B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning)

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-CAM-301	Web and Internet Technology	3:0:0	3	3	70	30	0	100	3
2	B23-CAM-303	Interactive Computer Graphics	3:0:0	3	3	70	30	0	100	3
3	B23-CAM-305	Advance Machine Learning	3:1:0	4	4	70	30	0	100	3
4	B23-CAM-307	Operating Systems	3:0:0	3	3	70	30	0	100	3
5	---	Open Elective-II	3:0:0	3	3	70	30	0	100	3
6	B23-CAM-309	Web and Internet Technology Lab	0:0:2	2	1	0	40	60	100	3
7	B23-CAM-311	ICG Lab	0:0:2	2	1	0	40	60	100	3
8	B23-CAM-313	Machine Learning Lab-II	0:0:2	2	1	0	40	60	100	3
9	B23-CAM-315	Industrial Training-I	0:0:2	2	1	--	100	--	100	3
10	B23-MAC-301	Constitution of India	2:0:0	2	1	--	100	0	100	3
11	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				**28**	**22**	**350**	**570**	**180**	**1100**	

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.

Open Elective-II	
Digital Electronics	B23-ESC-212
Innovation, Start-ups and Entrepreneurship	B23-HSM-202
Bioinformatics & Computational Biology	B23-OEC-425

B23-CAM-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 hypermedia design applications.						
Course Outcomes (CO)							
CO1	To understand the Internet, its architecture, and applications and to acquire basic the 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: 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. Bayross Ivan, Web Enabled Commercial Applications Development using HTML, JavaScript, DHTML & PHP, BPB Publication.

B23-CAM-303	Interactive Computer Graphics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	Introduces Computer Graphics that help in designing different kinds of static and movable objects.						
Course Outcomes (CO)							
CO1	Explore the background and standard line and circle drawing algorithms.						
CO2	Exposure of various transformation approaches and its comparative analysis.						
CO3	Illustrate Projection and clipping with different techniques.						
CO4	Apply design principles to create different curves and explore hidden lines and surface techniques.						

Unit 1
Introduction

Computer Graphics applications, Components, Display Devices, Scan conversion-Point & Line, Line drawing algorithms: DDA, Bresenham's, Circle drawing algorithms: Bresenham's, Mid point Algorithm .

Unit 2
Advanced Design Techniques

Window to view port transformation, Window to view port mapping, 2-Dimensional transformation: translation, scaling, rotation, reflection and Shear, Homogeneous Coordinate system. 3-D transformations.

Unit 3
Algorithms

Clipping: Point & Line clipping algorithm, 4-bit code algorithm, Cohen-Sutherland Line clipping algorithms, Polygon clipping: Sutherland-Hodgeman Polygon clipping algorithm. Curve clipping, Text clipping.
Projection: Parallel, Perspective, Vanishing Points

Unit 4
Applications

Representation of 3-D Curves and Surfaces: interpolation and approximation alpines, parametric conditions, Geometric continuity conditions, Bezier curves and surfaces: properties of bezier curves, bezier surfaces.
Hidden Surfaces removal: Hidden surface elimination, depth buffer algorithm, scan line coherence and area coherence algorithm, Painter's algorithm.

Text Books :

1. Zhigang Xiang & Roy A Plastock , Computer Graphics, Second Edition, Schaum's Outline, Tata McGraw Hill Education Private Limited, New Delhi, India.
2. William M. Newmann & Robert F. Sproull, Principles of Interactive Computer Graphics, Tata McGraw-Hill Second Edition, New Delhi, India.
3. Donald Hearn & M.Pauline Baker, Computer Graphics, 2nd Edition, Pearson Education.

B23-CAM-305	Advanced Machine Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 Hrs**
Purpose	Advanced ML covers high-dimensional data, generative models, ensemble learning, and deep RL with MDPs and policy optimization. It explores neural networks (CNNs, RNNs, Transformers, GNNs), applications in various domains, and AI ethics, interpretability, and deployment challenges.						
Course Outcomes (CO)							
CO 1	To understand advanced ML concepts, generative models, and optimization techniques.						
CO 2	To learn reinforcement learning algorithms and their real-world applications.						
CO 3	To explore deep neural networks, Transformers, and advanced architectures.						
CO 4	To apply advanced ML techniques across various domains and address AI challenges.						

Unit-I: Introduction to Advanced Machine Learning Concepts

Introduction: High-dimensional data handling, generative models: GANs, VAEs, Ensemble learning: bagging, boosting, stacking, Bayesian inference, probabilistic models, advanced optimization techniques, regularization strategies: dropout, batch normalization, L1/L2 regularization, self-supervised learning, meta-learning, transfer learning, domain adaptation, multi-task learning.

Unit-II: Reinforcement Learning and Real-World Applications

Markov Decision Processes: MDPs, reward functions, policy optimization, temporal difference learning, value-based methods: Q-learning, Deep Q-Networks, policy gradient methods, Actor-Critic algorithms, exploration-exploitation strategies, multi-agent reinforcement learning, deep reinforcement learning, inverse reinforcement learning, hierarchical reinforcement learning, model-based reinforcement learning, real-world applications in robotics, autonomous systems, and gaming.

Unit-III: Neural Networks in Machine Learning

Feedforward Neural Networks: FNNs, backpropagation, optimization techniques: Adam, RMSprop, L-BFGS, Convolutional Neural Networks: CNNs, object detection, image segmentation, advanced architectures: ResNet, EfficientNet, Vision Transformers, Recurrent Neural Networks: RNNs, Long Short-Term Memory: LSTM, Gated Recurrent Units (GRUs), Transformer models: BERT, GPT, self-supervised learning, attention mechanisms, energy-based models, graph neural networks (GNNs), spiking neural networks.

Unit-IV: Advanced Machine Learning in Various Domains

Natural Language Processing NLP: sentiment analysis, machine translation, conversational AI, large-scale pre-trained models. Computer vision: facial recognition, autonomous driving,

video analytics, anomaly detection, recommendation systems, AI-driven automation, ethical considerations in AI, explainability and fairness, deployment challenges in large-scale machine learning models.

Case Study: Healthcare applications: disease prediction, medical imaging, drug discovery, financial applications: fraud detection, risk assessment, algorithmic trading.

Suggested Books

1. "Pattern Recognition and Machine Learning" – Christopher M. Bishop (2006)
2. "Deep Learning" – Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016)
3. "Reinforcement Learning: An Introduction" – Richard S. Sutton and Andrew G. Barto (2nd Edition, 2018)
4. "Bayesian Reasoning and Machine Learning" – David Barber (2012)
5. "Neural Networks and Deep Learning" – Charu C. Aggarwal (2018)
6. "Graph Representation Learning" – William L. Hamilton (2020)

B23-CAM-307	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-ESC-212	Digital Electronics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 hrs**
Purpose	**To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.**						
Course Outcomes (CO)							
CO 1	**To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions**						
CO 2	**To introduce the methods for simplifying Boolean expressions**						
CO 3	**To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits**						
CO 4	**To introduce the concept of memories and programmable logic devices.**						

UNIT I Minimization Techniques and Logic Gates

Minimization Techniques: Boolean postulates and laws - De-Morgan's Theorem, Principle of Duality, Boolean expression - Minimization of Boolean expressions, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization - Don't care conditions, Quine - McCluskey method of minimization.

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR- Implementations of Logic Functions using gates, NAND-NOR implementations - Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics, Tristate gates.

UNIT II Combinational Circuits

Design procedure - Half adder, Full Adder, Half subtractor, Full subtractor, Parallel binary adder, parallel binary Subtractor, Fast Adder, Carry Look Ahead adder, Serial Adder/Subtractor, BCD adder, Binary Multiplier, Binary Divider, Multiplexer/ De-multiplexer, decoder, encoder, parity checker, parity generators, code converters, Magnitude Comparator.

UNIT III Sequential Circuits

Latches, Flip-flops - SR, JK, D, T, and Master-Slave - Characteristic table and equation, Application table, Edge triggering, Level Triggering, Realization of one flip-flop using other flip-flops, serial adder/subtractor, Asynchronous Ripple or serial counter, Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Down counters, Programmable counters, Design of Synchronous counters: state diagram, State table, State minimization, State assignment, Excitation table and maps-Circuit implementation, Modulo-n counter, 555 Timer, **Registers** - shift registers, Universal shift registers, Shift register counters, Ring counter, Shift counters, Sequence generators.

UNIT IV Memory Devices

Classification of memories - **ROM**: ROM organization, PROM, EPROM, EEPROM, **RAM**: - RAM organization - Write operation, Read operation, Memory cycle, Timing waveforms, Memory decoding, memory expansion, Static RAM Cell, Bipolar RAM cell, MOSFET RAM cell structure, Dynamic RAM cell structure, **Programmable Logic Devices** - Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of PLA, PAL using ROM. Introduction to Field Programmable Gate Arrays (FPGA).

TEXT BOOKS

1. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.M.
2. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCES

1. John F. Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
2. John. M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
3. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006
4. William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
5. Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003
6. Donald D. Givone, Digital Principles and Design, TMH, 2003.

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 startups, 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-OEC-425	Bioinformatics and Computational Biology						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs**
Purpose	This course is beneficial for students to understand the principles of analyzing biological data, building models and testing hypotheses using computer science algorithms. It will also introduce information technology practices in the field of biotechnology.						
Course Outcomes (CO)							
CO 1	Knowledge about basic overview of various information repositories widely used in biological sciences; and tools for searching or querying those databases						
CO 2	Student will learn about the foundation of sequence alignment techniques.						
CO 3	Student will learn about the foundation for how to find evolutionary connections.						
CO 4	Knowledge about analyzing mRNA expression data and gene annotations.						

Unit 1

General Introduction: To study bioinformatics and its applications.

Biological databases and tools: **a.)** Sequence Databases: introduction of Databases, primary and secondary databases and algorithums- pseudocodes, flow charts etc. nucleotide and protein sequence databases: Genbank, EMBL, DDBJ, Swissprot, pfam. **b**) Structure Databases: Introduction to structures. PDB (Protein Data bank) Molecular Modeling database at NCBI, database structure viewers. **c)** Sequence and Structure File Formats: The gene bank Flat file- a dissection.

Unit 2

The Entrez system: Integrated information axis, Information retrieval from biological database, retrieving database entries, integrated information retrieval, and sequence database beyond NCBI. Medical databases.

Sequence Alignment and Database Searching: Pair-wise Alignment, Dot matrix, Dynamic programming and gap penalties, Database similarity searching: BLAST and its types, low-complexity regions, Tool of multiple sequence alignment: CLUSTAL W/X.

Unit 3

Phylogenetic Analysis:

Elements of phylogenetic models, phylogenetic data analysis: alignment, substitution model building, tree building and tree evaluation, phylogenic software (PHYLIP). phylogenetics online tool and Applications.

Role of Programming languages in biology- Brief Account.

Unit 4

Computational Epigenetic: Epigenetic and its role in transcription regulation, development, and diseases. Transcription factor regulation and motif finding. Molecular modeling and validation, Docking.

Text Books/References:

1. Jonathan Pevsner. Bioinformatics and Functional Genomics, 2nd Edition. ISBN: 978-0-

470-08585-1.
2. Greg Gibson and Spencer V. Muse. A Primer of Genome Science, Third Edition. ISBN: 978-0-87893-309-9.
3. Essential Bioinformatics, Jin Xiong, Cambridge University Press; 1st edition 2006.
4. Bioinformatics: methods and applications, S. C. Rastogi, PHI learning; 4th edition, 2013.
5. The Dictionary of Genomics, Transcriptomics and Proteomics, Günter Kahl, Willey VCH, 2015.

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.

B23-CAM-309	Web and Internet Technology Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	**0**	**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.						
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-CAM-311	ICG Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	**0**	**2**	1	**40**	**60**	**100**	**3 Hour**
Purpose	To Design and implement various Line and Circle Drawing Algorithms.						
Course Outcomes (CO)							
CO1	Hands on experiments on 2-D transformations.						
CO2	Implement various Line & Circle Drawing Algorithms.						
CO3	Implement Line Clipping.						
CO4	Conceptual implementation of Clipping and Polygon filling.						

List of Practicals

1. Write a program to move an object using the concept of 2-D translation transformation.
2. Write a program to move an object using the concept of 2-D rotation transformation.
3. Write a program to move an object using the concept of 2-D scaling transformation
4. Write a program to move an object using the concept of 2-D shearing transformation.
5. Write a program to implement DDA line drawing algorithm.
6. Write a program to implement Bresenham’s line drawing algorithm.
7. Write a program to implement Bresenham’s circle drawing algorithm.
8. Write a program to implement the Midpoint circle drawing algorithm.
9. Write a program to perform line clipping.
10. Write a program to implement polygon filling.

B23-CAM-313	Machine Learning Lab-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	**0**	**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 the AND,OR, NAND and NOR using a Perceptron.
2. Implement the logic behind the Recurrent Neural Network.
3. Implement the logic behind an Artificial Neural Network.
4. Implementing the techniques of Convolution Neural Network.
5. Implement the XOR and XNOR using a Multilayer perceptron.
6. Implement the Particle Swarm Optimisation.
7. Implement Back-Propagation.
8. Implement the Naive Bayesian Classification algorithm.
9. Implement Generator Adversarial Network.
10. Implement the Principal Composition Analysis (PCA).

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							
CO1	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/

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	**<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	**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** BG3.16

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 (Artificial Intelligence and Machine Learning)

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-CAM-304	Big Data Analytics	3:1:0	4	4	70	30	0	100	3
3	---	Professional Elective-I	3:1:0	4	4	70	30	0	100	3
4	---	Professional Elective-II	3:1:0	4	4	70	30	0	100	3
5	B23-CAM-306	Optimization Techniques in Machine Learning	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-CAM-310	Big Data Analytics Lab	0:0:2	2	1	0	40	60	100	3
8	B23-CAM-312	Project-I	0:0:4	4	2	0	40	60	100	3
TOTAL				**26**	**22**	**350**	**270**	**180**	**800**	

Note:

- The course of both Professional 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.
- The Syllabus of B23-CSE-302, B23-CSE-308 subjects are same with B.Tech (CSE) scheme.

Professional Elective-I		**Professional Elective-II**	
Android and Mobile App Development	B23-PCA-314	Image and Video Processing	B23-PCA-320
Data and Visual Analytics in AI	B23-PCA-316	Deep Learning	B23-PCA-322
Natural Language Processing	B23-PCA-318	Data Mining	B23-PCA-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
3. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012.
4. William Stallings, “Data and Computer Communication”, Eighth Edition,Pearson Education, 2007.
5. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

B23-CAM-304	Big Data Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**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 explore knowledge of bigdata analysis with Spark.						
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 Analysis with Spark

Introduction to SPARK: Introduction to Data Analysis with Spark and its advantages over MapReduce, Downloading Spark and Getting Started, Spark Architecture:Driver, Executors, Cluster Manager (YARN, Mesos, Standalone), Programming with RDDs, Machine Learning with MLlib, Use cases of Apache Spark.

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-PCA-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-PCA-316	Data and Visual Analytics in AI						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 hrs**
Purpose	The understand techniques and algorithms for creating effective visualizations based on principles from graphic design. They will also be introduced to several industry-standard software tools to create a compelling and interactive visualization of various types of data.						
Course Outcomes (CO)							
CO 1	To use basic of data visualization and design principles.						
CO 2	To apply the transformations, perception, and graphical integrity.						
CO 3	To apply the effective visual representation and analysis.						
CO 4	To understand interactive and advanced data visualization.						

Unit-I: Introduction to Graphics and visualization

Graphics: Data for Graphics, Design principles, Value for visualization, Categorical, Time Series and Statistical Data Graphics, Introduction to Visualization Tools.

Unit-II: Graphics Pipeline and Aesthetics and Perception

Introduction, Primitives: Vertices, Edges, Triangles, Model transforms: Translations, Rotations, Scaling, View Transform, Perspective Transform, Graphical Perception Theory, Experimentation, and the Application, Graphical Integrity, Layering and Separation.

Unit-III: Visualization Design

Visual Design: Visual Display of Quantitative Information, Data-Ink Maximization, Graphical Design, Exploratory Data Analysis, Heat Map, Graph Visualization and Navigation.

Unit-IV: Multidimensional Data and Interaction

Multidimensional Data: Query, Analysis and Visualization of Multi-Dimensional Relational Databases, Interactive Exploration, T-distributed Stochastic Neighbor Embedding (t-SNE), Interactive Dynamics for Visual Analysis, Visual Queries, Finding Patterns in Time Series Data, Trend Visualization, Dashboard.

Suggested Books:

1. Claus O. Wilke, Fundamentals of Data Visualization, Oreilly publication, 1st Edition.
2. Kieran Healy, Data Visualization: A Practical Introduction 1st Edition, Princeton University Press.
3. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, 1st Edition, Wiley.
4. Scott Murray, Interactive Data Visualization for the Web, 2nd Edition, O'Reilly Media.
5. Edward R. Tufte, The Visual Display of Quantitative Information, 2nd Edition, Graphics Press.

B23-PCA-318	Natural Language Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**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-PCA-320	Image and Video Processing						
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 Image and Video Processing.						
Course Outcomes (CO)							
CO1	Students will be able to understand fundamentals of Digital Image Processing.						
CO2	Students will be able to apply Image Processing techniques in spatial domain.						
CO3	Students will be able to apply image segmentation and extract features for high level image algorithms.						
CO4	Students will be able to understand and appraise video processing solutions.						

Unit 1

Digital Image Processing: Introduction, Applications, fundamental steps in digital image processing, components of digital image processing system.

Digital Image: Fundamentals, elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationship between pixels, basic mathematical tools used in image processing.

Unit 2

Intensity Transformation and Spatial Filtering: Basic intensity transformation function, histogram processing, fundamental of spatial filtering, low pass, high pass filters. Introduction to frequency domain transform.

Morphological Image Processing: erosion, dilation, opening and closing, hot or miss transform, basic morphological transformations, morphological reconstruction, morphology on binary and gray scale images.

Unit 3

Image Segmentation: Fundamentals, point, line and edge detection, thresholding, segmentation by region growing, splitting and merging, segmentation using clustering and super-pixels, segmentation using graph cuts and morphological watersheds.

Feature Extraction: background pre-processing, boundary feature descriptor, region feature descriptor, principal components as features, whole image features, scale invariant feature transform.

Unit 4

Video Processing: definition, analog and digital video signal, video formats, frame type, video processing, sub sampling, video compression, motion estimation and compensation, transformation coding, predictive coding, gradient techniques, block matching techniques, video compression standards, scalable video coding.

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018.
2. A. Murat Tekalp, “Digital Video Processing,” Prentice Hall Signal Processing Series, Upper Saddle River, 1995.
3. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
4. Al Bovic, “Handbook of Image and Video Processing,” Elsevier, 2005.

B23-PCA-322	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-PCA-324	Data Mining						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 Hrs.**
Purpose	Introduces the detailed study on data mining approaches						
Course Outcomes (CO)							
CO1	Understand the basics of data mining						
CO2	Understand the detailed explanation of data generalization						
CO3	Description of mining associations, correlations, classification and prediction						
CO4	Description on cluster analysis and mining of complex type of data						

Unit I: Data Mining and Data Preprocessing

Introduction: Data Mining, Functionalities, Data Mining Systems classification, Integration with Data Warehouse System, Data summarization, data cleaning, data integration and transformation, data reduction. Data Warehouse: Need for Data Warehousing, Paradigm Shift, Business Problem Definition, Operational and Information Data Stores, Data Warehouse Definition and Characteristics, Data Warehouse Architecture and Implementation, OLAP.

Unit II: Data Generalization

Data Mining Primitives, Query Language and System Architecture, Concept Description, Data generalization, Analysis of attribute relevance, Mining descriptive statistical measures in large databases.

Unit III: Mining Associations and Correlations

Mining association rules in large databases: Association rule mining, Mining single dimensional boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Relational databases and data warehouses, correlation analysis, classification and prediction.

Unit IV: Cluster Analysis and Mining

Introduction to cluster analysis, Mining complex type of data: Multidimensional analysis and descriptive mining of complex data objects, Spatial databases, Multimedia databases, Mining time series and sequence data, Mining text databases, Mining World Wide Web, Applications and trends in data mining.

Text Books and References:

1. Data Mining : Concepts and Techniques; Jiawei Han and MichelineKamber; Elsevier. 2012
2. “Mastering Data Mining: The Art and Science of Customer Relationship Management”, by Berry and Lin off, John Wiley and Sons, 2001.
3. “Data Ware housing: Concepts, Techniques, Products and Applications”, by C.S.R. Prabhu, Prentice Hall of India, 2001.

4. “Data Mining: Concepts and Techniques”, J.Han, M.Kamber, Academic Press, Morgan Kanfman Publishers, 2001.
5. “Data Mining”, by Pieter Adrians, DolfZantinge, Addison Wesley 2000.
6. “Data Mining with Microsoft SQL Server”, by Seidman, Prentice Hall of India,2001.

B23-CAM-306	Optimization Techniques in Machine Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 hrs**
Purpose	Objective of this course is to understand the optimization techniques in machine learning, focusing on mathematical foundations, descent-based methods, constrained optimization, and advanced algorithms to enhance model performance and efficiency.						
Course Outcomes (CO)							
CO 1	To understand fundamental optimization concepts and their applications in machine learning models.						
CO 2	To gain knowledge of smooth optimization techniques, convexity properties, and convergence analysis.						
CO 3	To learn descent-based optimization methods, adaptive gradient techniques, and their role in training models.						
CO 4	To Apply advanced optimization strategies, duality concepts, and constrained optimization for efficient learning.						

Unit-I: Introduction to Optimization in Machine Learning

Introduction: Data Analysis and Optimization, Least Squares, Matrix Factorization Problems, Support Vector Machines, Logistic Regression, Deep Learning.

Unit-II: Fundamentals of Smooth Optimization

A taxonomy of solutions to optimization problems, Taylor's theorem, characterizing minima of smooth functions, convex sets and functions, strongly convex functions.

Unit-III: Descent-Based Optimization Techniques

Descent directions, line search, acceptability of step sizes, general minimization algorithm, steepest-descent method, convergence, line-search methods, mirror descent, the KL and PL properties.

Unit-IV: Advanced Optimization and Duality

Gradient methods, stochastic gradient, coordinate descent, first-order methods for constrained optimization, optimality conditions, Euclidean projection, projected gradient algorithm, conditional gradient (Frank–Wolfe) method, duality concepts, Lagrangians, dual algorithms, augmented Lagrangian method, alternating direction method of multipliers, applications of dual algorithms.

Suggested Books

1. Optimization for Data Analysis. Stephen J. Wright and Benjamin Recht. Cambridge University Press,2022.
2. First-Order Methods in Optimization. Amir Beck. SIAM, 2017.
3. Introduction to Optimization. Boris Polyak. Optimization software, 1987.
4. Lectures on Convex Optimization (2nd). YuriiNesterov. Springer, 2018.

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-CAM-310	Big Data Analytics 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)							
CO 1	To understand installation and configuration of Hadoop						
CO 2	To learn installation and configuration of python, numPy and Pandas						
CO 3	Learn to Develop a MapReduce program for different types of problems						
CO 4	To understand mongodb and SPARK						
CO 5	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.