and One-vs-All, Evaluation Metrics and Score: Confusion Matrix, Accuracy, Precision, Recall, F1-score, Cross-validation.

Mapping of Course Outcomes for Unit V	**CO5**

UNIT V	**Unsupervised Learning**	**07 Hours**

Introduction, **Clustering** : K-Means, K-medoids, Hierarchical, and Density-based Clustering, Spectral Clustering, **Association Rules**: Apriori Algorithm, FP growth, Evaluation metrics and score: elbow method, extrinsic and intrinsic methods.

Mapping of Course Outcomes for Unit VI	**CO6**

UNIT VI	**Introduction To Neural Networks**	**07 Hours**

Artificial Neural Networks: Single Layer Neural Network, Multilayer Perceptron, Back Propagation Learning, Functional Link Artificial Neural Network, and Radial Basis Function Network, Activation functions, Introduction to Recurrent Neural Networks and Convolutional Neural Networks.

Books and Other Resources

Text Books:

1. Bishop, Christopher M., and Nasser M. Nasrabadi, —Pattern recognition and machine learning,Vol. 4.No. 4. New York: springer, 2006.
2. Ethem Alpaydin, — Introduction to Machine Learning‖, PHI 2nd Edition-2013

Reference Books:

1. David Dietrich, Barry Hiller, Data Science and Big Data Analytics, EMC education services, Wiley publication, 2012, ISBN0-07-120413-X
2. Tom Mitchell, — Machine learning‖, McGraw-Hill series in Computer Science, 1997
3. Shalev-Shwartz, Shai, and Shai Ben-David, —Understanding machine learning: From theory to

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algorithms, Cambridge university press, 2014.

4. Jiawei Han, Micheline Kamber, and Jian Pie, —Data Mining: Concepts and Techniques‖, Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807
5. Hastie, Trevor, et al., —The elements of statistical learning: data mining, inference, and prediction, Vol. 2. New York: springer, 2009.
6. McKinney, —Python for Data Analysis —,O' Reilly media, ISBN : 978-1-449-31979-3
7. Trent hauk, —Scikit-learn‖, Cookbook, Packt Publishing, ISBN: 9781787286382
8. Goodfellow I.,Bengio Y. and Courville, — A Deep Learning‖, MIT Press, 2016

e-Books :

1. Python Machine Learning http://www.ru.ac.bd/wpcontent/uploads/sites/25/2019/03/207_05_01_Rajchka_Using-Python-for-machinelearning-2015.pdf
2. Foundation of Machine Learning: https://cs.nyu.edu/~mohri/mlbook/
3. Dive into Deep Learning: http://d2l.ai/
4. A brief introduction to machine learning for Engineers: https://arxiv.org/pdf/1709.02840.pdf
5. Feature selection: https://dl.acm.org/doi/pdf/10.5555/944919.944968
6. Introductory Machine Learning Nodes : http://lcsl.mit.edu/courses/ml/1718/MLNotes.pdf

MOOC Courses Links:

1. Introduction to Machine Learning : https://nptel.ac.in/courses/106105152
2. Introduction to Machine Learning (IIT Madras): https://onlinecourses.nptel.ac.in/noc22_cs29/prevew
3. Deep learning: https://nptel.ac.in/courses/106106184

Guidelines for Term Work Assessment:

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Assessment of each Laboratory assignment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality, documentation and neatness.

Guidelines for Practical Examination:

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student 's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction:

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy needs to address the average

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students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructors may also set one assignment or mini-project that is suitable to each branch beyond the scope of the syllabus.
Operating System recommended:- 64-bit Open source Linux or its derivative
Programming tools recommended: - C++, Java, Python, Solidity, etc.

Practical Assignments

1. Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform following tasks:
   1. Pre-process the dataset.
   2. Identify outliers.
   3. Check the correlation.
   4. Implement linear regression and random forest regression models.
   5. Evaluate the models and compare their respective scores like R2, RMSE, etc.

   Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-dataset
2. Classify the email using the binary classification method.
   Email Spam detection has two states: a) Normal State – Not Spam, b) Abnormal State – Spam.
   Use K-Nearest Neighbors, Support Vector Machine and Logistic Regression for classification. Analyze their performance and compare the performance.
   Dataset link: The emails.csv dataset on the Kaggle https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv
3. Implement K-Nearest Neighbors algorithm on diabetes.csv dataset. Compute confusion matrix, accuracy, error rate, precision and recall on the given dataset.
   Dataset link : https://www.kaggle.com/datasets/abdallamahgoub/diabetes
4. Use ensemble learning to predict whether a customer will default on a loan based on financial history and demographic data. Compare Bagging, Boosting, and Stacking techniques.
   Use following dataset link :- https://www.kaggle.com/datasets/nikhil1e9/loan-default?resource=download
5. Implement K-Means clustering/ hierarchical clustering on sales_data_sample.csv dataset. Determine the number of clusters using the elbow method.
   Dataset link : https://www.kaggle.com/datasets/kyanyoga/sample-sales-data
6. Implement machine learning model to predict future stock price returns based on Indian Market data from 2000 to 2020 using dataset to analyze ups and downs in the market
   Dataset Link: https://www.kaggle.com/datasets/sagara9595/stock-data
7. Build a machine learning model that predicts the type of people who survived the Titanic shipwreck using passenger data (i.e. name, age, gender, socio-economic class, etc.). Dataset Link: https://www.kaggle.com/competitions/titanic/data
8. Develop application for signature identification by creating your own dataset of your college student

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CO23312A: Cloud Computing

Teaching Scheme:	Credit: 04	Examination Scheme:
TH: 03 Hrs/Week	TH Credit :03	CAA: 10 Mark
PR: 02 Hrs/Week	PR Credit :01	In Semester: 30 Mark
		End Semester: 60 Mark
		Oral: 30 Mark

Prerequisite: Students are expected to have a good understanding of Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

- To provide students with the fundamentals and essentials of cloud computing
- To learn basics of virtualization and its importance in cloud computing
- To understand storage mechanisms and security challenges in cloud environments.
- To explore cloud migration strategies and implementation approaches
- To enable students exploring cloud computing architectures and application
- To analyse emerging trends and the future scope of cloud computing.

Course Outcomes:

CO1: Articulate the main concepts, key technologies and fundamentals of cloud computing.
CO2: Understand virtualization technology in cloud computing
CO3: **Analyze** various data storage techniques and security challenges in cloud environments.
CO4: **Analyze** cloud migration strategies and evaluate their impact on organizations.
CO5: Understand cloud architectures and identify their applicability in different real-world scenarios.
CO6: Explore future trends of cloud computing.

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

11. Mini Project
12. Industry Visit
13. Seminar
14. Research Paper in cloud computing domain
15. Group Discussion

Course Contents

Mapping of Course Outcomes for Unit I	CO1	
UNIT I	**Fundamentals of Cloud Computing**	**07 Hours**

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Types of Clouds, Pros and Cons of Cloud computing

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Virtualization in Cloud Computing**	**07 Hours**

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Introduction to Virtualization Technologies, Types of Virtualization, Virtualization Architecture and Software, Understanding Hyper visors, Types of Hypervisors, Load Balancing and Virtualization, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation, Virtualization Application, Pitfalls of Virtualization.

Mapping of Course Outcomes for Unit III		**CO3**
UNIT III	**Data Storage and Security in Cloud**	**07 Hours**

Data Storage: Introduction to Enterprise Data Storage, Direct Attached Storage, Storage Area Network, Network Attached Storage, Data Storage Management, File System, Cloud Data Stores, Using Grids for Data Storage.

Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing.

Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.

Mapping of Course Outcomes for Unit IV		**CO4**
UNIT IV	**Migrating into a Cloud**	**07Hours**

Introduction, Challenges while migrating to Cloud, Broad approaches to migrating into the cloud, the Seven-step model of migration into a cloud, Migration Risks and Mitigation, Enterprise cloud computing paradigm,

Deployment Models for Enterprise Cloud Computing, Adoption and Consumption Strategies, issues for enterprise applications on the cloud

Mapping of Course Outcomes for Unit V		**CO5**
UNIT V	**Cloud Architectures and Cloud Applications**	**07 Hours**

Amazon Web Services (AWS): Amazon Web Services and Components, Amazon Simple DB, Elastic Cloud Computing (EC2), Amazon Storage System, Amazon Database services (Dynamo DB).

Microsoft Cloud Services: Azure core concepts, SQL Azure, Windows Azure Platform Appliance.

Google Cloud Application: Google App Engine.

Cloud Computing Applications: Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Geosciences: Satellite Image Processing, Business and Consumer Applications: CRM and ERP, Social Networking

Mapping of Course Outcomes for Unit VI		**CO6**
UNIT VI	**Future of Cloud Computing**	**07 Hours**

Future Trends of Cloud Computing, Ten emerging future trends in cloud computing, Next generation networking, Next generation Services, Mobile Cloud Computing, Autonomic Cloud Engine, Multimedia Cloud, Cloud Computing Energy Efficiency, Jungle Computing.

Books and Other Resources

Text Books:

1. Thomas Erl, ZaighamMahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition

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2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach",2010, The McGraw-Hill.

Reference Books:

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. GautamShrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, ISBN: 9788126528097.
5. Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson, OpenStack:Cloud Application Development, Wrox, ISBN :9781119194316.
6. KailashJayaswal, JagannathKallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187

Guidelines for Laboratory Conduction :

Use of open source software is encouraged. Based on the concepts learned.
Operating System recommended:- 64-bit Open source Linux or its derivative Programming
Tools recommended: - Cloud Providers

Practical Assignments

1. To Study of cloud service providers (aws, google & Microsoft-azure)
2. To make spreadsheet and notes using Google drive
3. To demonstration of Software as a service using any cloud provider.
4. To demonstration of Platform as a service using any cloud provider.
5. To demonstration of Storage as a service using any cloud provider.
6. Installation of VMWARE work station & access the tools.
7. To Implement a program for web feed.
8. Creating an Application (Linear Search program) in SalesForce.com using Apex Programming Language.

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CO23312B : Compilers

Teaching Scheme		Credit: 04	Examination Scheme	
TH	03 Hrs/Week		CAA:	10 Mark
PR	02 Hrs/Week	TH Credit :03 PR Credit :01	In Semester:	30 Mark
			End Semester:	60 Mark
			Term work:	00 Mark
			Practical:	30 Mark

Prerequisite: Students are expected to have a good understanding of Computer Organization, Theory of Computer and Operating System

Course Objective:

- To aware about language translation theories and compiler design stages
- To illustrate the various parser configurations
- To exemplify the use of syntax directed translation in intermediate code
- To Understand Storage Management and Control Structure Environment.
- To Learn to develop a Code generator
- To demonstrate the numerous optimization methods used in the creation of different optimizing compilers

Course Outcomes:

CO1: **Design** and **implement** a lexical analyzer using LEX tools
CO2: **Design** and **implement** a syntax analyzer using YACC tools
CO3: **Understand** syntax-directed translation and run-time environment
CO4 : **Generate** intermediate codes for high-level statements.
CO5 : **Generate** machine code using code generator algorithm.
CO6: **Apply** various optimization transformations to improve machine code and execution efficiency

Course Activity:

Implementation of POS tagging for simple sentences written in any Indian Language. (Mini Project which can be carried out in group of 3 students)

Course Contents

Mapping of Course Outcomes for Unit I		CO1
UNIT I	**Basics of Compilers**	**06 Hours**

Introduction to Compiler: Definition, Phases of Compiler, Front End, Back End Introduction to Interpreter, Design issues of Compiler, Symbol table requirement and management

Introduction to Lexical Analysis: Lexical Analysis Tokens, Regular Expressions, Process of Lexical analysis, Block Schematic, Automatic construction of lexical analyzer using LEX, LEX features and specification.

Mapping of Course Outcomes for Unit II		CO2
UNIT II	**Syntax Analysis**	**06 Hours**

Syntax Analysis CFG, top-down and bottom-up parsers, RDP, Predictive parser, SLR, LR(1), LALR parsers, using ambiguous grammar, Error detection and recovery, automatic construction of parsers using YACC

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Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Semantic Analysis**	**06 Hours**

Introduction to Semantic analysis, Need of semantic analysis, type checking and type conversion. Syntax Directed Translation - Attribute grammar, S and L attributed grammar, bottom up and top down evaluations of S and L attributed grammar, Syntax directed translation scheme for – if, if-else statement, Switch- case, while, do -while statements

Mapping of Course Outcomes for Unit IV	CO4	
UNIT IV	**Intermediate Code Generation and Storage Management**	**08 Hours**

Intermediate code - need, types: Syntax Trees, DAG, Three-Address codes: Quadruples, Triples and Indirect Triples, Intermediate code generation of declaration statement and assignment statement

Storage Management – Static, Stack and Heap, Activation Record, static and control links, parameter passing, return value, passing array and variable number of arguments, Static and Dynamic scope,

Mapping of Course Outcomes for Unit V	CO5	
UNIT V	**Code Generation**	**06 Hours**

Code Generation - Issues in code generation, basic blocks, flow graphs, DAG representation of basic blocks, Target machine description, peephole optimization, Register allocation and Assignment, Simple code generator, Code generation from labeled tree

Mapping of Course Outcomes for Unit VI	CO6	
UNIT VI	**Code Optimization**	**06 Hours**

Need for Optimization, local, global and loop optimization, Optimizing transformations, compile time evaluation, common sub-expression elimination, variable propagation, code movement, strength reduction, dead code elimination, DAG based local optimization, Introduction to Data Flow Analysis

Books and Other Resources

Text Books:

1. V Aho, R Sethi, J D Ullman, —Compilers: Principles, Techniques, and Tools", Pearson Edition, ISBN 81-7758-590-8

Reference Books:

1. K Muneeswaran, —Compiler Design", Oxford University press, ISBN 0-19-806664-3
2. J R Levin, T Mason, D Brown, —Lex and Yacc", O'Reilly, 2000 ISBN 81-7366-061-X

Guidelines for Term Work Assessment :

Term work assessment will be based on overall performance of Laboratory assignments performed by students. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, efficient codes, and punctuality.

Guidelines for Practical Examination :

Problem statements will be formed based on assignments and performance will be evaluated by Internal and External Examiner. During practical assessment, maximum weightage should be given to satisfactory knowledge of the practical concepts required to implement it and implementation style. Relevant questions

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may be asked at the time of evaluation to test the student's understanding of the practical fundamentals and implementation platform

Guidelines for Laboratory Conduction :

Use of open source software is encouraged. Based on the concepts learned. Operating System recommended :- 64-bit Open source Linux or its derivative Programming

Tools recommended: - lex, yacc, flex, Python, gcc

Practical Assignments

1. Write a Lex program to count number of words, spaces, tabs, lines, special characters from the given input.
2. Write a Lex program for subset of C. Identify the C token appropriately from the given input.
3. Write a YACC program to perform arithmetic calculations.
4. Write a YACC program to convert simple infix expression into postfix expression.
5. Write a YACC Program to generate three address code for the given arithmetic expression.
6. Write a program in C++/Python/Java to generate machine code using simple code generator algorithm.
7. Write a Program using YACC/C++/Python/Java to apply various optimization transformations to intermediate code.



CO23312C: Image Processing

Teaching Scheme:	Credit:	Examination Scheme:	
Theory: 03 Hours/Week	03	CAA: In Semester: End Semester: Oral:	10 Mark 30 Mark 60 Mark 30 Mark

Prerequisite Courses, if any: Discrete Mathematics

Companion Course, if any: Image Processing Lab

Course Objectives: To make the students understand

- To Understand Digital Image Processing Concepts.
- To Study Various Methods for Image Enhancement using Spatial and Frequency Domain.
- To Learn Classification Techniques for Image Segmentation.
- To Understand Image Compression and Object Recognition.
- To Study Various Image Restoration Techniques.
- To Understand various Medical and Satellite Image Processing Applications.

Course Outcomes: After successfully completing the course, learner will be able to,

1. Apply Relevant Mathematics Required for Digital Image Processing.
2. Apply Special and Frequency Domain Method for Image Enhancement.
3. Apply algorithmic approaches for Image segmentation.
4. Summarize the Concept of Image Compression and Object Recognition.
5. Explore the Image Restoration Techniques.
6. Explore the Medical and Satellite Image Processing Applications.

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activities for course coordinator

1. Mini Project (Using MATLAB/Open CV/ Any other relevant tool)
2. Industry Visit
3. Seminar
4. Research Paper in Image processing domain

Course Contents

Unit I	Introduction to Digital Image Processing	(06Hrs.)

Introduction, Fundamental steps in Digital Image Processing, Components, Elements of visual perception Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, differen Color Models, Image Types, Image File Formats, Component Labeling algorithm. Introduction to OpenCV tool to Open and Display Images using Python or Eclipse C/C++.

Unit II	Image Enhancement	(08 Hrs.)

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Introduction to Image Enhancement and its Importance, Types of Image Enhancement- Spatial Domain Image Enhancement: Intensity Transformations, Contrast Stretching, Histogram Equalization, Correlation and Convolution, Smoothing Filters, Sharpening Filters, Gradient and Laplacian Frequency Domain Image Enhancement: Low Pass filtering in Frequency Domain (Ideal, Butterworth, Gaussian), High Pass filter in Frequency Domain (Ideal, Butterworth, Gaussian).

Unit III	Image Segmentation and Analysis	(08 Hrs.)

Introduction to Image Segmentation and its need. **Classification of Image Segmentation Techniques:** Threshold Based Image Segmentation, Edge Based Segmentation, Edge Detection, Edge Linking, Hough Transform, Watershed Transform, Clustering Techniques, region approach

Unit IV	Image Compression and Object Recognition	(06 Hrs.)

Image Compression: Introduction to Image Compression and its need, Classification of Image Compression Techniques- run-length coding, Shannon Fano coding, Huffman coding, Scalar and vector quantization, Compression Standards-JPEG/MPEG, Video compression.

Object Recognition: Introduction, Computer Vision, Tensor Methods in Computer Vision, Classifications Methods and Algorithm, Object Detection and Tracking, Object Recognition.

Unit V	Image Restoration and Reconstruction	(07 Hrs.)

Introduction, Model of Image degradation, Noise Models, Classification of image restoration techniques, Blind-deconvolution techniques, Lucy Richardson Filtering, Wiener Filtering

Unit VI	Medical and Satellite Image Processing	(07 Hrs.)

Medical Image Processing: Introduction, Medical Image Enhancement, Segmentation, Medical Image Analysis (Images of Brain MRI or Cardiac MRI or Breast Cancer).

Satellite Image Processing: Concepts and Foundations of Remote Sensing, GPS, GIS, Elements of Photographic Systems, Basic Principles of Photogrammetry, Multispectral, Thermal, and Hyper spectral Sensing, Earth Resource Satellites Operating in the Optical Spectrum

Learning Resources

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, —Digital Image processing‖, Pearson Education, Fourth Impression, 2008, ISBN: 978-81-7758-898- 9.
2. A. K. Jain, —Fundamentals of Digital Image Processing‖, PHI, ISBN-978-81- 203- 0929-6.
3. S. Annadurai, R. Shanmugalakshmi, —Fundamentals of Digital Image Processing, Pearson Education, First Edition, 2007, ISBN-8177584790.
4. Boguslaw Cyganek, —Object Detection and Recognition in Digital Images: Theory and Practice, Wiley, First Edition, 2013, ISBN: 978-0-470-97637-1.
5. Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich, Ton Kalker, —Digital Watermarking and Steganography‖, Morgan Kaufmann (MK), ISBN: 978-0-12- 372585-1.
6. 6. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman, —Remote Sensing

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Reference Books:

1. Isaac Bankman, —Handbook of Medical Imaging‖, Academic Press, Second Edition, 2008, ISBN: 9780080559148.
2. Jayaraman, Esakkirajan,Veerakumar, —Digital image processing‖ , , Mc Graw Hill, Second reprint- 2010, ISBN(13): 978-0-07-01447-8, ISBN(10):0-07-014479-6.K. Jain, "Digital Image Processing" - PHI. (R1)
3. Pratt W.K, "Digital Image Processing", Third Edition, John Wiley & Sons, 2001 (R2)

e-Books :

1. https://bookboon.com/en/3d-video-processing-and-transmission-fundamentals-ebook

MOOC / NPTEL Courses:

1. http://nptel.ac.in/courses/117105079.

2. Digital Image Processing, IIT Kharagpur ,Prof. P.K. BiswasLink: https://nptel.ac.in/courses/117105079

3. NPTEL Video Course : NOC:Digital Image ProcessingLink: https://www.digimat.in/nptel/courses/video/117105135/L02.html

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CO23313A : Business Intelligence

Teaching Scheme:	Credit:04	Examination Scheme:
TH : 03Hrs/Week	TH Credit : 03	CAA : 10 Marks
PR : 02Hrs/Week	PR Credit : 01	In Semester: 30Marks
		End Semester: 60 Marks
		Oral: 30 Marks

Prerequisite: Students are expected to have a good understanding of Database Management System, Data Science & Big data Analytics, Machine Learning

Course Objective:

- To introduce the fundamentals and elements of Business Intelligence (BI).
- To assess the technologies supporting BI, including data warehousing and OLAP.
- To recognize the architectural framework of BI systems.
- To explain various data preprocessing methods.
- To select appropriate machine learning models based on business requirements.
- To explore BI applications in marketing, logistics, finance, and telecommunications.

Course Outcomes: On completion of the course, student will be able to–

CO1: Distinguish between Decision Support Systems (DSS) and Business Intelligence (BI).
CO2: Utilize Data Warehousing and BI Architecture to develop a BI system.
CO3: Create visual reports and dashboards.
CO4: Apply various data preprocessing techniques to datasets.
CO5: Implement machine learning models based on business requirements.
CO6: Analyze the role of BI in marketing, logistics, finance, and telecommunications.

Course Activity :

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

16. Mini Project using BI tools
17. Seminar
18. Research Paper in BI
19. NPTEL course on BI

CourseContents

Mapping of Course Outcomes for Unit I		CO1
UNIT I	**Introduction to Decision support systems and Business Intelligence**	**07 Hours**

Decision Support Systems: Define DSS, depiction of the decision-making process, evolution of information systems, Development of a decision support system, Simon's decision-making model, methods and strategies used by decision-makers.

Business Intelligence (BI): Definition, Components and Architecture of BI, future of BI, usage of BI for all business users, user expectations, preparing data for BI, data, information, and knowledge, the significance of mathematical models, BI frameworks, and ethical considerations in business intelligence.

Mapping of Course Outcomes for Unit II	CO2

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UNIT II	Data Warehouse	07 Hours

BI and Data Warehousing (DW) architectures and their types, Relation between BI and DW, define OLAP (Online Analytical Processing), OLAP architectures, Data models, BI tools, Functions of DSS, EIS, MIS, and digital dashboards, Importance of Business Intelligence.

Comparison between OLAP and OLTP, Dimensional analysis , Understanding cubes, Drill-down and roll-up operations, Slice and dice, pivot rotation , OLAP models, ROLAP vs. MOLAP , Defining data schemas: Star, Snowflake, and Fact Constellations.

Mapping of Course Outcomes for Unit III	CO3

UNIT III	Reporting Authoring	07 Hours

Building reports with relational vs Multidimensional data models; Types of Reports – List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, csv, xml etc.

Mapping of Course Outcomes for Unit IV	CO4

UNIT IV	Data Preparation	07 Hours

Data validation: Incomplete data, Data affected by noise. **Data transformation:** Standardization, Feature extraction.
Data reduction: Sampling, Feature selection, Principal component analysis, Data discretization.
Data exploration:1. Univariate analysis: Graphical analysis of categorical attributes Graphical analysis of numerical attributes, Measures of central tendency for numerical attributes, Measures of dispersion for numerical attributes, Identification of outliers for numerical attributes **2. Bivariate analysis:** Graphical analysis, Measures of correlation for numerical attributes, Contingency tables for categorical attributes, **3. Multivariate analysis:** Graphical analysis. Measures of correlation for numerical attributes

Mapping of Course Outcomes for Unit V	CO5

UNIT V	Machine Learning's Impact on BI Processes	07 Hours

Classification: Types of classification problems, assessment of classification models, Bayesian approaches, logistic regression.
Clustering: Clustering techniques, partitioning methods, hierarchical approaches, evaluation of clustering models.
Association Rules: Framework of association rules, Apriori algorithm.

Mapping of Course Outcomes for Unit VI	CO6

UNIT VI	BI Applications	07 Hours

Business Intelligence Tools: Importance of analytical tools in BI, Case study of analytical tools: WEKA, Power BI, Rapid Miner, R.
Data & Business Analytics: Relationship between ERP and BI, BI in operations management, BI for inventory management, and its role in human resource management.
BI Applications: Implementation in CRM, marketing, logistics, and production; significance of BI in finance, banking, telecommunications, and salesforce management.

Books and Other Resources

Text Books:

3. Fundamental of Business Intelligence, Grossmann W, Rinderle-Ma, Springer,2015
4. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support, 10th Edition. Pearson/Prentice Hall, 2015

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Reference Books:

4. Paulraj Ponnian, —Data Warehousing Fundamentalsǁ, John Willey
5. Introduction to business Intelligence and data warehousing, IBM, PHI
6. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis,Wiley,2019
7. Data Mining for Business Intelligence, Wiley

Guidelines for Oral Examination:

Problem statements will be formed based on assignments and performance will be evaluated by Internal and External Examiner. Oral assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understandingof the fundamentals, effective and efficient implementation.

Guidelines for Laboratory Conduction :

Use of open sources of software is encouraged. Based on the concepts learned.
Operating System recommended :- 64-bit Open source Linux or its derivative Programming

Practical Assignments

Any Six of the following problem statements:

1. Perform what-if-analysis on book store scenario using excel
2. Identify key performance indicators(KPI) for any real time case study and present analysis for the same.
3. Create following visualization using excel:
   1. Combo chart
   2. Gantt chart
   3. Thermometer chart
   4. Band chart
   5. Waterfall chart
   6. Pivot chart
4. Import legacy data from various sources (such as Excel, SQL Server, Oracle, etc.) in Power BI and load it into the target system. (You can download sample databases like AdventureWorks, Northwind, FoodMart, etc.)
5. Create interactive visualization using any open source tool (eg. KNIME,D3.js,Grafana)
6. Carry out the Extraction, Transformation, and Loading (ETL) process to build the database in SQL Server.
7. Design a data cube with appropriate dimension and fact tables based on ROLAP, MOLAP, and HOLAP models.
8. Import data from the data warehouse into Microsoft Excel, and create Pivot Tables and Pivot Charts for analysis.
9. Apply a classification algorithm to categorize the data or perform data clustering using a clustering algorithm.
10. Design interactive dashboards with data visualizations (charts, graphs, maps) using tools like Tableau, Power BI, or QlikView.

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CO23313B : Object Oriented Modeling and Design

Teaching Scheme:	Credit: 04	Examination Scheme:
TH: 03 Hrs/Week	TH Credit :03	CAA: 10 Mark
PR: 02 Hrs/Week	PR Credit :01	In Semester: 30 Mark
		End Semester: 60 Mark
		Oral : 30 Mark

Prerequisite: Students are expected to have a good understanding of Software Engineering

Course Objective:

- Describe the concepts involved in Object-Oriented modeling and their benefits.
- Demonstrate concept of use-case model, sequence model and state chart model for a given problem.
- Explain the facets of the unified process approach to design and build a Software system.
- Translate the requirements into implementation for Object Oriented design.
- Choose an appropriate design pattern to facilitate development procedure. Select suitable design pattern depending on nature of application.
- To describe Designing and Management of Patterns.

Course Outcomes:

1. Describe object-oriented analysis and design methods with a clear emphasis on UML.
2. Analyze a system from the requirements and model in terms of static and dynamic behavior using relevant UML diagrams.
3. Build different interaction and behavior models using object oriented design.
4. Apply architecture design principles to draw different architectural diagrams for a given system.
5. Describe architectural design principles and guidelines in the various type of application development.
6. Make use of an appropriate design patterns to improve the overall design.

Course Activity :

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

1. Mini Project
2. Seminar
3. Research Paper in related domain

Course Contents

Mapping of Course Outcomes for Unit I	CO1	
UNIT I	**Introduction To Modeling**	**07 Hours**

What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history 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; ,Introduction to Unified Modeling Language (UML), UML history, UML Structure, UML Building Blocks UML new features, Rational unified process emphasizing inception, Elaboration, Construction, Transition phases, Architectural approaches, Use case centric, Architecture driven, Iterative approach, UML meta model, Extensibility

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mechanisms like stereotypes, Tagged values, Constraints and Profiles, OCL, Overview of all diagrams in UML.

Mapping of Course Outcomes for Unit II		CO2
UNIT II	**Use Case and Class Models**	**07 Hours**

Object Oriented Analysis Process, Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations. Introduction to object diagrams, Class diagrams - Domain / Class Modeling: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes, Class Associations and Identification of Associations, abstract classes, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.

Mapping of Course Outcomes for Unit III		CO3
UNIT III	**Interaction and Behavior Modeling**	**07 Hours**

Activity Diagram : Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes. Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions. Sequence Diagram: Context, Objects and Roles, Links. Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions. State Chart Diagram: State Machine, Transitions, Initial and Final State, Composite States, Submachine States, State Generalization Collaboration Diagram: Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, and Timing Diagram.

Mapping of Course Outcomes for Unit IV		CO4
UNIT IV	**Package, Component, Deployment diagrams**	**07 Hours**

Support for modeling, Architecture in UML, Package diagrams, Component diagrams, Deployment diagrams. Applications of UML in embedded systems, Web applications, Commercial applications, UML 2.0 for each diagram the Need, Purpose, Concepts, Notation, Forward Engineering, Reverse Engineering and Application.

Mapping of Course Outcomes for Unit V		CO5
UNIT V	**Architectural Design**	**07 Hours**

Overview of software Architecture, Designing Client / Server Software Architectures, Designing Service Oriented Software Architectures, Designing Component Based Software Architectures, Designing Concurrent and Real-Time Software Architectures, Designing Product Line Architectures, Related Case Studies.

Mapping of Course Outcomes for Unit VI		CO6
UNIT VI	**Design Pattern**	**07 Hours**

What is a design pattern? General Responsibility Assignment Software Patterns (GRASP) design principles: Creator, Information Expert, Low coupling, Controller, High Cohesion, Polymorphism, Pure fabrication, Indirection, Polymorphism. Gang of Four (GoF) design patterns: Introduction, Categories of Patterns - Creational, Structural and Behavioral Patterns.

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Books and Other Resources

Text Books:

5. Michael Blaha, James Rumbaugh, —Object-Oriented Modeling and Design with UML‖, 2 nd Edition, Pearson Education, 2005.
6. Frank Buchmann, Regine Meunier, Hans Rohnert, Peter Sommer lad, Michael Stal, —Pattern-Oriented Software Architecture, A System of Patterns‖, Volume 1, John Wiley and Sons, 2007

Reference Books:

8. Grady Booch et al, —Object-Oriented Analysis and Design with Applications‖, 3rd Edition, Pearson Education, 2007
9. Brahma Dathan, Sarnath Ramnath, —Object-Oriented Analysis, Design, and Implementation‖, UniversitiesPress, 2009
10. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, — UML 2 Toolkit‖, WileyDreamtech India, 2004
11. Simon Bennett, Steve McRobb and Ray Farmer, — UML 2 Toolkit, Object- Oriented Systems Analysis and Design Using UML, 2 nd Edition, Tata McGraw-Hill, 2002

Guidelines for Laboratory Conduction :

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Practical Assignments

1. Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include template showing description and steps of the Use Case for various scenarios.
2. Draw basic class diagrams to identify and describe key concepts like classes, types in your system and their relationships.
3. Draw activity diagrams to display either business flows or like flow charts.
4. Draw sequence diagrams to display either business flows or like flow charts.
5. Draw state model for telephone line, with various activities.
6. Draw component diagrams assuming that you will build your system reusing existing components along with a few new ones.
7. Draw deployment diagrams to model the runtime architecture of your system.
8. Mini Project : Draw all UML diagrams for your suitable Object oriented system

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CO23313C : Software Testing and Quality Assurance

Teaching Scheme:	Credit: 04	Examination Scheme:
TH: 03 Hrs/Week	TH Credit :03	CAA: 10 Mark
PR: 02 Hrs/Week	PR Credit :01	In Semester: 30 Mark
		End Semester: 60 Mark
		Oral: 30 Mark

Prerequisite: Students are expected to have a good understanding of Software Engineering and Software Engineering & Project Management.

Course Objective:

- Introduce basic concepts of software testing.
- Understand the best way to increase the effectiveness, test coverage, and execution speed in software testing.
- Understand white box, block box, object oriented, web based and cloud testing.
- Understand the importance of software quality and assurance software systems development.
- Know in details automation testing and tools used for automation testing.
- To learn and understand the combination of practices and tools that are designed to help QAprofessionals test more efficiently.

Course Outcomes:

On completion of the course, student will be able to–

1. Describe fundamental concepts in software testing such as manual testing, automation testingand software quality assurance.
2. Design and Develop project test plan, design test cases, test data, and conduct test operations.
3. Apply recent automation tool for various software testing for testing software.
4. Apply different approaches of quality management, assurance, and quality standard to software system.
5. Apply and analyze effectiveness Software Quality Tools.
6. Apply tools necessary for efficient testing framework

Course Activity :

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

1. Mini Project
2. Industry Visit
3. Seminar

Course Contents

Mapping of Course Outcomes for Unit I		CO1
UNIT I	**Introduction to Software Testing**	**07 Hours**

Introduction: historical perspective, Definition, Core Components, Customers suppliers and process, Objectives of Testing, Testing and Debugging, Need of Testing, Quality Assurance and Testing, Why Software has Errors, Defects and Failures and its Causes and Effects, Total Quality Management(TQM), Quality practices of TQM, Quality Management through- Statistical process Control, Cultural Changes, Continual Improvement cycle, Benchmarking and metrics, Problem Solving Techniques and Software Tools. Software Quality, Constraints of Software product Quality assessment, Quality and Productivity

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Relationship, Requirements of Product, Software Development Process, Types of Products, Software Development Lifecycle Models, Software Quality Management, Processes related to Software Quality, Quality Management System's Structure, Pillars of Quality Management System, Important aspects of quality management.

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Test Planning and Quality Management**	**07 Hours**

Test Planning: Artifacts, Strategy, Test Organization –Test Manager & Tester Role, Test plan purpose & contents, Test Strategy and Approach, Test cases & Test Data, Test Entry-Exit criteria, Test Execution Schedule, Use case Testing, Scenario Testing, Test Monitoring & Control- Test Metrics –Test Case Productivity, Test case Coverage, Defect Acceptance & Rejection, Test Efficiency, Efforts and Schedule Variance, Test Efforts biasing Factors, Test Report & configuration Management, Quality Assurance Process, Documentation Risk & Issues.

Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Test Case Design Techniques**	**07 Hours**

Software Testing Methodologies: White Box Testing, Black Box Testing, Grey Box Testing. Test Case Design Techniques: Static Techniques: Informal Reviews, Walkthroughs, Technical Reviews, Inspection. Dynamic Techniques: Structural Techniques: Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing Black Box Techniques: Boundary Value Analysis, Equivalence Class Partition, State Transition Technique, Cause Effective Graph, Decision Table, Use Case Testing, Experienced Based Techniques: Error guessing, Exploratory testing .
Levels of Testing: Functional Testing: Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Test, Retest. Non-Functional Testing: Performance Testing, Memory Test, Scalability Testing, Compatibility Testing, Security Testing, Cookies Testing, Session Testing, Recovery Testing, Installation Testing, Adhoc Testing, Risk Based Testing, I18N Testing, L1ON Testing, Compliance Testing.

Mapping of Course Outcomes for Unit IV	CO4	
UNIT IV	**Software Quality Assurance and Quality Control**	**07Hours**

Software Quality Assurance: Introduction, Constraints of Software Product Quality Assessment, Quality and Productivity Relationship, Requirements of a Product, Characteristics of Software, Software Development Process, Types of Products, Schemes of Criticality Definitions, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure.
Software Quality Control: Software quality models, Quality measurement and metrics, Quality plan, implementation and documentation, Quality tools including CASE tools, Quality control and reliability of quality process, Quality management system models, Complexity metrics and Customer Satisfaction. International quality standards – ISO, CMM

Mapping of Course Outcomes for Unit V	CO5	
UNIT V	**Automation Testing Tools / Performance Testing Tools**	**07 Hours**

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Automation Testing: What is automation testing, Automated Testing Process, Automation Frameworks, Benefits of automation testing, how to choose automation testing tools. Selenium Automation Tools: Selenium's Tool Suite- Selenium IDE, Selenium RC, Selenium Web driver, Selenium Grid. Automation Tools: SoapUI, Robotic Process Automation (RPA), Tosca, Appium.

Mapping of Course Outcomes for Unit VI		CO6
UNIT VI	**Testing Framework**	**07 Hours**

Testing Framework: Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan, Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance, Ishikawa's 7 basic tools, Flow Chart, Checklists, Pareto diagrams, Histogram, Run Charts, Scatter diagrams, Control chart, Cause Effect diagram. Defect Removal Effectiveness and Process.

Books and Other Resources

Text Books:

1. "M G Limaye", "Software Testing Principles, Techniques and Tools‖", Tata McGraw Hill, ISBN:9780070139909 0070139903
2. "Srinivasan Desikan, Gopal Swamy Ramesh", "Software Testing Principles and Practices‖", Pearson,ISBN-10: 817758121X

Reference Books:

12. "C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
13. "S.K.Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
14. "Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9
15. "Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereopty Limited,ISBN: 1743045743, 9781743045749
16. "Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications ISBN: 9788176569644, 9788176569644

Guidelines for Laboratory Conduction :

Use of open source software is encouraged. Based on the concepts learned.
Operating System recommended :- 64-bit Open source Linux or its derivative Programming
Tools recommended: - Selenium grid and selenium Web driver java eclipse (automation tools),Chrome

Practical Assignments

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1:

1. Write TEST Scenario for Gmail Login Page
2. Test Scenario for Gmail Login Page
3. Write Test cases in excel sheet for Social Media application or website

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4. Create Defect Report for Any application or web application

5. Installation of Selenium grid and selenium Web driver java eclipse (automation tools).

6. Prepare Software requirement specification for any project or problem statement

Group 2:

1. **Mini Project :** Software Testing and Quality Assurance Mini Project Dynamic website of covid19 information using HTML, CSS, JAVASCRIPT And PHP, MySQL database used to store user account, comment, and registration form details. Regular Expression testcases for testing purpose

2. **Mini Project:** Create a small application by selecting relevant system environment / platform and programming languages. Narrate concise Test Plan consisting features to be tested and bug taxonomy. Prepare Test Cases inclusive of Test Procedures for identified Test Scenarios

3. **Mini Project :** Create a small web-based application by selecting relevant system environment / platform and programming languages. Narrate concise Test Plan consisting features to be tested and bug taxonomy. Narrate scripts in order to perform regression tests. Identify the bugs using Selenium WebDriver and IDE and generate test reports encompassing exploratory testing.



HS24211 Environmental Studies

Teaching Scheme		Credit: 02	Examination Scheme	
TH	02 Hrs/Week	TH,Credit :02	CAA:	:10 Marks
			End Semester:	:60 Marks
			Total	:70 Marks

Course Objective:

The primary objectives of this course are to:

- Understand the fundamental concepts of environmental science and its relevance to engineering.
- Analyze the environmental impact of various engineering industries.
- Learn about sustainable engineering practices, pollution control, and waste management.
- Study environmental laws in India and global initiatives for environmental conservation.
- Explore corrective measures and preventive technologies for mitigating environmental damage

Course Outcomes:

At the end of the course, students will be able

CO1: Understand the components of the environment and types of energy resources.

CO2: Analyze the impact of engineering industries on the environment.

CO3: Learn sustainable engineering solutions for mitigating environmental damage.

CO4: Aware of Indian and global initiatives for environmental protection.

Course Contents

Mapping of Course Outcomes for Unit I	CO1	
UNIT I	**Introduction to Environmental Studies**	**06 Hours**

Importance of Environmental Studies, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere, Ecosystems and Biodiversity: Types, Importance, and Conservation, Sustainable Development Goals (SDGs) and Role of Engineers in Sustainability, Renewable and Non-Renewable Resources, Water Resources: Overuse, Pollution, and Engineering Solutions, Energy Resources: Fossil Fuels, Nuclear Power, and Renewable Energy Alternatives, Land Resources: Soil Degradation, Deforestation, and Urbanization

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Impact of Engineering Industries on Environment**	**07 Hours**

Manufacturing & Automobile Industry: Air pollution, Carbon emissions, Waste disposal, Chemical & Pharmaceutical Industry: Water and soil contamination, Hazardous waste, Construction & Infrastructure: Land degradation, Dust pollution, Waste generation, Electronics & IT Industry: E-waste, Energy consumption, Semiconductor waste, Power Generation (Thermal, Hydropower, Nuclear): Pollution, Waste heat, Radiation hazards, Causes and Effects of Climate Change, Global Warming and Greenhouse Effect.

Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Engineering Solutions for Environmental Mitigation and Sustainable Practices**	**07 Hours**

Carbon Capture and Storage (CCS), Eco-friendly Materials, Sustainable Design & Life Cycle Assessment (LCA), Energy-efficient Technologies & Smart Grids, Case Studies on Successful Pollution Reduction Waste Management Strategies: Solid Waste and Biomedical Waste Management, E-Waste: Sources, Impact, and Recycling, Hazardous Waste Handling and Treatment, Circular Economy and Zero-Waste

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Technologies Sustainable Engineering Practices: Renewable Energy Technologies (Solar, Wind, Biomass, Hydropower) Green Buildings and Sustainable Architecture, Electric Vehicles and Smart Transportation Systems, Sustainable Agriculture and Water Conservation Technologies

Mapping of Course Outcomes for Unit IV	CO4 CO5	
UNIT III	**Environmental Initiatives in India and Worldwide**	**06 Hours**

National Initiatives: Swachh Bharat Abhiyan, Namami Gange, National Green Tribunal (NGT), Corporate Social Responsibility (CSR) & Environmental Compliance, Environmental Activism and the Role of NGOs, Environmental Laws and Policies in India, The Environmental Protection Act, 1986, Role of Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCB), International Environmental Agreements (Kyoto Protocol, Paris Agreement, COP Summits), Global Initiatives: UNEP, IPCC, World Bank Environmental Policies

Books and Other Resources

Text Books:

1. Benny Joseph, Environmental Studies, McGraw Hill Education, 3rd Edition, 2021.
2. Anubha Kaushik & C.P. Kaushik, Environmental Studies, New Age International Publishers, 5th Edition, 2022.

Reference Books:

1. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 3rd Edition, 2021.
2. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Press, 3rd Edition, 2021.
3. Suresh K. Dhameja, Environmental Science and Engineering, S.K. Kataria & Sons, 2nd Edition, 2020

Additional Reports and Resources:

- Government of India - Ministry of Environment, Forest & Climate Change (MoEFCC) Reports (Website)
- United Nations Environment Programme (UNEP) Reports (Website)
- IPCC Climate Change Reports (Website)
- Central Pollution Control Board (CPCB) Reports (Website)

Activity

Perform any two activities of the following.

1. **Ecosystem Study Report** – Visit a local park, water body, or forested area and document its ecosystem components (flora, fauna, food chains).
2. **Sustainability Case Study** – Choose one of the Sustainable Development Goals (SDGs) and prepare a report on its implementation in India.
3. **Renewable vs. Non-Renewable Resources** – Prepare a comparative chart listing sources, usage, and sustainability factors.
4. **Water Conservation Survey** – Conduct a survey in your neighborhood or campus to assess water consumption and suggest conservation strategies.

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5. **Industrial Impact Assessment** – Select an engineering industry (automobile, chemical, IT, etc.) and analyze its environmental impact.
6. **Carbon Footprint Calculation** – Calculate the carbon footprint of your daily activities (electricity, transportation, food, etc.) and suggest ways to reduce it.
7. **Climate Change Awareness Video** – Create a short video (2–3 min) explaining global warming and its impact.
8. **Case Study on Pollution Control Failures** – Research a real-world incident of industrial pollution (e.g., Bhopal Gas Tragedy, Minamata Disease) and analyze the causes and consequences.
9. **Waste Management Audit** – Conduct a waste audit in your college or home, classify the waste generated, and propose a waste management plan.
10. **E-Waste Collection Drive** – Organize a drive to collect and safely dispose of e-waste in your locality. Submit a report on the amount collected and its disposal method.
11. **Renewable Energy Model** – Create a working or conceptual model of a solar panel, wind turbine, or biomass plant.
12. **Green Building Analysis** – Identify a green building in your city (or college) and analyze its energy-efficient features.
13. **Report on National Environmental Policies** – Summarize key environmental laws in India and their effectiveness.
14. **International Climate Agreements Presentation** – Prepare a presentation on major agreements like the Paris Agreement, Kyoto Protocol, and their impact on India.
15. **NGO/CSR Initiative Study** – Research an NGO or corporate social responsibility (CSR) initiative focused on environmental protection and prepare a report.
16. **Swachh Bharat Implementation Review** – Visit a local area, document cleanliness conditions, and suggest improvements under Swachh Bharat Abhiyan.

Evaluation Criteria

- Depth of Analysis (3 Marks)
- Presentation & Clarity (3 Marks)
- Creativity & Practical Application (2 Marks)
- Timely Submission (2 Mark)

Mr. Abhijeet Gaikwad
Course Coordinator

Prof R. K. Shastri
BOS Chairman HSS

Dr. C. B. Nayak
Dean Autonomy

Dr. S. M. Bhosle
Dean Academic

Dr. S. B. Lande
Principal

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Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

CO23214: Java Programming

Teaching Scheme:	Credit: 02	Examination Scheme:
PR: 04 Hrs/Week		CAA : 10 Marks Term-Work : 30 Marks Practical : 30 Marks

Prerequisite: Object Oriented Programming, Database

Course Objective:

- Explore advanced topic of Java programming for solving problems.
- Be able to put into use the advanced features of the Java language to build and compile robust enterprise grade applications.
- Design and develop GUI applications using AWT and Swings.
- To provide foundations on Servlets, JSP, Java Beans, Struts ,etc.

Course Outcomes:

On completion of this course students will be able to

1. Understand the structure and model of the Java programming language, (knowledge)
2. Apply the concepts of JDBC for developing dynamic web pages.
3. Develop web application using Servlets.
4. Use of the JSP in web application development.
5. Demonstrate the use of Java Beans.
6. Interpret the need of advance Java Concepts like RMI, Socket programming, etc.

Guidelines for Term Work Assessment :

Term work assessment will be based on overall performance of Laboratory assignments performed by students.

Guidelines for Practical Examination :

Problem statements will be formed based on assignments and performance will be evaluated by Internal and External Examiner. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation.

Guidelines for Laboratory Conduction :

- A working computer system with either Windows or Linux (with minimum configurations- HDD:40 GB,RAM: 512M
- Simple Editor Notepad or other editor tools like Edit plus or notepad++.
- A web browser IE/ Firefox/ chrome. ϖ Apache Tomcat web server.
- JVM(Java virtual machine) must be installed on your system
- BDK(Bean development kit) must be also be installed

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Practical Assignments

1 A. Create a basic applet that functions as a simple calculator. The applet should accept two numbers and perform operations such as addition, subtraction, multiplication, and division based on user input.

B. Create a basic calculator using Java Swing that can perform basic arithmetic operations like addition, subtraction, multiplication, and division. The calculator should have buttons for numbers, operations, and a display area

2 Build a form for student registration that takes inputs such as name, age, address, and course. Add validation to ensure all fields are filled and the data is in the correct format.

3 Write a java program that connects to a database using JDBC and perform Insert, delete, update and display operations..

4 Write a Java program that implements a multi-thread application that has three threads.

5 Implement a servlet that receives form data from a web page using the `GET` or `POST` method. The servlet should capture form input and display the submitted data on the webpage.

6 Develop a login servlet that authenticates users by checking the username and password against a database. After successful authentication, the user should be redirected to a protected page.

7 Create a servlet that connects to a MySQL database to retrieve and display user data (e.g., display a list of users or a particular user's details).

8 Implement a JSP page with an HTML form to collect user data (e.g., name, email). On form submission, use JSP to process and display the submitted information.

9 Create a JSP page that connects to a MySQL database, retrieves a list of products or users, and displays them in an HTML table.

10 Implement a login page that authenticates users based on their credentials stored in a database. On successful login, redirect to a dashboard page.

11 Write a java program to create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click. The color should also be changed if we change the color in the "property window ".

12 Write a java program to create a bean that counts the number of button clicks?

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13 A) Write a Java program that implements a simple client/server application. The client sends data to a server. The server receives the data, uses it to produce a result, and then sends the result back to the client. The client displays the result on the console. For ex: The data sent from the client is the radius of a circle, and the result produced by the server is the area of the circle. (Use java.net)
B) Write a Java program to retrieve the information from the given URL? (Note: Read the URL from Command Line Arguments).

14 Write a java program to create a sample TCP chat application where client and server can chat with each other.

15 Create a simple calculator application that demonstrates the use of RMI. You are not required to create GUI.

16 Implement a Java program using RMI for stock market functioning:
a. Develop remote interface.
b. Implement java/RMI server
c. Create your server
d. Develop security policy file.

17 Create a Servlet for demo of KBC game. There will be continuous two or three pages with different MCQs. Each correct answer carries Rs. 10000. At the end as per user's selection of answers total prize he won should be declared. User should not be allowed to backtrack.

18 A. Write a java program for one way TCP communication for server and client, where server will response to client with current data and time.

B. Write a java program for two way TCP communication for server and client. It should look like a simple chat application.

Mini Project:

Here are some key components mini-project should ideally contain:

- Core Java Concepts
- Advanced Java Features
- Connectivity
- Networking

Reference Books :

- Java; the complete reference, 7th editon,2017, Herbert schildt, TMH.
- Introduction to Java programming 6th edition, 2006, Y. Daniel Liang, Pearson education.
- An introduction to Java programming and object oriented application development, R.A. Johnson,Thomson.2016
- Core Java Volume I--Fundamentals Cay S. Horstmann, Pearson, Eleventh Edition, 2018
- Core Java Volume II-Advance Features Cay S. Horstmann, , Pearson, Eleventh Edition, 2019
- Java: The Complete Reference Herbert Schildt, McGraw-Hill Education, Eleventh Edition, 2018
- Core Servlets and Java Server pages volume1: Core Technologies By Marty Hall and Larry Brown Pearson, 2003

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References:

- https://www.simplilearn.com/data-science-vs-big-data-vs-data-analytics-article
- https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html
- https://www.edureka.co/blog/hadoop-ecosystem
- https://www.edureka.co/blog/mapreduce-tutorial/#mapreduce_word_count_example
- https://github.com/vasanth-mahendran/weather-data-hadoop
- https://spark.apache.org/docs/latest/quick-start.html#more-on-dataset-operations

MOOCs Courses link:

- https://nptel.ac.in/courses/106/106/106106212/
- https://onlinecourses.nptel.ac.in/noc21_cs33/preview
- https://nptel.ac.in/courses/106/104/106104189/
- https://onlinecourses.nptel.ac.in/noc20_cs92/preview



HS23312 Democracy, Election, and Governance

Teaching Scheme	Credit: Non Credit Audit Course	Examination Scheme	
TH 01 Hrs/Week	TH Credit :NIL	CAA:	NIL
		End Semester:	NIL
		Total	NIL

Course Objective:

The primary objectives of this course are to:

- Analyze the structure and role of democratic institutions
- Understand the electoral process and the role of the Election Commission of India,
- Study the framework of governance in India, covering the executive, legislative, and judicial branches at both central and state levels.

Course Outcomes:

At the end of the course, students will be able

CO1: Explain the evolution and significance of democracy in India, its core principles, and its role in nation-building

CO2: Describe the composition, powers, and functions of the Election Commission of India, and understand the electoral process

CO3: Interprete the governance structures at the Union and State levels, covering executive, legislative, and judicial functions

Course Contents

Mapping of Course Outcomes for Unit I	CO1	
UNIT I	**Democracy in India**	**05 Hours**

Evolution of Democracy, Dimensions of Democracy: Social, Economic and Political, Decentralisation: Grassroots Level Democracy, Challenges before Democracy: women and marginalized sections of the society

Mapping of Course Outcomes for Unit II	CO2	
UNIT II	**Election**	**04 Hours**

Election Commission of India-composition, powers and functions, and electoral process. Types of emergency grounds, procedure, duration, and effects. Amendment of the constitution- meaning, procedure, and limitations

Mapping of Course Outcomes for Unit III	CO3	
UNIT III	**Governance**	**04 Hours**

Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature-Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions.

State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government- Panchayat raj system Challenges of caste, gender, class, democracy and ethnicity

Books and Other Resources

Text and Reference Books:

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11. Banerjee-Dube, I. (2014). A history of modern India. Cambridge University Press.
12. Bhargava, R. (2008). Political theory: An introduction. Pearson Education India.
13. Bhargava, R., Vanaik, A. (2010) Understanding Contemporary India: Critical Perspective. New Delhi: Orient Blackswan.
14. Chandhoke. N., Proyadardhi.P, (ed) (2009), 'Contemporary India: Economy, Society, Politics', Pearson India Education Services Pvt. Ltd, ISBN 978-81- 317-1929-9.
15. Chandra, B. (1999). Essays on contemporary India. Har-Anand Publications.
16. Chaterjee, P. (1997). State and Politics in India.
17. Dasgupta. S., (ed) (2011), 'Political Sociology', Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education in south Asia. ISBN: 978-317-6027- 7.
18. Deshpande, S. (2003). Contemporary India: A Sociological View, New Delhi:Viking Publication.
19. Guha, R. (2007). India After Gandhi: The History of the World's Largest. Democracy, HarperCollins Publishers, New York.
20. Guha, R. (2013). Gandhi before India. Penguin UK.
21. Jayal. N.G. (2001). Democracy in India.New Delhi: Oxford University Press.
22. Kohli, A. (1990). Democracy and discontent: India's growing crisis of governability. Cambridge University Press.
23. Kohli, A., Breman, J., & Hawthorn, G. P. (Eds.). (2001). The success of India's democracy (Vol. 6). Cambridge University Press.
24. Kothari, R. (1989). State against democracy: In search of humane governance. Apex Pr.
25. Kothari, R. (1970). Politics in India. New Delhi: Orient Blackswan.
26. Kothari, R. (1995). Caste in Indian politics. Orient Blackswan.
27. Sarkar, S. (2001). Indian democracy: the historical inheritance. the Success of India's Democracy, 23-46.

Evaluation and Assessment

Since this is an audit course, evaluation will be based on active participation, understanding of concepts, and analytical skills:

- **Assignments & Reports** – Writing assignments on topics like electoral reforms, democratic challenges, or constitutional amendments.
- **Quizzes/MCQs** – Multiple-choice or short-answer questions covering key topics like the Election Commission, parliamentary proceedings, and governance.
- **Group Discussions/Presentations**– Debates on issues like democracy and social justice, governance challenges, and the effectiveness of grassroots-level democracy.

Dr. A. B. Patil
Course Coordinator

Prof R. K. Shastri
BOS Chairman HSS

Dr. C. B. Nayak
Dean Autonomy

Dr. S. M. Bhosle
Dean Academic

Dr. S. B. Lande
Principal

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