B.Tech. Computer Science and Engineering (CSE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

MODIFIED SCHEME OF EXAMS W.E.F THE SESSION 2025-26

SEMESTER-V

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-CSE-301	Web and Internet Technology	3:0:0	3	3	70	30	0	100	3
2	B23-CSE-303	Introduction to Database System	3:0:0	3	3	70	30	0	100	3
3	B23-CSE-305	Machine Learning	3:1:0	4	4	70	30	0	100	3
4	B23-CSE-307	Software Engineering	3:0:0	3	3	70	30	0	100	3
5	B23-HSM-202	Innovation, Startups and Entrepreneurship	3:0:0	3	3	70	30	0	100	3
6	B23-CSE-309	Web and Internet Technology Lab	0:0:2	2	1	0	40	60	100	3
7	B23-CSE-311	Introduction to Database Systems Lab	0:0:2	2	1	0	40	60	100	3
8	B23-CSE-313	Machine Learning Lab	0:0:2	2	1	0	40	60	100	3
9	B23-CSE-315	Industrial Training-I	0:0:2	2	1	--	100	--	100	--
10	B23-VAC-302/304/306/308/310	Hindi Language Skills/ Sanskrit Language Skills/ German Language Skills/ Japanese Language Skills/ French Language Skills	2:0:0	2	1	--	100	--	100	3
TOTAL				**26**	**21**	**350**	**470**	**180**	**1000**	

B23-CSE-301	Web and Internet Technology						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hour**
Purpose	To gain the knowledge of Internet technologies, Web development standards, scripting languages, modern tools and frameworks to create dynamic and responsive Web-based hypermedia design applications.						
Course Outcomes (CO)							
CO1	To understand the Internet, its architecture, and applications and to acquire basic the kknowledge of basic principles of Web site design.						
CO2	To learn HTML, XHTML, XML and CSS for structured Web-based development.						
CO3	To develop interactive Web applications using JavaScript.						
CO4	To explore modern Web development frameworks and deployment tools and technologies.						

Unit-I: Information Architecture

Introduction to World Wide Web, Web browsers, Web servers, Hypertext Transfer Protocol, URLs, The role of information architect, collaboration and communication, organizing information, organizing Web sites and Intranets, creating cohesive organization systems, designing navigation systems, types of navigation systems, searching systems, designing the search interface, basic steps for developing Website, Web publishing and hosting, types of hosting packages, five golden rules of Web designing.

Unit-II: Web Essentials and Standards

Introduction to elements of HTML, CSS, Introduction to Document Object Model (DOM), working with text, list, tables, frames, hyperlinks, images multimedia, forms and controls, CSS properties, Id and class, box model.

Introduction to XHTML: XML, Move to XHTML, Meta tags, benefits of XML, well-formed XML documents, XML syntax, XML declaration, XML schema, XML with CSS, Document Type Definition (DTD), creating DTD and its types (internal and external DTD), XSL.

Unit-III: Scripting Language: JavaScript

JavaScript: Data types, values, variables, expressions and operators, JavaScript statements, loops, arrays, strings, methods, defining and invoking functions and their closure, random functions and maths library, representing dates, pattern matching and regular expressions. difference between server side and client side JavaScript, embedding JavaScript in HTML and frameworks, changing CSS style, hiding HTML elements, showing hidden HTML elements, DOM and event handling, error handling, mouse, text, and keyboard events and cookies.

Unit-IV: Advanced Web Development and Web Applications Frameworks

Introduction to PHP, PHP syntax, variables, constants, data types, and operator, control structures: conditional statements (if-else, switch), loops (for, while, do-while), functions: Defining and calling functions, built-in functions, and user-defined functions, working with forms: GET and POST methods, form validation, handling form data, PHP and MySQL: Database connectivity, CRUD (Create, Read, Update, Delete) operations.

Introduction to Web application frameworks and tools: Angular JS, React JS, Node JS, Express JS, Bootstrap, Firebase, and Django- UI & UX.

Suggested Books

1. Peter Morville, Louis Rosenfeld, Information Architecture on the World Wide Web, O'Reilly Media.

2. Thomas A Powell, HTML: The Complete Reference, Tata McGraw Hill Publications.
3. Robert. W. Sebesta, Programming the World Wide Web, Fourth Edition, Pearson Education.
4. Michael J.Young, XML Step by Step, Microsoft Press/Prentice Hall of India.
5. Paul Deitel, Harvey Deitel, Abbey Deitel, Internet & World Wide Web How to Program, Fifth Edition, Pearson Education.
6. Marty Hall and Larry Brown, Core Web Programming, Pearson Education.
7. Bayross Ivan, Web Enabled Commercial Applications Development using HTML, JavaScript, DHTML & PHP, BPB Publication.

B23-CSE-303	Introduction to Database System						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hour**
Purpose	To familiarize the students with Database System						
Course Outcomes (CO)							
CO 1	Understand the basic database concepts, apply ER and Relational data model in database design.						
CO 2	Identify the purpose of relational algebra and query processing.						
CO 3	To realize about the concept of functional dependencies, normal form and query optimization.						
CO 4	Apply the concept of transaction management, concurrency control and recovery on database.						

UNIT I

Introduction: Concept & overview of DBMS, Data models- Network, Hierarchical ,Object oriented and Relational model, Levels of abstraction, Three schema architecture of DBMS, Classification of DBMS, Challenges in building a DBMS, Role of DBA ,Database users, Application.

Entity-Relationship Model: : Entities, Attributes and Entity sets, Relation and relationships sets, Mapping constraints, Keys, Entity-Relationship diagram, Weak entity sets, Reduction of ER database schema to tables, Extended E-R features – Generalization, Specialization, Inheritance, Aggregation.

UNIT II

Relational Model: Structure of relational databases, Relational algebra operators (Unary and Binary) and queries, Relational algebra operators from set theory, Operations on relational calculus, Tuple relational calculus, Domain relational calculus.

SQL and Integrity Constraints: Concept of DDL, DML, DCL and TCL. Basic Structure, Set operations , Aggregate functions , Null values , Domain constraints, Referential integrity constraints, Introduction to views, Querying, Nested sub queries, Stored procedures and triggers.

UNIT III

Relational Database Design:

Importance of a good schema design, Different anomalies in designing a database, Motivation for normal forms, Dependency theory -functional dependencies, Armstrong's axioms for FDs, Closure of a FD set and attribute set, Irreducible set of FD, Minimal covers, Normalization - 1NF, 2NF, 3NF and BCNF, Properties of relational decompositions, Multi-valued dependencies and 4NF, Join dependencies and 5NF.

Internals of RDBMS: Physical data structures, Query optimization: Join algorithm, Statistics and cost base optimization.

UNIT IV

TRANSACTIONS MANAGEMENT: Transaction concept, Transaction states, ACID Properties, Serializability, Recoverability.

CONCURRENCY CONTROL AND RECOVERY SYSTEM: Problems of Concurrent transactions execution and need of concurrency control, Lock based protocols, Time-stamp based protocols, Validation based protocols, Multiple granularity. Recovery system - Failure classification, Log- based recovery, Shadow

paging, Buffer management, Advanced recovery techniques, Remote backup systems.
FILE ORGANIZATIONS: Indexed sequential access method (ISAM), Sequential file organizations, Heap file organization, Hash file organization, B+ Tree, Clustered file organization.

Suggested Books:

- Ramez Elmasri, Shamkant B. Navathe ,"Fundamentals of Database systems", Pearson
- Korth, Silberschatz, Sudarshan: database concepts, MGH
- R. Ramakrishnan and J. Gehrks database management system; MGH, International edition
- C. J. Date, data base systems: 7th edition, Addison Wesley, Pearson Education
- Chakrabarti, Advance database management systems, Wiley Dream tech

B23-CSE-305	Machine Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 hrs**
Purpose	Objective of this course is to learn conceptually how Machine Learning algorithms work and interact with data; the emphasis will be on effective methodology for using Machine Learning to solve practical problems						
Course Outcomes (CO)							
CO 1	To develop an understanding of where and how Machine Learning can be used.						
CO 2	To learn and apply supervised learning techniques to regression and classification problems						
CO 3	To understand and apply the concept of KNN and SVM.						
CO 4	To learn and apply unsupervised Machine Learning techniques.						

Unit-I: **Introduction to Machine Learning**

Introduction-Data representation, domain knowledge for productive use of machine learning, diversity of data: structured/unstructured, machine learning and data mining, basic linear algebra in machine learning techniques, relevant resources for machine learning.

Unit-II: **Regression and Classification Techniques.**

Supervised learning using regression, types of regression, linear regression: simple and multiple, logistic regression, overview of other types of regression; model diagnostics and analysis using residual and outlier, handling of multi-collinearity.

Classification: Decision Tree algorithms, Random forests, Decision tree learning, Building a decision tree, combining weak to strong learners via random forest. Regularized loss minimization machine learning and inferential statistical analysis, descriptive statistics in learning techniques, Bayesian reasoning: a probabilistic approach to inference.

Unit –III: Supervised Learning using KNN and SVM.

K-Nearest Neighbor (KNN) Algorithm, Naive Bayes, Linear Discriminant Analysis, Latent variables and Expectation-maximization algorithm, Bayesian learning Feature Selection and Generation: Feature selection, Feature transformations, Feature learning.

Learning with support vector machines (SVM)-introduction, linear discriminant functions for binary classification, perceptron algorithm, linear maximal margin classifier for linearly separable data, linear soft margin classifier for overlapping classes, kernel-induced feature spaces, nonlinear classifier, regression by support vector machines, decomposing multiclass classification problem into binary classification tasks, variants of basic SVM techniques

Unit –IV: Unsupervised Learning.

Unsupervised Learning-unsupervised learning, engineering the data, overview of basic clustering methods means clustering, k-means clustering, expectation-maximization (EM) algorithm and gaussian mixtures clustering, some useful data transformations, Dimensionality reduction: Principal Component Analysis, Random projections, Compressed sensing entropy–based method for attribute discretization, principal components analysis (PCA) for attribute reduction, rough sets-based methods for attribute reduction.

Suggested Books

1. M. Pradhan, U. Dinesh Kumar, Machine Learning using Python, Wiley India, Latest Edition.

2. J. Han, M. Kamber, J. Pei, Data Mining Concepts and Techniques, Latest Edition
3. Christopher Bishop. Pattern Recognition and Machine Learning. 2e.
4. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
5. Introduction to Machine Learning Edition 2, by EthemAlpaydin.
6. M. Gopal, Applied Machine learning, McGraw-Hill Education, 2019
7. David Forsyth, Applied Machine learning, Springer, 2019
8. Pascal Bugnion, Patrick R. Nicolas, Alex Kozlov, Scala: Applied Machine Learning,Packt Publishing,1st Edition, 2017.

B23-CSE-307	Software Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 hrs**
Purpose	To understand the techniques and methodologies involved in software development, including software process models, design strategies, reliability measures, testing methodologies, and maintenance models to ensure high-quality software engineering practices.						
Course Outcomes (CO)							
CO 1	To apply process models and analyze requirement techniques.						
CO 2	To understand software design, strategies, and analysis metrics.						
CO 3	To design various software reliability measures to assess the quality of software in case of various faults and failures						
CO 4	To develop various testing methodologies debugging tools and maintenance models to ensure the accountability of software.						

Unit-I: Introduction

Introduction to Software crisis & Software processes: Software life cycle models – Build & Fix, waterfall prototype evolutionary, spiral model.

Problem Analysis: DFD, Data dictionaries, ER diagrams, object diagrams; approaches to problems analysis; SRS; specifying behavioral & non-behavioral requirements.

Unit-II: Design and Metrics

Software Design: What is design? Modularity, strategy of design, function oriented design, object oriented design.

Software Metrics: Introduction, size metrics, data structure metrics, information flow metrics, entropy-based measures, metric analysis.

Unit-III: Software Reliability

Reliability: Importance, Software reliability & Hardware reliability, failures & faults, reliability concepts, reliability models – macro, basic, logarithmic Poisson, calendar time component, micro models; estimating number of residual errors; reliability allocation.

Unit-IV Testing and Maintenance

Software Testing: Introduction, Functional testing, structural testing, activities during testing, debugging, testing tools.

Software Maintenance: Introduction, types of maintenance, maintenance process, maintenance models, reverse engineering, reengineering.

Suggested Books

1. K.K.Aggarwal, Yogesh Singh: Software Engineering, New Age International Ltd, 2001.
2. R.S. Pressman, Software Engineering – A Practitioner‟s Approach, 5th Ed, TMH, 2000.
3. Ian Sommerville, Software Engineering, 4th Ed., Addison Wesley.
4. Pankaj Jalote, An Integrated Approach to Software Engineering 2nd Ed, Narosa Publishing.

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B23-HSM-202		Innovation, Startups and Entrepreneurship					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3** Hours

Course Outcomes (CO)	
Purpose	**The objective of this Course is to inspire students and help them imbibe entrepreneurial mindset.**
CO 1	**Understanding the essence of innovation and features of innovative processes; models and methods of innovative entrepreneurship, the role of innovation as a major factor in creating the value of companies**
CO 2	**Understanding, the dynamic role of entrepreneurship and small businesses, , types of business structure, organizing and managing a Small Business**
CO 3	**Understanding concept of start-ups, Control Strategic Marketing Planning , concept of incubation and proto type, new Product Development, Business Plan Creation.**
CO 4	**Understanding risk analysis in business, financing methods, role of government in supporting entrepreneurship**

Unit -I

Introduction to Innovation and Entrepreneurial Idea Generation and Identifying Business Opportunities, Management Skills for Entrepreneurs, Innovations and their forms, Innovation - features and characteristics, Factors initiating innovations, Innovation process and its stages, Statistical measurement of innovation, Model of innovation, Source of innovation, Technological transfer, Information technology to support innovation, difference between technological and non-technological innovation

Unit-II

Introduction to Entrepreneurship and Start – Ups - Definitions, Traits of an entrepreneur, Intrapreneurship, Entrepreneurial Motivation ,Functions of Entrepreneur, Concept, Growth of Entrepreneurship in India, Types of Business Structures, Similarities /differences between entrepreneurs and managers, Business Ideas and their implementation, Discovering ideas and visualizing the business, Activity map, Types of startups, role of entrepreneurs in economic development, future of entrepreneurs, entrepreneurial process

Unit -III

Start-ups - Initial idea generation and planning stages, and incubation referring to the development process of identifying and developing new ideas for products, services, or processes, and creating a working model or prototype to test the feasibility of the concept.

Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Five Cs of Opportunity Identification, Market Opportunity Identification in emerging technology companies, Process of creating and growing a new business venture, Business plan of the innovation project.

Unit -IV

Risk Analysis: Risk management in venture projects, Financing and Protection of Ideas-

Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy, venture capital, angel investment, and crowdfunding.

Government support- programs and initiatives aimed at supporting the development of new ideas, innovations, and startups, funding and mentorship, IPR - legal protection of a person's or organization's rights to their invention, brand, or creative work

Suggested Readings:

- Shrutin N Shetty, (2018), Design the Future: Simplifying Design Thinking to Help You, Notion Press
- "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
- Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
- "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
- "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- The Three-Box Solution: A Strategy for Leading Innovation By Vijay Govindarajan
- Boutellier, Roman; Gassmann, Oliver; von Zedtwitz, Maximilian (2000). Managing Global Innovation. Berlin: Springer.. ISBN 3-540-66832-2.
- Brown K. and Stephen P. Osborne (2005) Managing change and innovation in public service organisation. New York: Routledge
- Cappellin R. and Wink R. (2009) International Knowledge and Innovation Networks Knowledge Creation and Innovation in Medium-technology Clusters. UK: Edward Elgar Publishing Limited.
- Eveleens, C. (2010). Innovation management; a literature review of innovation process models and their implications. Working Paper HAN University of Applied Sciences.
- Enterpreneurship Development- S.Chand & Co.,Delhi- S.S.Khanka 1999
- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
- Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.

B23-CSE-309	Web and Internet Technology Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
-	**-**	**2**	**1**	**40**	**60**	**100**	**3 Hours**
Purpose	To develop the ability to implement dynamic Web applications using modern front-end and back-end technologies.						
Course Outcomes (CO)							
CO1	To implement interactive and responsive Web pages using HTML, CSS, and JavaScript.						
CO2	To develop server-side applications using PHP, MySQL, and Web applications frameworks for dynamic content management.						
CO3	To integrate APIs, authentication, and database operations to build full-stack web applications.						
CO4	To deploy Web applications on cloud platforms.						

List of Practicals

1. Design a Web page of your home town with an attractive background color, text color, an image, font etc. (use internal CSS).
2. Design a Web page to format college Website using external, internal, and inline CSS.
3. Create HTML Page with JavaScript which takes integer number as input and tells whether the number is odd or even.
4. Write a program to validate a user form using JavaScript.
5. Write a program to create a dynamic image gallery using JavaScript.
6. Create XML file to store student information like enrollment number, name, mobile number, E-mail Id and also create DTD for above XML file.
7. Write a PHP program to check if number is prime or not.
8. Write a PHP program to print first 10 Fibonacci Numbers.
9. Create HTML page that contain textbox, submit / reset button. Write PHP program to display this information and also store into text file.
10. Write a PHP Script for login authentication. Design an html form which takes username and password from user and validate against stored username and password in file.
11. Write PHP Script for storing and retrieving user information from MySQL table.
12. (i) Design HTML page which takes name, address, E-mail and mobile, (ii) No. From user register.php), (iii) Store this data in MySQL database / text file, and (iv) Next page display all user in html table using PHP (display.php).
13. Write a program to implement a simple login and registration system using PHP and MySQL.
14. Write a program to implement session management and cookies in PHP.
15. Write a program to create a responsive Web page using Bootstrap.
16. Write a program to fetch and display data from an API using JavaScript (Fetch API/Axios).
17. Write a program using React JS/Angular JS to build a simple dynamic Web application.
18. Write a program using Node JS/Express JS to create a basic server-side application.
19. Write a program to deploy a Web application on Firebase.
20. Write a program to build a simple chat application using Web Sockets and Node JS.
21. Write a program to integrate Google Maps API into a Web page.

B23-CSE-311	Introduction to Database Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hours**
Purpose	**To familiarize the students with the basics of Data base management system.**						
Course Outcomes (CO)							
CO1	To understand basic DDL, DML, DCL and TCL commands						
CO2	To learn about different types of functions						
CO3	To understand the SQL queries using SQL operators						
CO4	To understand the Sub queries and nested queries						
CO5	To learn view, procedure and triggers.						

1. Implementation of DDL commands of SQL with suitable examples.
2. Implementation of DML commands of SQL with suitable examples.
3. Implementation of DCL commands of SQL with suitable examples.
4. Concepts for ROLL BACK, COMMIT & CHECK POINTS.
5. Implementation of different types of function with suitable examples.
    - Number function
    - Aggregate Function
    - Character Function
    - Conversion Function
    - Date Function
6. Implementation of different types of operators in SQL
    - Arithmetic Operators
    - Logical Operators
    - Comparison Operator
    - Special Operator
    - Set Operation
7. Implementation of different types of Joins
    - Inner Join
    - Outer Join
    - Natural Join etc.
8. Study & Implementation of Sub queries and nested queries
9. Study & Implementation of Views.
10. Study & Implementation of SQL Triggers.
11. To perform various integrity constraints on relational database.
12. Write a procedure for computing income tax of employee on the basic of following conditions: -
    a. if gross pay<=40,000 then I.T rate is 0%.
    b. if gross pay>40,000 but <60000 then I.T rate is 10%.
    c. if gross pay>60,000 but <1,00,0000 then I.T rate is 20%.
    d. if gross pay>1,00,0000 then I.T rate is 30%.

    For this purpose, create a table with name, ssn, gross salary and income tax of the employee.

B23-CSE-313	Machine Learning Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
-	**-**	**2**	**1**	**40**	**60**	**100**	**3 hrs**
Purpose	To develop the ability to implement the supervised and the unsupervised machine learning algorithms.						
Course Outcomes (CO)							
CO1	To develop proficiency in fundamental operations for machine learning.						
CO2	To implement supervised learning algorithms for predictive modeling and classification.						
CO3	To apply unsupervised learning techniques for clustering and dimensionality reduction.						
CO4	To enhance problem-solving skills through practical machine learning implementations.						

List of Practicals

1. Implement Python Program to clean and load the data for the preprocessing using Numpy and Pandas.
2. Implement the Linear Regression algorithm using Python.
3. Implement the Logistic Regression algorithm using Python.
4. Implement the K-nearest Neighbour algorithm.
5. Implement the Decision Tree algorithm.
6. Implement the Random Forest algorithm.
7. Implement the Naive Bayesian Classification algorithm.
8. Implement the Support Vector Machine algorithm.
9. Implement the K-Means Clustering Algorithm.
10. Implement the Principal Composition Analysis (PCA).

B23-VAC-302	Hindi Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
2	**-**	**-**	**1**	**--**	**100**	**100**	**3**

This course will be offered through NPTEL/MOOC online courses with the following link - https://onlinecourses.nptel.ac.in/noc23_hs125/preview.
The syllabus of NPTEL/MOOC platform will be acceptable. Students can also learn online from videos and internal assessment can be made in the Institute by taking an internal exam of 100 marks.

B23-VAC-304	Sanskrit Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
2	**-**	**-**	**1**	**--**	**100**	**100**	**3 hrs**
Course Outcomes **At the end of this course, student will**							
CO 1	Learn behavioural science from Bhagwat Gita						
CO 2	Learn self awareness and spirituality from Bhagwat Gita						
CO 3	Learn mind management from Bhagwat Gita						
CO 4	Learn responsible behaviour from Bhagwat Gita						

Unit 1	**BEHAVIOURAL SCIENCE** ● **Learning different personality types from Gita.** BG 14.6-8 ● Dealing with stress, depression and **self-destructive** urges. BG 2.14 ● Overcoming **procrastination and hyperactivity.** BG 18.35-36 ● **Developing *sattva* - platform of controlled action.** BG 18.33 ● Balancing physical, mental and emotional health. BG 6.16-17, 6.5 ● Increasing productivity in activity through spirituality. BG 2.47 ● **Mind Intelligence mechanism.** BG 3.42-43 ● **Tapping the power of meditation**. BG 6.10-15

Unit 2	**SELF-AWARENESS** ● **Understanding Different Layers of Self - Physical, Mental and Spiritual** – BG 2.13 ● Becoming Sensitive Towards Other Beings and Nature at Large – BG 5.18, 6.29-32 ● **Cultivating Culture of Respect** – BG 13.8-12 ● Dealing with Grief – BG 2.11, 2.27 ● **Holistic Wellbeing Through Self-Awareness** – BG 6.5, 6.7 ● Recognizing the Impermanence of the Body – BG 2.14 ● Cultivating Detachment for True Self-Awareness – BG 2.71, 5.29 ● **Connecting with the Higher Self Through Meditation** – BG 6.10 ● Transcending Ego for Inner Peace – BG 3.27 ● Self-Reflection for Personal Growth – BG 6.5 ● Overcoming False Identification with the Body – BG 2.30 ● Seeing the Divine in All Beings – BG 9.22
Unit 3	**MIND MANAGEMENT - ART OF MIND CONTROL** ● **The Root of Frustration & Anger** – BG 2.62-63 ● Discover the Real Reason Behind Lack of Motivation – BG 3.36, 3.41 ● **Controlling the Uncontrolled Mind** – BG 6.26 ● **Understanding the Mind & Its Power** – BG 6.6, 3.42 ● Mind Like a Boat in Stormy Waters – BG 2.67 ● **Learn to Stay Calm Under Pressure** – BG 2.14, 2.56 ● The Peaceful Mind of a Wise Person – BG 2.70, 2.56 ● Freedom from Attachment = Peace – BG 2.71, 5.26 ● Peace Through Detachment – BG 2.71, 5.20
Unit 4	**RESPONSIBLE ACTION** ● **Understanding Intricacies of Action and Reaction - Karma, Vikarma & Akarma** – BG 4.17 ● Principles of Forbearance and Tolerance – BG 2.14, 12.13-14 ● Coping with Adversities and Reversals in Life – BG 2.14-15, 18.11 ● **Becoming Responsible in Action - Karma Yogi** – BG 3.7, 3.19, 3.30, 5.10 ● Performing Actions Without Attachment to Results – BG 2.47, 3.19 ● Acting in Accordance with Dharma – BG 3.35

	• Surrendering the Fruits of Actions to God – BG 9.22, 18.66 • Selflessness in Actions – BG 18.9 • Discerning Between Right and Wrong Actions – BG 18.63 • **Balanced Approach to Work and Rest** – BG 6.17 • Purifying Intentions Behind Actions – BG 18.11 • **Taking Responsibility for One's Actions and Their Impact** – BG 3.16

B23-VAC-306	German Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Examination**	**Internal assessment**	**Total**	**Duration of exam (Hours)**
2	**0**	**0**	**1**	**-**	**100**	**100**	**3 Hrs**
Purpose	**To learn about German Language Skills**						
Course Outcomes							
CO1	**Introduce students to basic German language.**						
CO2	**Enable basic communication in German (self-introduction, daily routine, etc.).**						
CO3	**Develop foundational skills in vocabulary and grammar.**						
CO4	**Develop foundational skills in reading, writing, listening, and speaking.**						

Course Outline

Unit 1: Introduction & Basics

- German alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite (der/die/das), indefinite (ein/eine)
- Personal pronouns (ich, du, er, etc.)
- Verb conjugation (regular verbs in Präsens)
- Sentence structure: main clause word order

Grammar II

- Verbs: haben, sein, modal verbs (möchten, können)
- Question words (wer, was, wo, etc.)
- Negation (nicht, kein)
- Possessive pronouns (mein, dein, etc.)
- Accusative case basics

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine

- Time and date
- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B23-VAC-308	Japanese Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Examination**	**Internal assessment**	**Total**	**Duration of exam (Hours)**
2	**0**	**0**	**1**	**-**	**100**	**100**	**3 Hrs**
Purpose	**To learn about Japanese Language Skills**						
Course Outcomes							
CO1	**Introduce students to basic Japanese language.**						
CO2	**Enable basic communication in Japanese (self-introduction, daily routine, etc.).**						
CO3	**Develop foundational skills in vocabulary and grammar.**						
CO4	**Develop foundational skills in reading, writing, listening, and speaking.**						

Course Outline

Unit 1: Introduction & Basics

- Alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite and indefinite
- Personal pronouns
- Verb conjugation (regular verbs in present tense)
- Sentence structure: main clause word order

Grammar II

- Common verbs (e.g., to be, to have, modal verbs)
- Question words
- Negation
- Possessive pronouns
- Basic cases or particles (as applicable)

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine
- Time and date
- House and furniture

- Hobbies and leisure

Communication Practice

- Simple dialogues (e.g., in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B23-VAC-310	French Language Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Examination**	**Internal assessment**	**Total**	**Duration of exam (Hours)**
2	**0**	**0**	**1**	**-**	**100**	**100**	**3 Hrs**
Purpose	**To learn about French Language Skills**						
Course Outcomes							
CO1	**Introduce students to basic French language.**						
CO2	**Enable basic communication in French (self-introduction, daily routine, etc.).**						
CO3	**Develop foundational skills in vocabulary and grammar.**						
CO4	**Develop foundational skills in reading, writing, listening, and speaking**						

Course Outline

Unit 1: Introduction & Basics

- Alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite and indefinite
- Personal pronouns
- Verb conjugation (regular verbs in present tense)
- Sentence structure: main clause word order

Grammar II

- Common verbs (e.g., to be, to have, modal verbs)
- Question words
- Negation
- Possessive pronouns
- Basic cases or particles (as applicable)

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine

- Time and date
- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (e.g., in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B. Tech. Computer Science and Engineering (CSE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

MODIFIED SCHEME OF EXAMS W.E.F THE SESSION 2025-26

SEMESTER-VI

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-CSE-302	Computer Networks	3:0:0	3	3	70	30	0	100	3
2	B23-CSE-304	Big Data Analytics and Visualization	3:0:0	3	3	70	30	0	100	3
3	--	Program Elective-I	3:1:0	4	4	70	30	0	100	3
4	--	Program Elective-II	3:1:0	4	4	70	30	0	100	3
5	B23-CSE-306	Operating Systems	3:0:0	3	3	70	30	0	100	3
6	B23-CSE-308	Computer Networks Lab	0:0:2	2	1	0	40	60	100	3
7	B23-CSE-310	Big Data Analytics and Visualization Lab	0:0:2	2	1	0	40	60	100	3
8	B23-CSE-312	Project-1	0:0:4	4	2	0	40	60	100	3
9	B23-MAC-301	Constitution of India	2:0:0	2	1	--	100	--	100	3
TOTAL				**27**	**22**	**350**	**370**	**180**	**900**	

Note:

- The course of both Program Elective and Open Elective will be offered at1/3rd strength or 20 students (whichever is smaller) of the section.
- All students have to undertake the industrial training for 6 to 8 weeks after 6th semester which will be evaluated in 7th semester.

Program Elective-I		**Program Elective-II**	
Android and Mobile App Development	B23-PEC-314	Automata Theory	B23-PEC-320
Deep Learning	B23-PEC-316	Compiler Design	B23-PEC-322
Natural Language Processing	B23-PEC-318	Mobile Sensor Networks	B23-PEC-324

B23-CSE-302	Computer Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	To introduce the architecture and layers of computer network, protocols used at different Layers.						
Course Outcomes (CO)							
CO1	To understand the basic concept of networking, types, networking topologies and layered architecture.						
CO2	To understand data link layer and MAC sub-layer`						
CO3	To understand the network Layer functioning						
CO4	To understand the transport layer and application layer operation						

Unit -I

Introduction to Computer Networks: Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and Wired networks, broadcast and point-to-point networks, Network topologies, protocols, interfaces and services, ISO- OSI reference model, TCP/IP architecture.

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing: Frequency Division, Time Division, Wavelength Division, Transmission Media: Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching, Packet Switching & comparisons, narrowband ISDN, broadband ISDN.

Unit -II

Data link layer: Error Control, Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, sliding window protocols, Selective repeat ARQ, HDLC;

Medium access sub layer: Point to point protocol, FDDI, token bus, token ring; Reservation, polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA, LLC, Traditional Ethernet, fast Ethernet, Network devices-repeaters, hubs, switches, Bridges, Router, Gateway.

Unit-III

Network layer: Addressing: Internet address, sub-netting; Routing techniques, static vs. dynamic routing, routing table, DHCP, IEEE standards 802.x, Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IGMP, IPV6; Unicast and multicast routing protocols, ATM.

Unit-IV

Transport layer: Process to process delivery; UDP; TCP, RPC, Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS.

Application layer: DNS; SMTP, SNMP, FTP, HTTP & WWW; Firewalls, Bluetooth, Email, S/MIME, IMAP,

Network Security: Cryptography, user authentication, security protocols in internet, public key encryption algorithm, digital signatures

Suggested Books:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw Hill, Fourth Edition, 2011.
2. Computer Networks, 4th Edition, Pearson Education by Andrew S. Tanenbaum
1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012.
2. William Stallings, “Data and Computer Communication”, Eighth Edition,Pearson Education, 2007.
3. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

B23-CSE-304	Big Data Analytics and Visualization						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	**To provide knowledge of Big Data Analytics and Distributed File Systems.**						
Course Outcomes (CO)							
CO1	To learn in details the concepts of big data.						
CO2	Expose the criteria of big data analytics and big data storage.						
CO3	To learn big data Visualization.						
CO4	To explore learning of big data tools and state-of-the-art knowledge with implementation for big data.						

Unit I: Big Data Background

Big data definition and features of big data, big data value, development of big data, challenges of big data, NoSQL databases, technologies related to big data including cloud computing, Internet of Things, data center, Hadoop, relationship between IoT and big data, relationship between hadoop and big data, big data generation and acquisition includes data collection, data transmission, data pre-processing, big data applications.

Unit II: Big Data Analytics and Storage

Big data analysis, big data analytic methods and tools, Pig, Hive, Flume, Mahout, Big data storage, distributed storage system for massive data, storage mechanism for big data GFS, HDFS, HBase, MongoDB, Cassandra, big data storage deduplication techniques, fixed-size and variable-size blocks based deduplication, content defined chunking, frequency based chunking, byte and multi- byte indexing techniques, Cloud storage.

Unit III: Big Data Visualization

Introduction to Data Visualization: Concepts, challenges, advantages, principles, Data Visualization types (Bar Charts, Histograms, Pie Charts, Scatter Plots, Line Plots, heatmap and treemap), Techniques for visual data representation.

Unit IV: Big Data Processing

Installation procedure with system requirements for Apache Hadoop, Cassandra, Spark, Pig, Hive, HBase, MongoDB large scale distributed storage systems, Map Reduce programming model working, YARN architecture, Apache Pig and Hive architecture, Single node and Multi-nodes Hadoop Cluster Set up and running a Big Data example, NoSQL implementation.

Text Books:

1. "Big Data" by Viktor Mayer-Schönberger, Kenneth Cukier, ISBN:978-0544002692, Eamon Dolan/Houghton Mifflin Harcourt 2013.
2. "Big Data Now", by O'Reilly Media Inc., ASIN: B0097E4EBQ, O'Reilly 2012.
3. "Hadoop Operation", by Eric Sammer, ISBN: 978-1449327057, O'Reilly 2012.
4. "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems", by Donald Miner, Adam Shook, ISBN:978-1449327170, O'Reilly 2012.

Reference Books:

1. "Programming Hive", by Edward Capriolo, ISBN: 978-1449319335,O'Reilly 2012.
2. "HBase: the Definitive Guide", by Lars George, ISBN: 978-1449396107, O'Reilly 2011.
3. "Mahout in Action", by Sean Owen, Robin Anil, Ted Dunning, Ellen

Friedman, ISBN: 978-1935182689, Manning 2011.
4. "Programming Pig", by Alan Gates, ISBN: 978-1449302641, O'Reilly 2011.
5. "Cassandra, the Definitive Guide", by Eben Hewitt ISBN: 978-1449390419 O'Reilly 2011.
6. "MongoDB: The Definitive Guide" by Kristina Chodorow, Michael Dirolf,ISBN: 978- 1449381561, O'Reilly, 2010.

B23-PEC-314	Android and Mobile App Development						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 hrs**
Purpose	**To introduce the concepts of developing the mobile applications.**						
Course Outcomes (CO)							
CO1	Be exposed to technology and Mobile apps development aspects.						
CO2	Be competent with the characterization and architecture of mobile applications.						
CO3	Appreciation of nuances such as native hardware play, location awareness, graphics, and multimedia.						
CO4	Perform testing, signing, packaging and distribution of mobile apps.						

Unit 1: Introduction to Mobility

Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, challenges of Android app development, Android SDK, versions of Android, setting up the Mobile App Development environment along with an Emulator, Understanding Anatomy of Android Application.

Mobile Platforms: URIs for mobile apps, Compare and contrast native mobile platforms such as tightly controlled (IPhone), open (Android), and licensed (Windows Mobile).

Unit II: Building blocks of Mobile

Activities, Activity life cycle and interaction between activities, App User Interface Designing – User Interaction, user input controls, Mobile UI resources (Layout, UI elements, Drawable, Menu) screen navigation. App functionality beyond user interface - Threads, Async task, Services – States and Life Cycle, Notifications, Broadcast receivers.

Unit III: Sprucing up Mobile Apps

Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, transferring data efficiently. Graphics and animation – Custom views, Animation APIs, Multimedia – Audio/Video playback and record, Location awareness.

Native data handling –file I/O, Shared preferences, shared data through content provider, Mobile databases such as SQLite.

Unit IV: Testing and Launching Mobile Apps

Debugging mobile apps, White box testing, Black box testing, and test automation of Mobile apps, JUnit for Android. Loading data using loaders, Permissions, Performance and Security, Firebase.

Suggested Books:

1. Barry Burd, *Android Application Development All in one for Dummies*, Wiley publications, 2nd Edition 2015.
2. Android Developer Fundamentals Course– Concepts (Learn to develop Android applications) Concepts Reference *Developed by Google Developer Training Team, 2016.*
3. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
4. Rick Boyer, Kyle Mew,Android Application Development Cookbook - Second Edition,2016.
5. Carmen Delessio, Lauren Darcey, Teach Yourself Android Application Development In 24 Hours , SAMS, 2013.
6. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009.
7. Maximiliano Firtman, Programming the Mobile Web, O'Reilly Media, 2010.

B23-PEC-316	Deep Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 hrs**
Purpose	To introduce deep learning concepts and study various types of networks in deep learning and its applications.						
Course Outcomes (CO)							
CO1	Demonstrate the basic concepts of deep learning and neural networks.						
CO2	To learn the feedforward and deep neural networks.						
CO3	Apply the concepts of RNN, long short term memory and other gated RNNs.						
CO4	To study applications of deep leaning in various domains.						

Unit-1: Introduction to Deep Learning

History of Deep learning, Deep learning model, Biological neuron, idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear perceptron, Perceptron learning algorithm, Linear separability, Convergence theorem for perceptron learning algorithm, Deep learning algorithms.

Unit-2: Feedforward & Deep Neural Networks

Feedforward neural networks: Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders.
Deep neural networks: Difficulty of training deep neural networks, Greedy layer-wise training.

Unit-3: Recurrent and Recursive Neural Networks

Newer optimization methods for neural networks (Adagrad, Adadelta, RMSprop, Adam, Nesterov Accelerated Gradient (NAG)), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).
Recurrent Neural Networks (RNNs): Back propagation through time, Long Short Term Memory (LSTM), Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

Unit-4: Convolutional Neural Networks, Generative Models and Recent Trends

Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet,Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.
Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to Markov Chain Monte Carlo (MCMC) and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.
Recent Trends: Variational Autoencoders, Generative Adversarial Networks, Multi-task deep learning, Multi-view deep learning.

Recommendation for students: Laboratory Work: To implement deep learning models using Python, Google Colab, Google open source library TensorFlow.

Suggested Books:

1. M Gopal, “Deep Learning, Core Concepts, Methods and Applications”, Pearson Education.
2. Ian J. Goodfellow, Bengio Yoshua, and Aaron Courville, “Deep Learning”, MIT Press.
3. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer Nature.
4. Seth Weidman, “Deep Learning from Scratch: Building with Python from First Principles” O’REILLY.

B23-PEC-318	Natural Language Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3 hrs.**
Purpose	This course aims to provide a comprehensive view of building real-world natural language processing (NLP) applications.						
Course Outcomes(CO)							
CO1	The students will be able to understand the wide spectrum of problem statements, tasks, and solution approaches within NLP						
CO2	The students will be able to implement and evaluate different NLP applications and apply machine learning and deep learning methods for this process						
CO3	Evaluate various algorithms and approaches for the given task, dataset, and stage of the NLP product.						
CO4	Understand best practices, opportunities, and the roadmap for NLP from a business and product leader's perspective						

UNIT-I Introduction

Origins and challenges of NLP – language modeling: grammar-based language modeling, statistical language modeling, regular expressions, finite-state automata – English morphology, transducers for lexicon and rules, tokenization, detecting and correcting spelling errors, minimum edit distance

UNIT-II Word Level Analysis and Syntactic Analysis

Unsmoothed n-grams, evaluating n-grams, smoothing, interpolation and backoff – word classes, part-of-speech tagging, rule-based, stochastic and transformation-based tagging, issues in pos tagging – hidden Markov and maximum entropy models.

Context-free grammar, grammar rules for English, treebanks, normal forms for grammar – dependency grammar – syntactic parsing, ambiguity, dynamic programming parsing – shallow parsing – probabilistic CFG, probabilistic CYK, probabilistic lexicalized CFGS – feature structures, unification of feature structures.

UNIT-III Semantics and Pragmatics

Requirements for representation, first-order logic, description logics – syntax-driven semantic analysis, semantic attachments – word senses, relations between senses, thematic roles, selectional restrictions – word sense disambiguation, WSD using supervised, dictionary & thesaurus, bootstrapping methods – word similarity using thesaurus and distributional methods.

UNIT-IV Basic Concepts of Speech Processing

Speech fundamentals: articulatory phonetics – production and classification of speech sounds; acoustic phonetics – acoustics of speech production; review of digital signal processing concepts; short-time Fourier transform, filter- bank, and LPC methods.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Lawrence Rabiner And Biing-Hwang Juang, "Fundamentals Of SpeechRecognition", Pearson Education, 2003.
4. Daniel Jurafsky And James H Martin, "Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And

Speech Recognition", Pearson Education, 2002

REFERENCE BOOKS:

1. Frederick Jelinek, "Statistical Methods Of Speech Recognition", MIT Press, 1997.

2. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015
3. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.

B23-PEC-320	Automata Theory						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3 hrs**
Purpose	To understand the challenges for Theoretical Computer Science and its contribution to other sciences						
Course Outcomes (CO)							
CO1	To explain and manipulate the different fundamental concepts in automata theory and formal languages.						
CO2	To gain insights into automata and context-free grammars, properties of languages, grammars and automata with rigorously formal mathematical methods, minimization.						
CO3	To differentiate and manipulate formal descriptions of push down automata, its applications and transducer machines.						
CO4	To understand basic properties of Turing machines and computing with Turing machine, the concepts of tractability and decidability.						

Unit-I: Introduction to Automata and Regular Expression

Introduction to Automata: Study and Central Concepts of Automata Theory, Applications of Finite Automata, An Introduction of Deterministic Finite Automata (DFA) and Non-Deterministic Finite Automata (NFA), Finite Automata with Epsilon (€) Transitions.

Regular Expression and Languages: Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws of Regular Expressions, Closure Properties of Regular Languages, RE to NFA, DFA Conversion and DFA to RE, Equivalence and Minimization of NFA and DFA automata.

Unit-II: Context Free Grammar and Pumping Lemma

Context Free Grammar and Language: Parse Trees, Context Sensitive Grammar, Context Free Grammar, Regular Grammar, Applications of Context Free Grammars, Ambiguity in Grammars and Languages. Closure Properties of CFL, Chomsky Theorem, Chomsky Hierarchy, Normal forms of context free grammars: Chomsky Normal Form, Greibach Normal Form.

Pumping Lemma: Introduction to Pumping Lemma, pumping lemma for context free languages, Applications of Pumping Lemma, Minimization of Finite Automata, and Recursive Language

Unit-III: Mealey and Moore Machines and Push Down Automata

Mealey and Moore Machines: Definitions, Representation, Equivalence of Moore and Mealey Machines and its Designing, Introduction of Push Down Automata (PDA), Language of PDA, Equivalence of PDA's and CFG's, Deterministic Push Down Automata, Designing of PDA, Applications of PDA.

Unit-IV: Turing Machine and Decidability

Introduction to Turing Machine: The Turing Machine, Programming Techniques for Turing Machine, Extensions of Turing Machine, Restricted Turing Machines, Universal Turing Machines and Designing of Turing Machines, Time and Tape Complexity Measures of Turing machines

Decidability: Post's Correspondence Problem (PCP), Rice's Theorem, Decidability and Undecidability properties, P-NP class and completeness.

Suggested Books:

1. J.E.Hopcroft, R.Motwani and J.D.Ullman, “Introduction to Automata Theory Languages and computation”, Pearson Education.
2. K.Krithivasan and R.Rama, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education.
3. Peter Linz, “An Introduction to Formal Language and Automata”, 4th Edition, Narosa Publishing House.
4. M.Sipser, “Introduction to the Theory of Computation, Brooks/Cole, Thomson Learning.
5. John.C.Martin, “Introduction to the Languages and the Theory of Computation”, Third edition, Tata McGrawHill.

B23-PEC-322	Compiler Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 Hrs.**
Purpose	To introduce complier design concepts and their implementation						
Course Outcomes(CO)							
CO1	To understand the role and designing of a lexical analyzer.						
CO2	To analyze the role and designing of syntax analyzer or parser.						
CO3	To identify the role of semantic analyzer and intermediate code generation.						
CO4	To explore the design importance of optimization of codes and error detection						

UNIT I

Introduction to Language Processing System, Compiling Analysis of the Source Program, Phases of a Compiler, Compiler Construction Tools. Lexical Analysis – Introduction to Finite Automata and Regular Expression, Conversion of Regular Expression to NFA, Working of Lexical Analyzer, Specification of Tokens.

UNIT II

Syntax Analysis: Role of the Parser, Construction of syntax trees, Abstract Syntax Trees, Ambiguity in Context-Free Grammars, Types of Parsing: - Top Down Parsing, Recursive Descent Parsing, LL Parser, Back Tracking, Bottom Up Parsing, SLR Parser, Canonical LR Parser, LALR Parser.

UNIT III

Semantic Analysis: Semantic Errors, Attribute Grammar, Synthesized attributes, Static Allocation, Stack Allocation, Heap Allocation, Activation Trees, Symbol Table, Intermediate Code Generation and Code Intermediate languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, DAG representation of Basic Blocks, A simple Code generator from DAG, Issues in the Design of Code Generator

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UNIT 1V

Code Optimization and Run Time Environments, Principal Sources of Optimization, Machine-independent Optimization, Machine-dependent Optimization, Optimization of Basic Blocks, Loop Optimization, Peephole Optimization, Introduction to Global Data Flow Analysis, Storage Organization, Static Storage Management, Heap Storage management, Parameter Passing. Error Recovery, Panic mode, Statement mode, Global correction.

Suggested Books:

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, “Compilers Principles, Techniques and Tools”, Pearson Education Asia, 2018.
2. Allen I. Holub “Compiler Design in C”, Prentice Hall of India, 2003.
3. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings, 2003.
4. V Raghavan , “ Principles of Compiler Design”, Second Edition, Tata McGraw-Hill, 2018.
5. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
6. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003

B23-PEC-324	Mobile Sensor Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 hrs**
Purpose	To enable students to develop comprehensive understanding of Mobile Ad-hoc Networks and Wireless Sensor Networks along with their routing protocol, real time applications and security issues.						
Course Outcomes (CO)							
CO 1	To understand the fundamental principles of Ad-hoc Networks.						
CO 2	To develop comprehensive understanding of Ad-hoc network protocols.						
CO 3	To understand network layer security for MANET and concepts for wireless sensor networks.						
CO 4	To explore data management in WSN and analyze the issues in security provision						

Unit I

Introduction to Mobile Ad hoc Networks (MANET) – Mobility Management, Characteristics, features and Attributes related to MANETs, Modeling distributed applications for MANET, MAC mechanisms and protocols.

Unit II

MANET Routing Protocols: Introduction, issues in designing a routing protocol for Ad-hoc networks, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, OLSR & TORA routing, location aided routing, zonal routing algorithm.

Unit III

Ad-Hoc Network Security: Link layer, Network layer, Trust and key management. Self-policing MANET – Node Misbehaviour, secure routing, reputation systems.
Wireless Sensor Networks (WSN): Design Issues, Clustering, Applications of WSN.

Unit IV

Data Management: Retrieval Techniques in WSN, Sensor databases, Data dissemination and aggregation schemes, Operating Systems for WSN.
Security issues and challenges in WSN, network security attacks

Suggested Books:

1 C. Siva Ram Murthy & B.S. Manoj, Mobile Ad hoc Networks – Architectures & Protocols, Pearson Education, New Delhi, 2004
2 C M Cordeiro& D.P. Agrawal, Adhoc & Sensor Networks – Theory and Applications, ISBN 981256-682-1, World Scientific Singapore, 2006
3 C. S. Raghvendra, Wireless Sensor Networks, Springer-Verlag, 2006.

B23-CSE-306	Operating Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hour**
Purpose	To familiarize the students with the basics of Operating Systems.						
Course Outcomes (CO)							
CO 1	To understand the structure and functions of Operating system.						
CO 2	To learn about processes, threads and scheduling algorithms.						
CO 3	To understand the concept of deadlocks.						
CO 4	To study I/O management and file systems, Protection and security						

UNIT I

Introduction: Introduction to OS. Operating system functions, Different types of O.S.: batch process, multi-programmed, time-sharing, real-time, distributed, parallel. System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

UNIT II

CPU scheduling: scheduling criteria, preemptive and non-preemptive scheduling,scheduling algorithms, algorithm evaluation, multiprocessor scheduling.

Threads: overview, benefits of threads, user and kernel threads. Process Management: Concept of processes, process states, process control, co-operating processes, inter-process communication. Process Synchronization: background, critical section problem, critical region, synchronization hardware, Classical problems of synchronization, semaphores.

UNIT III

Deadlocks: Concept of deadlock, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock. Memory Management: background, logical vs. physical address space, contiguous memory allocation, paging, segmentation, segmentation with paging. Concept of fragmentation. Virtual Memory: background, demand paging, concept of page replacement, page replacement algorithms, allocation of frames, thrashing.

UNIT IV

File Systems: file concept, file organization and access methods, allocation methods, directory structure, free-space management I/O Management: I/O hardware, polling, interrupts, DMA, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation) Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN) , disk reliability, disk Performance parameters

Protection and Security: Goals of protection and security, security attacks, authentication, program threats, system threats, threat monitoring.

Suggested Books:

1. Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley 2. 2. Operating systems: a concept based approach", Dhananjay M. Dhamdhere, McGraw Hill
3. Operating Systems : Internals and Design Principles, William Stallings, Pearson
4. Operating Systems Design and Implementation" ,(Prentice Hall Software Series) Andrew S Tanenbaum and Albert S Woodhull.
5. Taub and Schilling, Principles of Communication Systems, TMH.
6. Mithal G K, Radio Engineering, Khanna Pub.
7. Sirnon Haykin, Communication Systems, John Wiley

B23-CSE-308	Computer Networks Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 hrs**
Purpose	**To explore networking concepts using Java programming & networking tools.**						
Course Outcomes (CO)							
CO1	Do Problem Solving using algorithms.						
CO2	Design and test simple programs to implement networking concepts using Java.						
CO3	Document artifacts using applied addressing & quality standards.						
CO4	Design simple data transmission using networking concepts and implement.						

List of Practicals:

1. Study of Network Devices in Detail
2. Create a socket for HTTP for web page upload and download.
3. Performance comparison of MAC protocols
4. Implementation of STOP & WAIT protocol and sliding window protocol
5. Write a code simulating ARP /RARP protocols.
6. Write a program to implement a chat server and client in java using TCP sockets.
7. Write a program to implement a chat server and client in java using UDP sockets.
8. To study the working of firewall.
9. To sniff and parse packets that pass through using raw sockets.
10. To implement simple calculator and invoke arithmetic operations from a remote client.
11. Configure Network using Link State Vector Routing protocol.
12. Configure a Network using Distance Vector Routing protocol.
13. Study of basic network command and Network configuration commands.

B23-CSE-310	Big Data Analytics and Visualization Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hours**
Purpose	**To familiarize the students with the basics of Big Data Analytics**						
Course Outcomes (CO)							
CO1	To understand installation and configuration of Hadoop						
CO2	To learn installation and configuration of python, numPy and Pandas						
CO3	Learn to Develop a MapReduce program for different types of problems						
CO4	To understand mongodb and SPARK						
CO5	Learn to stores big data in MongoDB / Pig using Hadoop / R.						

List of Practicals:

1. Install, configure and run Hadoop
2. Install, configure and run python, numPy and Pandas.
3. Implement a MapReduce program that processes a dataset.
4. Develop a MapReduce program to calculate the frequency of a given word in a given file.
5. Develop a MapReduce program to find the maximum temperature in each year.
6. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB.
7. Implement clustering techniques using SPARK.
8. Implement an application that stores big data in MongoDB / Pig using Hadoop / R.
9. Visualize data using basic plotting techniques in Python.
10. Implementing database operations on Hive.

B23-MAC-301	Constitution of India						
				Examination Schedule (Marks)			
Lecture	Tutorial	Practical	Credit	End semester exam	Internal assessment	Total	Duration of Exam (Hours)
2	0	0	1	--	100	100	3
Purpose	This course introduces students to the basic Philosophy of Indian Constitution.						
Course Outcomes (CO): After completion of course, the students will be able							
CO 1	To explain the basic structure of Indian Constitution						
CO 2	To understand the structure of Indian Union						
CO 3	To write down roles and powers of Governor						
CO 4	To explain the election process under Indian Constitution.						

Unit 1

The Constitution - Introduction, The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties, Brief overview of Directive principles of State Policy.

Unit 2

Union Government, Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Brief overview of Lok Sabha and Rajya Sabha.

Unit 3

State Government, Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat, distributions of powers between state and centre under Indian Constitution.

Unit 4

Local Administration, District Administration, Municipal Corporation, Zila Panchayat.
Election Commission a. Role and Functioning b. Chief Election Commissioner c. State Election Commission

Suggested Learning Resources:

1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/