

Bachelor of Technology (Information Technology)										
Credit-Based Scheme of Studies/Examination										
Semester V (w.e.f. session 2026-2027)										
S. No.	Course Code	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1.	B24-IT-301	Web and Internet Technology	3:0:0	3	3	70	30	0	100	3
2.	B24-IT-303	Design and Analysis of algorithms	3:0:0	3	3	70	30	0	100	3
3.	B24-IT-305	Machine Learning	3:1:0	4	4	70	30	0	100	3
4	B24-IT-307	Software Engineering	3:0:0	3	3	70	30	0	100	3
5	B24-HSM-IT-317	Innovation, Startups and Entrepreneurship	3:0:0	3	3	70	30	0	100	3
6	B24-IT-309	Web and Internet Technology Lab	0:0:2	2	1	0	40	60	100	3
7	B24-IT-311	Design and Analysis of Algorithms Lab	0:0:2	2	1	0	40	60	100	3
8	B24-IT-313	Machine Learning Lab	0:0:2	2	1	0	40	60	100	3
9	B24-IT-315	Industrial training	0:0:2	2	1	-	100	-	100	-
10	B24-VAC-IT-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	

B24-IT-301	Web and Internet Technology						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	0	0	3	70	30	100	3 hrs.
Purpose	To gain the knowledge of Internet technologies, Web development standards, scripting languages, modern tools and frameworks to create dynamic and responsive Web-based hyper media design applications.						
CourseOutcomes(CO)							
CO1	To understand the Internet, its architecture, and applications and to acquire Basic knowledge 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:ScriptingLanguage: 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 HTMLand 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

IntroductiontoPHP,PHPsyntax,variables,constants,datatypes,andoperator,control structures:conditionalstatements(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: AngularJS, ReactJS, NodeJS, 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

B24-IT-303	Design and Analysis of Algorithms						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	0	0	3	70	30	100	3 hrs.
Purpose	Describe, apply and analyze the complexity of various sorting and searching algorithms.						
	Course Outcomes						
CO1	Demonstrate different ways to measure the efficiency of algorithms using Asymptotic notation.						
CO2	Identify and analyze various single source shortest path algorithms.						
CO3	Study various algorithms and implementation methods for divide and conquer greedy and dynamic programming approaches.						
CO4	Demonstrate a familiarity with major algorithms like Back Travelling and Branch & Bound.						

Unit-1

Introduction: Algorithm, Analyzing algorithm, Designing algorithm, Concept of algorithmic efficiency, Run time analysis of algorithms, Asymptotic Notations.

Divide and conquer: Structure of divide and conquer algorithms : examples; binary search, quick sort, Strassen Multiplication; Analysis of divide and conquer run time recurrence relations.

Unit-2

Greedy Method: Overview of the greedy paradigm examples of exact optimization solution (minimum cost spanning tree), approximate solution (Knapsack problem), Single source shortest paths.

Dynamic programming: Overview, difference between dynamic programming and divide and conquer, Applications: Shortest path in graph, Matrix multiplication, Travelling salesman problem, longest common sequence.

Unit-3

Backtracking: Overview, 8-queen problem, and Knapsack problem

Branch and bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem.

Unit-4

Graph searching and Traversal: Overview, Traversal methods (depth first and breadth first search).

Trees: Review of trees, Binary search tree, Traversal, Insertion & Deletion in Binary Search Tree, B-Trees, B+ Trees, Basic operations on B Trees.

Computational Complexity: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

Suggested Book:

1. E. Horowitz, S. Sahni, and S. Rajsekar, "Fundamental Computer Algorithms," Galgotia Publication of
2. T. H. Cormen, L. Leiserson, R. Rivest and S. Stein, "Introduction of Computer Algorithm," PHI.
3. Sara Basse, A. V. Gelder, "Computer Algorithms," Addison Wesley.

B24-IT-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,DataMiningConceptsandTechniques,LatestEdition
3. ChristopherBishop.PatternRecognitionandMachineLearning.2e.
4. MachineLearning.TomMitchell.FirstEdition,McGraw-Hill,1997.
5. Introductionto Machine LearningEdition2, byEthemAlpaydin.
6. M.Gopal,AppliedMachine learning,McGraw-HillEducation, 2019
7. DavidForsyth,AppliedMachinelearning,Springer,2019
8. PascalBugnion,PatrickR.Nicolas,AlexKozlov,Scala:AppliedMachine Learning,Packt Publishing,1st Edition, 2017.

B24-IT-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 account ability of software.						

Unit-I:

Introduction: Program vs. software products, emergence of software engineering, software life cycle, models: waterfall, prototype, evolutionary and spiral model, Software Characteristics, Applications, Software crisis. Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation techniques, empirical estimation techniques, COCOMO, A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking.

Unit-II:

Requirements Analysis and specification: Requirements engineering, SRS, Specifying behavioral and non-behavioral requirements.

System Design:

Design concepts and principles: the design process: Design and software quality, design principles, Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure software procedure, information hiding, Effective modular design: Functional independence, Cohesion, Coupling, Architectural Design: Software architecture, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into software architecture.

Unit-III:

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, Unit testing: white box testing, basic path testing; Control structure testing: Black box testing, Software Testing Strategies: Verification and validation, Integration testing, Validation testing, alpha and beta testing. Debugging process, debugging approaches.

Software re-engineering: Reverse engineering, restructuring, forward engineering.

Unit-1V

Software Reliability and Quality Assurance: Quality concepts, Software quality assurance, SQA activities; formal technical reviews: The review meeting, review reporting and record

keeping, review guidelines.

Software reliability: Measures of reliability and availability, The ISO 9000 Quality standards, SEI-CMM Capability Maturity Model.

SuggestedBooks

1. K.K.Aggarwal, YogeshSingh:SoftwareEngineering,NewAgeInternationalLtd,2001.
2. R.S.Pressman,SoftwareEngineering–APractitioner’sApproach,5thEd,TMH,2000.
3. IanSommerville,SoftwareEngineering,4thEd.,Addison Wesley.
4. PankajJalote,AnIntegratedApproachtoSoftwareEngineering2ndEd,NarosaPublishing

B24-HSM-IT-317		Innovation, Start ups and Entrepreneurship					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	0	0	3	70	30	100	3 hrs.
Course Outcomes (CO)							
Purpose	The objective of this Course is to inspire students and help them imbibe entrepreneurial mindset.						
CO1	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.						
CO2	Understanding the dynamic role of entrepreneurship and small businesses, Types of business structure, organizing and managing a Small Business						
CO3	Understanding concept of start-ups, Control Strategic Marketing Planning, concept of incubation and proto type, new Product Development, Business Plan Creation.						
CO4	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:

- ShrutinNShetty,(2018),DesigntheFuture:SimplifyingDesign ThinkingtoHelpYou, Notion Press
- “Entrepreneurshipdevelopmentsmallbusinessenterprises”, Pearson,PoornimaM Charantimath,2013.
- RoyRajiv,“Entrepreneurship”,OxfordUniversityPress,2011.
- “InnovationandEntrepreneurship”,Harperbusiness-Drucker.F,Peter,2006.
- “Entrepreneurship”,TataMc-grawHillPublishingCo.ltdnewDelhi-RobertD.Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- TheThree-BoxSolution:AStrategyforLeadingInnovationByVijayGovindarajan
- Boutellier,Roman;Gassmann,Oliver;vonZedtwitz,Maximilian(2000).ManagingGlobal Innovation. Berlin: Springer.. ISBN 3-540-66832-2.
- BrownK.andStephenP.Osborne(2005)Managingchangeandinnovationinpublicservice organisation. New York: Routledge
- Cappellin R. and Wink R. (2009) International Knowledge and Innovation Networks KnowledgeCreationandInnovationinMedium-technologyClusters.UK:EdwardElgar Publishing Limited.
- Eveleens,C.(2010).Innovationmanagement;aliteraturereviewofinnovationprocess models and their implications. Working Paper HAN University of Applied Sciences.
- EntrepreneurshipDevelopment-S.Chand&Co.,Delhi-S.S.Khanka1999
- Small-ScaleIndustriesandEntrepreneurship.HimalayaPublishingHouse,Delhi–Vasant Desai 2003.
- EntrepreneurshipManagement-Cynthia,Kaulgud,Aruna,VikasPublishingHouse,Delhi, 2003

B24-IT-309	Web and Internet Technology 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 dynamic Web applications using modern Front-end and back-end technologies.						
CourseOutcomes (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 buildfull-stack web applications.						
CO4	To deploy Web applications on cloud platforms.						

List of Practicals

- Design a Web page of your home town with an attractive background color, text color, an image, font etc. (use internal CSS).
- Design a Webpage to format college Website using external, internal, and inline CSS.
- Create HTML Page with JavaScript which takes integer number as input and tells whether the number is odd or even.
- Write a program to validate a user form using JavaScript.
- Write a program to create a dynamic image gallery using JavaScript.
- Create XML file to store student information like enrollment number, name, mobile number, E-mail Id and also create DTD for above XML file.
- Write a PHP program to check if number is prime or not.
- Write a PHP program to print first 10 Fibonacci Numbers.
- Create HTML page that contains textbox, submit / reset button. Write PHP program to display this information and also store into text file.
- 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.
- Write PHP Script for storing and retrieving user information from MySQL table.
- (i) Design HTML page which takes name, address, E-mail and mobile, (ii) No. From userregister.php, (iii) Store this data in MySQL database / text file, and (iv) Next page display all user in HTML table using PHP (display.php).
- Write a program to implement a simple login and registration system using PHP and MySQL.
- Write a program to implement session management and cookies in PHP.
- Write a program to create a responsive Web page using Bootstrap.
- Write a program to fetch and display data from an API using JavaScript (Fetch API/Axios).
- Write a program using ReactJS/AngularJS to build a simple dynamic Web application.
- Write a program using NodeJS/ExpressJS to create a basic server-side application.
- Write a program to deploy a Web application on Firebase.
- Write a program to build a simple chat application using Web Sockets and NodeJS.
- Write a program to integrate Google Maps API into a Webpage.

B24-IT- 311	Design and Analysis of algorithms Lab						
Lecture	Tutorial	Practical	Credit	Internal Assessment	Practical Exam	Total	Time
--	--	2	1	40	60	100	3Hour
Purpose	The student will learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and understand how to implement various algorithms						
CourseOutcomes(CO)							
CO1	The student should be able to Design algorithms for various computing problems						
CO2	The student should be able to Analyse the time and space complexity of algorithms.						
CO3	The student should be able to critically analyse the different algorithm design techniques for a given problem.						
CO4	The student should be able to modify existing algorithms to improve efficiency.						

List of Practicals

1. Program to find the given element in Binary Search Tree.
2. Program to implement Binary Search Tree.
3. Program to implement Prim's algorithm using greedy method.
4. Program to implement Kruskal's algorithm using greedy method.
5. Program to implement graph traversal using Breadth First Search.
6. Program to implement graph traversal using Depth First Search.
7. Program to implement N-queen's problem.
8. Program to implement all pairs shortest path.
9. Program to implement Activity Selection Problem.
10. Program to implement Knapsack problem.
11. Program to implement Graph Coloring Problem.
12. Program to implement Naïve String matching algorithm.

B24-IT-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 Naïve Bayesian Classification algorithm.
8. Implement the Support Vector Machine algorithm.
9. Implement the K-Means Clustering Algorithm.
10. Implement the Principal Composition Analysis(PCA).

B24-VAC-IT-302	Hindi Language Skills						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
2	-	-	1	-	100	100	3 hrs

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.

B24-VAC-IT-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							
CO1	Learn behavioural science from Bhagwat Gita						
CO2	Learn self awareness and spirituality from Bhagwat Gita						
CO3	Learn mind management from Bhagwat Gita						
CO4	Learn responsible behavior from Bhagwat Gita						

Unit 1	<u>BEHAVIOURAL SCIENCE</u> • 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	<u>SELF-AWARENESS</u> • 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	<u>MINDMANAGEMENT-ART OFMINDCONTROL</u> • TheRootof Frustration &Anger–BG 2.62-63 • Discover the Real Reason Behind Lack of Motivation–BG3.36, 3.41 • ControllingtheUncontrolledMind–BG6.26 • UnderstandingtheMind&Its Power–BG6.6,3.42 • Mind Like a Boatin StormyWaters–BG2.67 • LearntoStay CalmUnderPressure– BG2.14,2.56 • The Peaceful Mind of a Wise Person–BG 2.70,2.56 • FreedomfromAttachment=Peace–BG2.71,5.26 • PeaceThroughDetachment–BG2.71,5.20
Unit 4	<u>RESPONSIBLEACTION</u> • Understanding Intricacies of Action and Reaction-Karma, Vikarma & Akarma – BG 4.17 • Principles of For bearance and Tolerance –BG2.14,12.13-14 • Coping with Adversities and ReversalsinLife– BG2.14-15,18.11 • Becoming Responsible in Action-KarmaYogi–BG3.7,3.19, 3.30, 5.10 • PerformingActionsWithoutAttachmentto Results–BG2.47, 3.19 • ActinginAccordance withDharma–BG 3.35 • Surrenderingthe Fruitsof ActionstoGod–BG9.22, 18.66 • SelflessnessinActions–BG18.9 • Discerning Between Right and Wrong Actions–BG 18.63 • Balanced Approach to Work and Rest –BG6.17 • PurifyingIntentions BehindActions –BG18.11 • Taking Responsibility for One’sActions and TheirImpact–BG 3.16

B24-VAC-IT-306	GermanLanguage Skills						
Lecture	Tutorial	Practical	Credit	End semester Examination	Internal Assessment	Total	Duration of exam
2	0	0	1	-	100	100	3hrs
Purpose	To learn about German Language Skills						
CourseOutcomes							
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

Unit1:Introduction&Basics

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

Unit2:VocabularyBuildingI

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colorsandclothing
- Weather

Unit3:GrammarI

- 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

GrammarII

- Verbs:haben,sein,modalverbs(möchten,können)
- Question words(wer,was,wo,etc.)
- Negation(nicht,kein)
- Possessive pronouns(mein,dein,etc.)
- Accusativecasebasics

Unit4:VocabularyBuildingII

- Foodand drink
- Daily routine
- Timeanddate
- Houseand furniture
- Hobbiesand leisure

CommunicationPractice

- Simpliedialogues(incafé,atuniversity,athome)
- Roleplays(shopping,askingdirections,introductions)
- Listeningpractice(audioexercises)
- Writingpractice(shorttexts,fillingforms)

Assessment(Optional/Recommended)

- Vocabularyquizzes
- Shortwrittenassignments
- Oralpresentationorrole-play
- Finaltest(basicgrammarandvocabulary)

B24-VAC-IT 308	Japanese Language Skills						
Lecture	Tutorial	Practical	Credit	End semester Examination	Internal assessment	Total	Duration ofexam
2	0	0	1	-	100	100	3Hrs
Purpose	To learn about Japanese Language Skills						
CourseOutcomes							
CO1	Introduce students to basic Japanese language.						
CO2	Enable basiccommunication in Japanese(self-introduction,daily routine, etc.)						
CO3	Develop foundational skills in vocabulary and grammar.						
CO4	Develop foundational skills in reading, writing, listening,						

Course Outline

Unit1: Introduction & Basics

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

Unit2: Vocabulary Building I

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

Unit3: 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)

Unit4: Vocabulary Building II

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

- Hobbies and leisure

Communication Practice

- Simple dialogues(e.g.,incafé,atuniversity,athome)
- Role plays(shopping,askingdirections,introductions)
- Listening practice(audioexercises)
- Writing practice(shorttexts,fillingforms)

Assessment(Optional/Recommended)

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

B24-VAC-IT-310	French Language Skills						
Lecture	Tutorial	Practical	Credit	End semester Examination	Internal assessment	Total	Duration of exam (Hours)
2	0	0	1	-	100	100	3Hrs
Purpose	To learn about French Language Skills						
CourseOutcomes							
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

Unit1: Introduction & Basics

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

Unit2: Vocabulary Building I

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

Unit3: 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)

Unit4: Vocabulary Building II

- Food and drink
- Daily routine

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

Communication Practice

- Simple dialogues(e.g.,incafé,atuniversity,athome)
- 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)

Bachelor of Technology (Information Technology)										
Credit-Based Scheme of Studies/Examination										
Semester VI(w.e.f. session 2026-2027)										
S. No.	Course Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Durati on of Exam (Hrs.)
						End Semest er Exam	Intern al Assess ment	Practic al Exam	Total	
1	B24-IT-302	Computer Networks	3:0:0	3	3	70	30	0	100	3
2	B24-IT-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	B24-HSM-IT-306	Intellectual Property Rights(IPR) and Regulatory	3:0:0	3	3	70	30	0	100	3
6	B24-IT-308	Computer Networks Lab	0:0:2	2	1	0	40	60	100	3
7	B24-IT-310	Big Data Analytics and Visualization Lab	0:0:2	2	1	0	40	60	100	3
8	B24-IT-312	Project-1	0:0:4	4	2	0	40	60	100	3
9	B24-MAC-IT-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 at 1/3rd 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	B24-PEC-IT-314	Automata Theory	B24-PEC-IT-320
Deep Learning	B24-PEC-IT-316	Compiler Design	B24-PEC-IT-322
Natural Language Processing	B24-PEC-IT-318	Mobile Sensor Networks	B24-PEC-IT-324

B24-IT-302	Computer Networks						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	0	0	3	70	30	100	3 hrs.
Purpose	This course covers the concepts of computer networking and communication.						
Course Outcomes							
CO1	To understand OSI layer model in networking protocols and services.						
CO2	To understand, differentiate & analyze various high speed LAN, MAN &WAN. .						
CO3	Study different protocols of TCP/IP layers with real life applications.						
CO4	Learn Mobile IP principles, multicast protocols and security issues for mobile IP.						

Unit-1

Introduction: Basics of Computer Networks, need and Evolution of computer networks, description of LAN, MAN, WAN & wireless networks.

Basics terminology of Computer Networks: Bandwidth, physical and logical topologies, media 10 base 2, 10 base 5, 10base-T, 100 base FX, 100base LX.

LAN & WAN devices–Repeaters, Hubs, Switches, Bridges, Router, Gateway

OSI Reference Model: Laying architecture of networks, OSI model, Functions of each layer, Services and Protocols of each Layer.

Unit-2

TCP/IP: Introduction History of TCP/IP, Layers of TCP/IP, Protocols, Internet Protocol, Transmission control protocol, User Datagram Protocol, Internet control Protocols, ARP, RARP, DHCP, ICMP, application layer, Domain Name System, Email-SMTP, POP, IMAP, FTP, HTTP, TELNET, overview of IP version 6.

OSI and TCP/IP model with description of data encapsulation & peer to peer communication, comparison of OSI and TCP/IP model.

Unit-3

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise. Different types of media-twisted pair, unshielded twisted pair, coaxial cable, optical Fiber cable and wireless.

Data Link Layer: LLC and MAC sub layer, framing error control and flow control. Error detection & correction- CRC, block codes parity and checksum, elementary data link protocol, sliding window protocol, channel allocation problem-static and dynamic, Multiple Access protocol- ALOHA, CSMA/CA, Token bus, Token ring, FDDI.

Unit-4

Network Layer: Internet address: IP addressed Classes. Subnetting – Sub-network, Subnet Mask, Routing techniques, static vs. dynamic routing, routing table, Routing algorithms: optimality principle, shortest path algorithm, distance vector routing, link state routing, hierarchical routing, Broadcast routing, Multicast routing, Routing for mobile host.

Transport Layer: Process to process delivery; TCP & UDP. Three-way handshaking. ATM AAL layer protocol.

Suggested books

1. Tanenbaum. “Computer Networks”, PHI
2. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill
3. Darlax, “Computer Network and their protocols”, DLA Labs.

4. Freer, "Comp. Communication and Networks", East-West-Press.
5. Halsall Fred, Data Communications, Computer Networks & open systems Addison Wesley
6. Fitzgerald Jerry, Business data communications,
7. Larry L. Peterson & Bruce S. Davie Computer Networks—A system approach, 2nd Ed TMH.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B24-IT-304	Big Data Analytics and Visualization						
Lecture	Tutorial	Practical	Credit	EndSemester 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 bigdata.						
CO2	Expose the criteria of bigdata analytics and bigdata storage.						
CO3	To learn bigdataVisualization.						
CO4	To explore learning of bigdata tools and state-of-the-art knowledge with implementation for big data.						

UnitI

BigDataBackground: 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.

UnitII

BigDataAnalyticsandStorage: 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.

UnitIII

BigDataVisualization: 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.

UnitIV

BigData Processing: Installation procedurewith system requirements forApacheHadoop, 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.

TextBooks:

1. "BigData"byViktorMayer-Schönberger,KennethCukier,ISBN:978-0544002692, Eamon Dolan/Houghton Mifflin Harcourt 2013.
2. "BigDataNow",byO'ReillyMediaInc.,ASIN:B0097E4EBQ,O'Reilly2012.
3. "HadoopOperation",byEricSammer,ISBN:978-1449327057,O'Reilly2012.
4. "MapReduceDesignPatterns:BuildingEffectiveAlgorithmsandAnalyticsfor Hadoop and Other Systems", by Donald Miner, Adam Shook, ISBN:978- 1449327170, O'Reilly 2012.

ReferenceBooks:

1. "ProgrammingHive",byEdwardCapriolo,ISBN:978-1449319335,O'Reilly2012.
2. "HBase:theDefinitiveGuide",byLarsGeorge,ISBN:978-1449396107,O'Reilly2011.
3. "MahoutinAction", bySeanOwen,RobinAnil,TedDunning, EllenFriedman,ISBN:978-1935182689,Manning2011.
4. "ProgrammingPig",byAlanGates,ISBN:978-1449302641,O'Reilly2011.
5. "Cassandra,theDefinitiveGuide",byEbenHewittISBN:978-1449390419O'Reilly 2011.
6. "MongoDB:TheDefinitiveGuide"byKristinaChodorow,Michael Dirolf,ISBN: 978-1449381561, O'Reilly, 2010.

B24-PEC-IT-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 nuancessuchas native hardware play, location awareness, graphics, and multimedia.						
CO4	Perform testing, signing, packaging and distribution of mobileapps.						

Unit-I

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.

B24-PEC-IT-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 feed forward 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-I

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-II

Feed forward & Deep Neural Networks: Feed forward neural networks: Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, autoencoders. Deep neural networks: Difficulty of training deep neural networks, Greedy layer-wise training.

Unit-III

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-IV

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. MGopal, "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.

B24-PEC-IT-318	Natural Language Processing						
Lecture	Tutorial	Practical	Credit	EndSemester 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 evaluated different NLP applications and apply machine learning and deep learning methods for this process						
CO3	Evaluatevariousalgorithmsandapproachesforthe giventask,dataset,andstageoftheNLPproduct.						
CO4	Understandbestpractices,opportunities,andtheroadmapforNLPfromabusinessandpr oductleader’sperspective						

UNIT-I

Introduction: Origins and challenges of NLP – language modeling: grammar-based language modeling, statistical languagemodeling,regularexpressions,finite-stateautomata–Englishmorphology,transducersforlexicon 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–syntacticparsing,ambiguity,dynamicprogrammingparsing–shallowparsing–probabilistic CFG, probabilistic CYK, probabilistic lexicalized CFGS – feature structures, unification of feature structures.

UNIT-III

SemanticsandPragmatics: 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.

TEXTBOOKS:

1. DanielJurafsky,JamesH.Martin—SpeechandLanguageProcessing:AnIntroductiontoNatural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. StevenBird,EwanKleinandEdwardLoper,—NaturalLanguageProcessingwithPython,First Edition, O'Reilly Media, 2009.
3. LawrenceRabinerAndBiing-HwangJuang,“FundamentalsOfSpeechRecognition”,Pearson Education, 2003.
4. DanielJurafskyAndJamesH.Martin,“SpeechAndLanguageProcessing–AnIntroductionTo Natural

Language Processing,
And Speech Recognition”, Pearson Education, 2002

Computational

Linguistics,

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.

B24-PEC-IT-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 in to 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 (ϵ) 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

ContextFreeGrammarandPumping Lemma: Context Free Grammar and Language: Parse Trees, Context Sensitive Grammar, Context Free Grammar, Regular Grammar, Applications of Context Free Grammars, Ambiguity in GrammarsandLanguages.ClosurePropertiesofCFL,ChomskyTheorem,ChomskyHierarchy,Normalforms 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

Mealeyand MooreMachinesandPushDown 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.

SuggestedBooks:

1. J.E.Hopcroft,R.MotwaniandJ.D.Ullman,“IntroductiontoAutomataTheoryLanguages and computation”, Pearson Education.

2. K.KrithivasanandR.Rama,“IntroductiontoFormalLanguages,AutomataTheoryand Computation”, Pearson Education.
3. PeterLinz,“AnIntroductiontoFormalLanguageandAutomata”,4thEdition,Narosa Publishing House.
4. M.Sipser,“Introductionto theTheoryofComputation, Brooks/Cole,ThomsonLearning.
5. John.C.Martin,“IntroductiontotheLanguagesandtheTheoryofComputation”,Third edition, Tata McGrawHill.

B24-PEC-IT-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

UNIT-IV

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, 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

B24-PEC-IT-324		Mobile Sensor Networks					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal assessment		Time
3	1	0	4	70	30		3 hrs.
Purpose	To enable students to develop comprehensive understanding of Mobile Ad-hoc Networks and Wireless Sensor Networks along with their routing protocol, realtime 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.SivaRam Murthy&B.S.Manoj, Mobile Adhoc Networks –Architectures & Protocols, Pearson Education, New Delhi, 2004
- 2 CMCordeiro&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.

B24-HSM-IT-306	Intellectual Property Rights(IPR) and Regulatory						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3.0	70	30	100	3 hrs.
Course Outcomes							
Purpose	The course is designed to provide comprehensive knowledge to the students regarding the general principles of IPR, Concept and Theories, International Regime Relating to IPR						
CO1	Students will be familiarized with the introduction about patent concept and legal implications						
CO2	Students will be able understand the concept of copyright in detail						
CO3	Students will be able to understand trademark and law associated with it.						
CO4	Students will be able to know about geographical Indications, industrial design and IPR in information Technology						

UNIT-I

Indian patent law: The patents act, 1970, amendments to the patents act, patentable subject matter, patentability criteria, procedure for filing patent applications, patent granting procedure, revocation, patent infringement and remedies, relevant provisions of the biological diversity act, 2002, access and benefit sharing issues, objectives, rights, patent act 1970 and its amendments. procedure of obtaining patents, working of patents. infringement.

UNIT-II

Copyrights: Introduction, works protected under copyright law, infringement. introduction to copyright, international protection of copyright and related rights- an overview Indian copyright act, 1957 with its amendments, copyright works, ownership, transfer and duration of copyright, renewal and termination of copyright

Industrial Designs: Need for protection of industrial designs, subject matter of protection and requirements, the designs act, 2000, procedure for obtaining design protection, revocation, infringement and remedies.

UNIT-III

Trademarks: Objectives, types, rights, protection of goodwill, infringement, passing off, need for protection of trademark, kinds of trademark, Indian trademarks law, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, assignment under licensing, infringement, right of goodwill, passing off, domain names and effects of new technology (internet).

UNIT-IV

Geographical Indications: Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position. **Industrial Designs:** Objectives, Rights, Assignments, Infringements, Information Technology Related Intellectual Property Rights, Computer Software and Intellectual Property, Database and Data Protection, Protection of Semiconductor chips, Domain Name Protection, Implications of intellectual property rights on the commercialization of Biotechnology products.

References:

- N.S.Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
- David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012
- Susan K. Sell, Private Power, Public Law: The Globalization of Intellectual Property Rights, Cambridge University Press, 2003
- N.S.Gopalakrishnan & T.G. Ajitha, Principles of Intellectual Property, Eastern Book Company, 2nd Edition, 2014
- Jayashree Watal, Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, 2001
- Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford University Press, 3rd Edition, 2008
- Duggal Pavan, Legal Framework on Electronic Commerce & Intellectual Property Rights, Universal Publishing House, 2014
- Paul Torremans, Intellectual Property and Human Rights, Kluwer Law International, 2008
- Steven D. Anderman, Interface Between Intellectual Property Rights and Competition Policy, Cambridge University Press, 2007.
- Philippe Cullet, Intellectual Property Protection and Sustainable Development, Lexis Nexis, 2005

B24-IT-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	Identify, analyze, and implement basic network infrastructure by studying physical media, cable pin configurations (straight-through and cross-over), and installing and configuring LAN cards.						
CO2	Design and establish a functional Local Area Network (LAN) by configuring switches and understanding the working of hubs, bridges, and routers.						
CO3	Apply networking commands and services such as Telnet, FTP, and Remote Desktop to configure, manage, and troubleshoot networked systems.						
CO4	Explain and implement FTP for file transfer operations in a networked environment.						

List of Practicals:

1. To study the physical media of connectivity
2. To study the pin structure of straight cable and cross-over cable.
3. How to configure and install LAN card.
4. Study the functioning of switches, Establishing LAN for the lab.
5. To study networking commands.
6. To install windows server.
7. To study different LAN technologies (Ethernet, Token Ring, FDDI, VLAN, ATM and LAN topologies).
8. Study the functioning of Hub, Bridge and Router.
9. To study configuration and use of telnet.
10. To study FTP and its working on the network.
11. To setup remote desktop connection between computers on network.

B24-IT-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 hrs.
Purpose	To familiarize the students with the basics of BigData 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 Map Reduce program for different types of problems						
CO4	To understand mongodb and SPARK						
CO5	Learn to stores bigdata in MongoDB/ Pigusing Hadoop/ R.						

ListofPracticals:

1. Install,configure and run Hadoop
2. Install,configureandrun python,numPy and Pandas.
3. Implement a MapReduce program that processes a dataset.
4. Developa MapReduce program to calculate the frequency of a given word in a given file.
5. Develop a Map Reduce 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 bigdata in MongoDB/ PigusingHadoop/ R.
9. Visualize data using basic plotting techniques in Python.
10. Implementing database operations on Hive.

B24-MAC-IT-301	Constitution of India						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam (Hours)
2	0	0	1	--	100	100	3 hrs.
Purpose	This course introduces students to the basic Philosophy of Indian Constitution.						
Course Outcomes(CO): After completion of course, the students will be able							
CO1	To explain the basic structure of Indian Constitution						
CO2	To understand the structure of Indian Union						
CO3	To write down roles and powers of Governor						
CO4	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 LexisNexis; 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-of-india/>