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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

VI Semester
Scheme & Syllabus of B.E. Programme
Information Science & Engineering
(2024 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NAAC A+

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

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SCHEME OF TEACHING AND EXAMINATION – B.E. –

Information Science and Engineering

(Applicable for students admitted from the Academic Year 2024-25 and onwards)

6th Semester

Information Science and Engineering

Sl. No.	Course Code	Course Title	Course Type	TD/ PSB	Teaching Hours/Week			Examination				
					L	T	P	SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	Credits
1	BCS601	Artificial Intelligence and Machine Learning Techniques	PCC	TD:IS PSB:IS	3	2	0	**3**	**50**	**50**	**100**	**4**
2	BIS602	Cloud Computing	IPCC	TD:IS PSB:IS	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BXX623x	Professional Elective Course – II	PEC	TD:IS PSB:IS	3	0	0	**3**	**50**	**50**	**100**	**3**
4	BIS624x	Professional Elective Course – III	PEC	TD:IS PSB:IS	3	0	0	**3**	**50**	**50**	**100**	**3**
5	BXX645x	Open Elective Course – I	OEC	Any Dept.	3	0	0	**3**	**50**	**50**	**100**	**3**
6	BIS636	Major Project Phase – I	PROJ	TD:IS PSB:IS	0	0	4	-	**100**	-	**100**	**2**
7	BCSL607	Machine Learning lab	PCCL	TD:IS PSB:IS	0	0	2	**3**	**50**	**50**	**100**	**1**
8	BCE608	Competency Enhancement Course-4	NCMC	CDCAC	0	2	0	-	**100**	-	**100**	**0**
9	BIK609	Indian Knowledge System	NCMC	Any Dept.	1	0	0	-	**100**	-	**100**	**0**
10	BNS610	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	-	**100**	-	**100**	**0**
	BPE610	Physical Education (PE) (Sports and Athletics)		Physical Education Director								
	BYO610	Yoga		Yoga Teacher								
	BMU610	Music		Music Teacher								
									700	**300**	**1000**	**20**

ASC: Applied Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

Professional Elective Course – II

Course Code	Course Name	Course Code	Course Name
BCS623A	Blockchain Technology	BIS623C	Full Stack Development with MERN
BIS623B	Natural Language Processing and Generative AI	BCS623D	Introduction to Quantum Computing

Professional Elective Course – III

Course Code	Course Name	Course Code	Course Name
BIS624A	Foundations of Human Computer Interface	BIS624C	Agentic AI and Applications
BIS624B	Robotic Process Automation	BIS624D	DevOps

Open Elective Course – I

Course Code	Course Name	Course Code	Course Name
BCS645A	Introduction to Data Structures	BIS645C	Mobile Application Development
BCS645B	Fundamentals of Operating Systems	BCI645D	Introduction to Artificial Intelligence

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2024-25 may please be referred.

National Service Scheme /Physical Education/Yoga/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE)(Sports and Athletics), Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3rd semester. Activities shall be carried out between 3rd semester to the 6th semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Music activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10.

However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I: Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work

Semester: VI					
Artificial Intelligence and Machine Learning Techniques					
Course Code	**:**	BCS601	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:2:0	**CIE**	**:**	50 Marks
Total Hours	**:**	50L	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Linear Algebra, Probability and Statistics, Calculus
Knowledge on Fundamental Concepts	Mathematics, Statistics, Algorithms, Probability, Logical Connectives.
Knowledge on Connected Tools (If any)	Jupyter, IDLE.

Course Learning Objectives: This course will enable the students to	
CLO1	Introduce the foundational concepts, historical evolution, and core philosophies driving Artificial Intelligence and Machine Learning.
CLO2	Impart knowledge on problem-solving agents and formulation strategies using both blind (uninformed) and heuristic (informed) search algorithms.
CLO3	Provide a deep understanding of data preprocessing, exploratory data analysis, descriptive statistics, and feature engineering workflows.
CLO4	Explore the mathematical and algorithmic frameworks of supervised learning techniques, including regression, decision trees, and Bayesian classifiers.
CLO5	Explore the architectures of Artificial Neural Networks (ANNs) and unsupervised clustering techniques alongside their evaluation frameworks.

Module – 1	**08Hrs**
Introduction: What is AI? Foundations and History of AI Problem-solving: Problem-solving agents, Example problems, Searching for Solutions, Uninformed Search Strategies: Breadth First search, Depth First Search, **Textbook 1: Ch. 1: 1.1, 1.2, 1.3** **Textbook 1: Ch. 3: 3.1, 3.2, 3.3, 3.4.1, 3.4.3**	
Module – 2	**08Hrs**
Informed Search Strategies: Greedy best-first search, A*search, Heuristic functions. **Introduction to Machine Learning:** Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Applications. **Understanding Data**: What is Data?, Big Data Analytics and Types of Analytics, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization, Bivariate Data and Multivariate Data, Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques. **Textbook 1: Ch. 3: 3.5, 3.5.1, 3.5.2, 3.6** **Textbook 2: Ch. 1, Ch. 2**	

Module – 3	08Hrs

Basics of Learning Theory: Introduction to Learning and its Types, Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning.

Similarity Based Learning: Introduction to Similarity or Instance-based Learning, Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).

Regression Analysis: Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods.

Textbook 2: Ch. 3: 3.1 to 3.4, Ch. 4, Ch. 5: 5.1 to 5.4

Module – 4	08Hrs

Decision Tree Learning: Introduction to Decision Tree Learning Modules, Decision Tree Induction Algorithms, Validating and Pruning of Decision Trees.

Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Modules, Naïve Bayes Algorithm for Continuous Attributes, Other Popular Types of Naïve Bayes Classifiers.

Textbook 2: Ch. 6, Ch. 8

Module – 5	08Hrs

Artificial neural Network: Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Networks, Learning in a Multi-Layer Perceptron, Radial Basis Function Neural Network, Self-Organizing Feature Map, Popular Applications of Artificial Neural Networks, Advantages and Disadvantages of ANN, Challenges of Artificial Neural Networks.

Clustering Algorithms: Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Gride-based Approach, Probability Module-based Methods, Cluster Evaluation Methods.

Textbook 2: Ch. 10, Ch. 13

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the foundational concepts of AI and implement blind search strategies (BFS, DFS) to design basic problem-solving agents.
CO2	Apply appropriate search and reasoning techniques to address various real-world problems.
CO3	Analyze data distributions using descriptive statistics and build predictive frameworks using similarity-based algorithms and regression models.
CO4	Construct and optimize Decision Trees and probabilistic Naïve Bayes Classifiers for continuous and discrete datasets.
CO5	Design neural network architectures for classification tasks and evaluate unsupervised clustering models using proximity and validation metrics.

Textbooks	
1	"Artificial Intelligence", Stuart J. Russell and Peter Norvig, 3rd Edition, Pearson,2015, ISBN: 978-9332543515
2	"Machine Learning". S. Sridhar, M Vijayalakshmi, Oxford ,2021, ISBN: 978-0199494545

Reference Books	
1	"Artificial Intelligence", Elaine Rich, Kevin K and S B Nair, 3rd Edition, McGraw Hill Education, 2017, ISBN-13: 978-1259004377
2	"The Elements of Statistical Learning", Trevor Hastie, Robert Tibshirani& Jerome Friedman. Springer Series in Statistics, 2nd Edition 2001, ISBN-13: 978-0387848570.
3	"Pattern Recognition and Machine Learning", Chrishtopher M.Bishop, Springer, 2006, ISBN-13: 978-0387310732.

Web links and Video Lectures (e – Resources)	
1	https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2	https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3	https://nptel.ac.in/courses/106/105/106105077/
4	https://www.javatpoint.com/history-of-artificial-intelligence
5	https://www.tutorialandexample.com/problem-solving-in-artificial-intelligence
6	https://techvidvan.com/tutorials/ai-heuristic-search/
7	https://www.analyticsvidhya.com/machine-learning/
8	https://www.javatpoint.com/decision-tree-induction
9	https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/mldecision-tree/tutorial/
10	https://www.javatpoint.com/unsupervised-artificial-neural-networks

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2									1
CO2	3	3	2	2							1
CO3	3	3		3	2						1
CO4	3	3	2								1
CO5	3	3	3	2	2	1	1				2

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Semester: VI					
Cloud Computing					
Course Code	**:**	BIS602	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40L+15L	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks ,Operating Systems
Knowledge on Fundamental Concepts	Networking fundamentals: IP addressing, DNS, routing, HTTP/HTTPS Operating System concepts: Process, Memory, File system management
Knowledge on Connected Tools (If any)	Development Environments**:** OpenStack**,** AWS Cloud9, Google Cloud Shell

Course Learning Objectives: This course will enable the students to	
CLO1	Introduce the rationale behind the cloud computing revolution and the business drivers
CLO2	Understand various models, types and challenges of cloud computing
CLO3	Understand the design of cloud native applications, the necessary tools and the design tradeoffs.
CLO4	Realize the importance of Cloud Virtualization, Abstraction`s, Enabling Technologies and cloud security
CLO5	Enable students to design, deploy, and manage scalable cloud-based applications using industry-relevant platforms and tools, integrating best practices for performance, security, and cost optimization

Module – 1	**08 Hrs**
Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency. **Textbook 1**: **Ch 1: 1.1 - 1.5**	
Module – 2	**08 Hrs**
Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation. **Textbook 1**: **Ch 3: 3.1 - 3.5**	
Module – 3	**08 Hrs**
Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure, Inter-Cloud Resource Management.	

Textbook 1: Ch 4: 4.1 - 4.5

Module – 4	**08 Hrs**

Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor, Mobile Devices and Cloud Security. Cloud Security and Trust Management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.

Textbook 1: **Ch 4: 4.6**
Textbook 2: **Ch 11: 11.1 -11.3, 11.5 - 11.8, 11.10 - 11.14**

Module – 5	**08 Hrs**

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.

Textbook 1: **Ch 6: 6.1 - 6.5**

Practical Components	
Sl.NO	**Experiments**
1.	**Creating a Virtual Machine**: Configure and deploy a virtual machine with specific CPU, memory, and storage requirements using the OpenStack cloud platform.
2.	**Getting Started with OpenStack CLI**: Managing OpenStack Resources Using Command-Line Interface
3.	**Cloud Functions**: Implement Event-Driven Automation for Cloud Resource Management Using OpenStack Mistral
4.	**App Engine**: Deploying a Web Application on an OpenStack Virtual Machine and Configuring Load Balancing for Scalable Access.
5.	**Managing Object Storage Using OpenStack Swift**: Create, manage, and access object storage containers and objects using the Horizon Dashboard and OpenStack CLI.
6.	**Cloud Monitoring**: Monitoring Cloud Resource Health and Performance Using OpenStack Telemetry
7.	**Kubernetes Engine**: Deploying a Containerized Application on a Kubernetes Cluster Hosted on OpenStack Virtual Machines
	Open Ended Experiments (Not for CIE) **Create and Manage Cloud Resources Using OpenStack**: In this lab, students will use the **OpenStack Horizon Dashboard** and **OpenStack CLI** to create and manage cloud resources. Students will create virtual machines with required CPU and memory configurations, configure networks and security groups, create storage containers using **OpenStack Swift**, and manage users and roles using **Keystone**. They will also monitor the resources created and verify their proper functioning.

Course Outcomes: After completing the course, the students will be able to	
CO1	Evaluate various cloud computing platforms and service providers with respect to their architecture, features, and service models.
CO2	Examine the effectiveness of virtualization technologies in resource management and system performance.
CO3	Apply cloud computing architectures, service delivery models, and industrial platforms to design and implement cloud-based applications.
CO4	Analyze the role of Security aspects of cloud computing.
CO5	Develop cloud based applications using suitable platforms and tools.

Text Books	
1	Distributed and Cloud Computing Kai Hwang, Geoffrey C Fox, and Jack J Dongarra, Morgan Kaufmann, 2012, Elsevier, ISBN: 978-0-12-385880-1
2	Cloud Computing Theory and Practice ,Dan C. Marinescu, , Morgan Kaufmann, 2nd Edition, 2018 Elsevier, ISBN: 978-0-12404-627-6

Reference Books	
1	Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, 1st Edition, 2017, McGrawHill Education, ISBN: 978-0-12-411454-8.
2	Cloud Computing: A Practical Approach To, Velte, Anthony Velte, 2017, McGraw-Hill Education, ISBN-13. 978-0070683518.
3	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud George Reese, 1st Edition, 2009, O'Reilly Publication ISBN: 978-0-596-1536-7.
4	Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, 2nd Edition, 2009, Recursive Press ISBN:0956355609.

Web links and Video Lectures (e – Resources)

1.	**https://freevideolectures.com/course/4639/nptel-cloud-computing/1.**
2.	**https://www.youtube.com/playlist?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J**
3.	**https://www.youtube.com/watch?v=EN4fEbcFZ_E**
4.	**https://www.youtube.com/watch?v=RWgW-CgdIk0**
5.	**https://www.geeksforgeeks.org/virtualization-cloud-computing-types/**
6.	**https://www.javatpoint.com/cloud-service-provider-companies**

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	2	2		2				
CO2	3		3	2	2						
CO3	3		3	2	3		2				
CO4	3	2	3	2	2	2	2				2
CO5	3		3	3	3	2	2	2	2	2	2

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Semester: VI					
Blockchain Technology					
Course Code	**:**	BCS623A	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Data Structures and Algorithms, Computer Networks, Cryptography Fundamentals
Knowledge on Fundamental Concepts	Distributed systems, cryptographic hashing, consensus mechanisms and peer-to-peer networks
Knowledge on Connected Tools (If any)	Hyperledger

Course Learning Objectives: This course will enable the students to	
CLO1	Understand Blockchain terminologies with its applications.
CLO2	Learn working principles of Blockchain and methodologies used in Bitcoin
CLO3	Build a strong foundation in Ethereum by studying its network, wallets, nodes, smart contracts, and DApps.
CLO4	Understand the design and implementation of blockchain applications with Hyperledger and the lifecycle of smart contracts.

Module – 1	**08Hrs**
Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of blockchain, Introduction to blockchain, Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Consensus in blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **Textbook 1: Ch.1**	
Module – 2	**08Hrs**
Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies Decentralized applications, Platforms for decentralization. **Textbook 1: Ch. 2, Ch. 3**	
Module – 3	**08Hrs**
Bitcoin, Bitcoin definition, Transactions, The transaction life cycle, The transaction structure, Types of transaction, The structure of a block, The structure of a block header, The bit coin network, Wallets, Smart Contracts-History, Definition, Ricardian contracts, Smart contract templates. **Textbook 1: Ch. 4, Ch. 6**	
Module – 4	**08Hrs**
Ethereum 101, Introduction, Ethereum clients and releases, The Ethereum stack, Ethereum blockchain, Currency (ETH and ETC), Forks, Gas, The consensus mechanism, The world	

state, Transactions, Contract creation transaction, Message call transaction, Elements of the Ethereum blockchain, Ethereum virtual machine (EVM). **Textbook 1: Ch. 7**

Module – 5	**08Hrs**
Hyperledger, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda **Textbook 1: Ch. 9**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the Block chain terminologies with its applications.
CO2	Illustrate the working principles of Blockchain and the Smart Contract Lifecycle
CO3	Demonstrate the principles and methodologies used in Bitcoin
CO4	Develop Ethereum Network, Wallets, Nodes, Smart contract and DApps.
CO5	Analyze the use of Hyperledger in Blockchain.

Textbook	
1	"Mastering Blockchain", Imran Bashir Third Edition, Packt – 2020. ISBN: 978-1-83921-319-9

Reference Book	
1	"Mastering Bitcoin: Programming the Open Blockchain ", Andreas M., O'rielly – 2017. ISBN: 978-149-195438-6.

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/106104220
2	https://www.geeksforgeeks.org/blockchain/
3	https://www.tutorialspoint.com/blockchain/index.htm

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	1	2						1
CO2	3	3	3	2	2						2
CO3	3	3	2	2	3						1
CO4	3	3	3	2	2			2	2	2	3
CO5	3	3	3	2	3	2		2	2	2	2

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Semester: VI					
Natural Language Processing and Generative AI					
Course Code	**:**	BIS623B	**Credits**	**:**	03
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	03 Hours

Prerequisites:	
Courses	Foundations of AI, Theory of Computation
Knowledge on Fundamental Concepts	Grammar
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Learn the algorithmic description of the main language levels: morphology, syntax, semantics and pragmatics, as well as the resources of natural language data – corpora.
CLO2	Understand knowledge representation, inference, and relations to artificial intelligence.
CLO3	Explore linguistic phenomena and linguistic features relevant to each NP task.
CLO4	Analyze the NLP tools like classifiers, translators, pos taggers, stemmers for Indian and other languages.
CLO5	Develop generative models to synthesize data such as images, text, and music using modern deep learning architectures.

Module – 1	**08 Hrs**
Introduction: What is Natural Language Processing? Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications. **Language Modelling:** Statistical Language Model - N-gram model (unigram, bigram), Paninion Framework, Karaka theory. **Text Book 1: Ch 1, 2**	
Module – 2	**08 Hrs**
Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of Speech Tagging. **Syntactic Analysis:** Context-Free Grammar, Constituency, Top-down and Bottom-up Parsing, CYK Parsing. **Text Book 1: Ch 3, 4**	

Module – 3	**08 Hrs**
Naive Bayes, Text Classification and Sentiment: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked Example, Optimizing for Sentiment Analysis, Naive Bayes for Other Text Classification Tasks, Naive Bayes as a Language Model. **Machine Translation:** Language Divergences and Typology, Machine Translation using Encoder Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation. **Text Book 2: Ch 4, 6, 13**	
Module – 4	**08 Hrs**
Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval - Custer model, Fuzzy model, LSTM model, Major Issues in Information Retrieval. **Lexical Resources:** WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora. **Text Book 1: Ch 9, 12**	
Module – 5	**08 Hrs**
Introduction to Generative Adversarial Networks Introduction to GAN: Introduction to Generative Adversarial Networks (GANs), Working principles and training. **Autoencoders:** Introduction to autoencoder, High-level functionality, distinction between autoencoder and GAN, Content generation using autoencoder, Variational autoencoders**.** **Text Book 3: Ch 1 , Ch 2: 2.1 to 2.6**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the fundamental concept of NLP, grammar-based language model and statistical-based language model.
CO2	Develop the morphological analysis using Finite State Transducers and parsing using context-free grammar and different parsing approaches.
CO3	Apply Naïve Bayes for text sentiment classification and recognize Encoder–Decoder applications in machine translation.
CO4	Analyze the the concepts of information retrieval, lexical semantics, lexical dictionaries such as WordNet, lexical computational semantics, distributional word similarity.
CO5	Implement the concepts and principles of Generative Artificial Intelligence to engineering requirements.

Text Books	
1.	Natural Language Processing and Information Retrieval, Tanveer Siddiqui, U.S. Tiwary, 1st edition,2008, reprint 2014, Oxford University Press, ISBN: 9780195692327.

2.	Speech and Language Processing: An Introduction to Natural Language Processing, Daniel Jurafsky, James H. Martin, 2nd Edition, 2014, Pearson Education, ISBN: 9780131873216.
3.	GANs in Action: Deep Learning with Generative Adversarial Networks, Jakub Langr, Vladimir Bok,1st Edition, 2019, Manning Publications, ISBN-13: 9781638354239.
Reference Books	
1.	"Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python", Akshay Kulkarni, Adarsha Shivananda, Apress, 2019, ISBN: 978-1484242667.
2.	"Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives", T V Geetha, 2024**,** Pearson, ISBN-13: 9788119896004.
3.	"Information Storage and Retrieval systems", Gerald J. Kowalski and Mark.T. Maybury, Kluwer Academic Publishers**,** ISBN-10: 0792379241.

Web links and Video Lectures (e – Resources)	
1.	https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2.	https://www.udemy.com/course/generative-ai-for-beginners-b/?utm_source=chatgpt.com&couponCode=PMNVD2025

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	2	3				1		2
CO2	3	3	2	3	3						2
CO3	3	3	3	2	3	1		1	1		3
CO4	3	3	2	2	3				1		3
CO5	3	2	3	2	3	2	1		2	2	3

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Semester: VI					
Full Stack Development with MERN					
Course Code	**:**	BIS623C	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Foundation in programming, operating systems, Database concepts
Knowledge on Fundamental Concepts	Programming constructs, OOPS concept, Internet and web basics
Knowledge on Connected Tools(If any)	Text Editors/IDEs, Web Browsers and Developer Tools:, Version Control: Git and GitHub, Command Line Interface (CLI)

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basics of HTML, XHTML, and HTML5 to create structured web pages.
CLO2	Use CSS and CSS3 to design and style attractive web pages.
CLO3	Create interactive web pages using JavaScript and work with data using Node.js and MongoDB.
CLO4	Build web applications using React components and manage application data and state.
CLO5	Implement complete full-stack web applications using the MERN stack with user authentication and server-side features.

Module – 1	**08 Hrs**
Part I Core Markup: Traditional HTML and XHTML, Introducing HTML5, HTML Element Reference **Part II Core Style:** Introduction to CSS, CSS Syntax and Property Reference. **Textbook 1**: **Ch 1,2,3,4,5**	
Module – 2	**08 Hrs**
Javascript: Basics and Introduction; Getting started; Working with arrays and Regular Expressions; Dynamically changing web pages; Working with Forms; **Textbook 2**: **Ch 1.2, 2.1-2.3, 4.3,4.9, 5.1-5.5,7.1-7.3**	
Module – 3	**08 Hrs**
MERN Stack-1: Introduction: Whats MERN, MERN Components, Why Mern; Hello World: Serverless Hello World, JSX; React Components: React Classes, Composing Components, passing data using Properties and children. **Textbook 3: Ch 1,2,3**	
Module – 4	**08 Hrs**

MERN Stack-2: React State: Initial state and updating state, Event handling, stateless components; Express and GraphQL, MongoDB: Express, REST API, Graph QL, MongoDB Basics, MongoDB CRUD Operations. **Textbook 3: Ch 4,5,6**

Module – 5	**08 Hrs**
MERN Stack-3: React Forms: Controlled Components in Forms, React Bootstrap; Server Rendering and Authentication: Basic Server Rendering and data from API, SiginUI and Google signin **Textbook 3: Ch 9,10,11,12**	

PRACTICAL COMPONENT	
Sl.NO	**Experiments**
1.	a)Write a script that Logs "Hello, World!" to the console. Create a script that calculates the sum of two numbers and displays the result in an alert box. b) Create an array of 5 cities and perform the following operations: Log the total number of cities. Add a new city at the end. Remove the first city. Find and log the index of a specific city.
2.	a.Read a string from the user, Find its length. Extract the word "JavaScript" using substring() or slice(). Replace one word with another word and log the new string. Write a function isPalindrome(str) that checks if a given string is a palindrome (reads the same backward).
3.	Create an object student with properties: name (string), grade (number), subjects (array), displayInfo() (method to log the student's details) Write a script to dynamically add a passed property to the student object, with a value of true or false based on their grade. Create a loop to log all keys and values of the student object.
4.	Create a button in your HTML with the text "Click Me". Add an event listener to log "Button clicked!" to the console when the button is clicked. Select an image and add a mouseover event listener to change its border color. Add an event listener to the document that logs the key pressed by the user.
5.	Build a React application to track issues. Display a list of issues (use static data). Each issue should have a title, description, and status (e.g., Open/Closed). Render the list using a functional component.
6.	Create a component Counter with A state variable count initialized to 0. Create Buttons to increment and decrement the count. Simulate fetching initial data for the Counter component using useEffect (functional component) or componentDidMount (class component). Extend the Counter component to Double the count value when a button is clicked. Reset the count to 0 using another button.
7.	Install Express (npm install express). Set up a basic server that responds with "Hello, Express!" at the root endpoint (GET /). Create a REST API. Implement endpoints for a Product resource: GET : Returns a list of products. POST : Adds a new product. GET /:id: Returns details of a specific product. PUT /:id: Updates an existing product. DELETE /:id: Deletes a product. Add middleware to log requests to the console. Use express.json() to parse incoming JSON payloads.
8.	Install the MongoDB driver for Node.js. Create a Node.js script to connect to the shop database. Implement insert, find, update, and delete operations using the Node.js MongoDB driver. Define a product schema using Mongoose. Insert data into the products

	collection using Mongoose. Create an Express API with a /products endpoint to fetch all products. Use fetch in React to call the /products endpoint and display the list of products. Add a POST /products endpoint in Express to insert a new product. Update the Product List, After adding a product, update the list of products displayed in React.

Course Outcomes: After completing the course, the students will be able to	
CO1	Design structured web pages using HTML, XHTML, and apply styling with CSS and CSS3.
CO2	Integrate dynamic and interactive web elements using JavaScript and Node.js.
CO3	Develop modular React components and integrate them in MERN stack applications.
CO4	Perform CRUD operations with MongoDB and build RESTful APIs using Express and GraphQL.
CO5	Create full-stack applications using the MERN stack with client-server communication and user authentication.

Text Books	
1	HTML & CSS: The Complete Reference, Thomas Powell, 5th Edition, 2017, McGraw-HillJanuary, ISBN 9780070701946.
2	JavaScript: The Comprehensive Guide Philip Ackermann Rheinwerk Publishing.2022, ISBN 978-1-4932-2287-2
3	Pro MERN Stack FullStack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, Apress, Second Edition, 2019, ISBN 978-1484243909

Reference Books	
1	Learning React, Alex Banks & Eve Porcello, 3rd Edition, O'Reilly Media, 2022.
2	MongoDB: The Definitive Guide, Kristina Chodorow, 3rd Edition, O'Reilly Media, 2019.
3	Node.js Design Patterns, Mario Casciaro and Luciano Mammino, Third Edition, Packt Publishing, 2022.

Web links and Video Lectures (e – Resources)	
1	https://www.udemy.com/course/mern-stack-front-to-back/
2	https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer
3	https://www.geeksforgeeks.org/what-is-full-stack-development/
4	https://www.w3schools.com/whatis/whatis_fullstack.asp

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2	2		3				1	1	
CO2	3	3	2	1	3				1	2	
CO3	2	2	3	1	3				2	2	1
CO4	3	3	3	2	3				1	2	1
CO5	3	3	3	2	3				2	2	2

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Semester: VI					
Introduction to Quantum Computing					
Course Code	**:**	BCS623D	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Probability and Statistics, Algorithms and Programming skills.
Knowledge on Fundamental Concepts	Basic understanding of probability and statistics, Fundamentals of linear algebra, Basic concepts of algorithms and programming, Knowledge of classical computing principles and Boolean logic.
Knowledge on Connected Tools (If any)	Basic knowledge of Python programming environment. NumPy, Qiskit, Cirq, QuTiP.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the foundational principles and technological dimensions of quantum computing.
CLO2	Identify the difference of foundational concepts in classical and quantum computing.
CLO3	Explore the foundational workings of quantum computing models.
CLO4	Learn and interpret quantum operations.
CLO5	Apply quantum computing concepts and basic quantum algorithms using quantum programming tools.

Module – 1	**08Hrs**
Fundamental concepts: Introduction and overview, Global perspectives, Quantum bits, Quantum computation, Introduction to Superposition, What Is a Qubit?, Mathematical Representation of Qubits, Matrix Representation, Bloch Sphere. **Textbook 1: Ch. 1, 2, Text Book 2: Ch.1, 2**	
Module – 2	**08Hrs**
Quantum algorithms: Classical computations on a quantum computer, Quantum parallelism, Deutsch's algorithm. **Textbook 1: Ch. 1**	
Module – 3	**08Hrs**
Quantum circuits design, Quantum gates: Single qubit operations, Controlled operations, Universal quantum gates, Entanglement, Entanglement Fundamentals, Hidden Variable Theory, Multi-Qubit States, Non-Entangled Systems. Entangled Systems.	

Textbook 1: Ch. 3, Text Book 2: Ch.7

Module – 4	**08Hrs**

Introduction to quantum mechanics: Linear algebra, Bases and linear independence, Linear operators and matrices, The Pauli matrices, Inner products, Eigenvectors and eigenvalues, Adjoints and Hermitian operators, Tensor products, Operator functions, Probability, Scalars, Vectors and Matrices.

Textbook 1: Ch. 2, Textbook 2: Ch. 10

Module – 5	**08Hrs**

Quantum error-correction: Introduction, Theory of quantum error-correction, Constructing quantum codes, Entropy and information, Basic properties of entropy, VonNeumann entropy.

Textbook 1: Ch. 10,11

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret fundamental ideas and terms related to classical and quantum computing
CO2	Analyze quantum computing technology for real life applications.
CO3	Outline the principles and the technology involved in quantum computing.
CO4	Apply fundamental mathematical concepts and techniques in the context of quantum computation.
CO5	Evaluate the performance of quantum algorithms and quantum computing approaches for addressing complex computational problems.

Textbooks	
1	"Quantum Computation and Quantum Information", M. A. Nielsen and I. L. Chuang, 10th anniversary ed. Cambridge, U.K.: Cambridge University Press, 2010, ISBN: 978-1-107-00217-3.
2	"Quantum Computing for the Quantum Curious", C. Hughes, J. Isaacson, A. Perry, R. F. Sun, and J. Turner, Cham, Switzerland: Springer International Publishing, 2021, ISBN: 978-3-030-61600-7.

Reference Books	
1	"An Introduction to Quantum Computing", P. Kaye, R. Laflamme, and M. Mosca, Oxford, U.K.: Oxford University Press, 2007. ISBN: 978-0198570004.
2	"Fundamentals of Quantum Computing: Theory and Practice", V. Kasirajan, 1st Edition. Cham, Switzerland: Springer, 2021. ISBN: 978-3-030-63688-3.

Web links and Video Lectures (e – Resources)	
1	https://www.amazon.in/Quantum-Computing-Curious-Ciaran-ughes/dp/3030616002
2	https://www.amazon.in/Elements-Quantum-Computing-Engineering-Applications/dp/3319082833
3	https://www.amazon.in/Quantum-Computation-Information-10th-Anniversary/dp/1107002176
4	https://www.youtube.com/watch?v=h3w_B7BN_Qw
5	https://www.youtube.com/watch?v=zm64o27eHYw&list=PLxP0p--aBHmIe--9rczWe4AZmw03e2bz0

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2								
CO2	3	3	2	2							
CO3	2	2	2	2							
CO4	2	2	2	2	2	1					
CO5	3	3	3	2	1	1					

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Semester: VI					
Foundations of Human Computer Interface					
Course Code	**:**	BIS624A	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving Through Programming, Web Development in HTML and PHP
Knowledge on Fundamental Concepts	Programming Basics ,HTML, CSS, JavaScript, Basics of Graphic or Visual Design
Knowledge on Connected Tools (If any)	Adobe XD, Sketch, and Figma

Course Learning Objectives: This course will enable the students to	
CLO1	Understand how humans perceive, process, and interact with computer systems through input/output channels and cognitive functions.
CLO2	Learn and apply user-centered design principles for creating intuitive and accessible interfaces.
CLO3	Able to analyze interaction models, communication techniques, and task analysis methods for interface design
CLO4	Explore the use of emerging technologies like augmented reality and ubiquitous computing in modern HCI applications.

Module – 1	**08 Hrs**
Foundations: The Human - Introduction, Input-output channels, Human memory, Thinking: reasoning and problem solving, **The Computer**: Text entry devices, Positioning, pointing and drawing, Display devices, **The Interaction:** Models of interaction, Frameworks and HCI, Interaction styles, Interactivity. **Paradigms**: Paradigms of interaction **Text Book 1: Ch 1: 1.1-1.5, Ch 2: 2.2-2.4, Ch 3: 3.2, 3.3, 3.5 Ch 4: 4.2**	
Module – 2	**08 Hrs**
Design Process: The process of design, User focus, Navigation design, **HCI in The Software Process**: Iterative design and prototyping, **Implementation Support:** Elements of windowing systems, Programming the application, Using toolkits, **Evaluation techniques**: Evaluation through expert analysis, **Universal design**: Universal design principles, **User Support**: Requirements of user support, Approaches to user support, Adaptive help systems **Text Book 1: Ch 5: 5.3-5.5, Ch 6: 6.4, Ch 8: 8.2, 8.3 Ch 9: 9.3, Ch 10: 10.2, Ch 11: 11.2-11.3**	
Module – 3	**08 Hrs**
Models and Theories: Models and Theories Linguistic models, Physical and device models, Cognitive architecture, **Communication and Collaboration Models**: Face-to-face communication, Conversation, Text-based communication, **Task Analysis**: Difference between task analysis and other techniques, Task decomposition **Dialog Notations and Design:** Dialog design notations, Diagrammatic notations **Text Book 1: Ch12: 12.2-12.5, Ch 14: 14.2 -14.4, Ch 15: 15.2-15.5, Ch 16: 16.2, 16.3,16.6**	
Module – 4	**08 Hrs**

Mobile Ecosystem: Platforms, Application frameworks, **Types of Mobile Applications:** Widgets, Applications, Games, **Mobile Information Architecture**, Mobile 2.0, **Mobile Design**: Elements of Mobile Design, Tools. **Text Book 2: Ch 2, Ch 6, Ch 7, Ch 8**

Module – 5	**08 Hrs**
Designing Web Interfaces, Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. **Text Book 3: Ch 2, Ch 3, Ch 4, Ch 5, Ch 6, Ch 7, Ch 8**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the concepts of usability, user experience, and user-centered design in developing interactive systems.
CO2	Interpret usability goals for designing an interactive product.
CO3	Apply user experience goals for designing an interactive product.
CO4	Analyze the different types of requirements from the users.
CO5	Analyze the interface problems to recognize the suitable design approach and interaction styles

Text Books	
1	Human-Computer Interaction by Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale, 3rd Edition, 2004, Pearson Education, ISBN: 13: 978-0-13-046109-4
2	Brian Fling, "Mobile Design and Development", First Edition , 2009, O'Reilly Media Inc, ISBN: 9780596155445
3	Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, 2009, O'Reilly, ISBN: 9780596516253

Reference Books	
1	Designing with the Mind in Mind by Jeff Johnson 3rd Edition, 2020, Morgan Kaufmann Publishers. ISBN: 13. 978-0128182024
2	Human-Computer Interaction by I. Scott Mackenzie, 2nd Edition, 2024, Morgan Kaufmann Publishers, ISBN: 978-0443140969

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=Ovj4hFxko7c
2	https://www.youtube.com/watch?v=uB9LaBIAcRs&list=PLQ-nEJNYlEV1CfTcLCx_S7D2of3QAsvTT

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2				1	2	2
CO2	3	2	2	1	3				1	2	2
CO3	3	2	2	1	3				1	2	2
CO4	3	3	2	2	2				1	3	3
CO5	3	3	3	2	3				1	3	3

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Semester: VI					
Robotic Process Automation					
Course Code	**:**	BIS624B	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving through Programming, Introduction to Python Programming
Knowledge on Fundamental Concepts	Understanding of business processes, Basics of workflow automation, Concepts of conditional logic, loops, and variables
Knowledge on Connected Tools (If any)	Excel, SQL Databases

Course Learning Objectives: This course will enable the students to	
CLO1	Understand basic concepts of RPA.
CLO2	Analyze Intelligent Process Automation (IIPA), its application areas, and demonstrate how it is implemented.
CLO3	Identify various types of variables, and apply control flow and data manipulation techniques.
CLO4	Understand Image,Text lnd nata Tables Automation.
CLO5	Identify various types of exceptions and b strategies for handling them.

Module – 1	**08 Hrs**
RPA Foundations - What is RPA, Flavors of RPA, History of RPA, Benefits of RPA, Downsides of RPA, RPA vs BPO, BPM and BPA, Consumer willingness for automation, Workforce of the future. **RPA skills** - On-premise vs Cloud, Web technologies, Programming languages and low-code platforms, OCR, Databases, APIs, AI, Cognitive automation, Agile, Scrum, Kanban, Waterfall, DevOps, Flowcharts. **Textbook 1: Ch 1, Ch 2**	
Module – 2	**08 Hrs**
Robotic Process Automation - Components of RPA, RPA Platforms, About UiPath, The Future of automation. **Record and Play** - Downloading and installing UiPath Studio, Learning UiPath Studio interface, Task recorder, Step-by-step examples using the recorder. **Textbook 2 : Ch 1, Ch 2**	
Module – 3	**08 Hrs**

Sequence, Flowchart, and Control Flow - Sequence, Flowchart, Control Flow, Sequencing the workflow, UiPath activities, Loops and decision making, Examples using Sequence, Flowchart and Control Flow. **Data manipulation** - Variables and scope, Collections, Arguments, Purpose and use, Data table usage with examples, Clipboard management, File operations with examples, CSV/Excel to DataTable and vice versa. **Textbook 2: Ch 3, Ch 4**

Module – 4	**08 Hrs**
Taking Control of the Controls- Finding and attaching windows, Identifying UI controls, Waiting for controls, Mouse and keyboard activities, Working with UiExplorer, Handling events, Revisiting the recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points. **Textbook 2: Ch 5**	

Module – 5	**08 Hrs**
Exception Handling, Debugging, and Logging - Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting. **Text book 2: Ch 8**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the basic concepts of Robotic Process Automation (RPA) in automation workflows.
CO2	Analyze the functionalities of different RPA components and platforms for business automation.
CO3	Examine different types of variables, control flow mechanisms, and data manipulation techniques.
CO4	Evaluate various control techniques and Optical Character Recognition (OCR) methods used in Robotic Process Automation (RPA).
CO5	Apply various types and strategies to handle exceptions.

Text Books	
1	The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems, Tom Taulli, 2020, Apress publications, lSBN-13 (electronic):978-7-4842-5729-6.
2	Learning Robotic Process Automation, Alok Mani Tripathi, Date: March 2018, Publisher: Packt Publishing Release, ISBN: 9787788470940.

Reference Books	
1	lntroduction to Robotic Process Automation: a Primer, Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, Institute of Robotic Process Automation, 2018, Amazon Asia-Pacific Holdings Private Limited.

2	Robotic Process Automation: Guide To Building Software Robots, Automate Repititive Tasks & Become An RPA Consultant, Richard Murdoch, 1st Edition, 2018, Amazon Asia-Pacific Holdings Private Limited. ISBN-10: 1983036838

Web links and Video Lectures (e – Resources)	
1	https://www.uipath.com/rpa/robotic-process-automation

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2			2						2
CO2	3	2	1		3						2
CO3	3	2	2	2	3						2
CO4	3	2	3	2	3				1		2
CO5	3	2	2	2	3		1	1	1		2

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Semester: VI					
Agentic AI and Applications					
Course Code	**:**	BIS624C	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to AI, Python programming.
Knowledge on Fundamental Concepts	Types of agents, Autonomy level in agents
Knowledge on Connected Tools (If any)	ChatGPT, GitHub, CoPilot

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the fundamental concepts, evolution, and architecture of Agentic AI systems.
CLO2	Analyze the design principles and core components of AI agents, including models, tools, memory, and orchestration.
CLO3	Develop intelligent single-agent and multi-agent systems for autonomous problem-solving.
CLO4	Explore techniques for validation, monitoring, security, and continuous improvement of agentic systems.
CLO5	Apply Agentic AI frameworks and methodologies to real-world applications across multiple domains.

Module – 1	**08 Hrs**
Foundations of Agentic AI: Introduction to Artificial Intelligence and Generative AI, Evolution from Traditional ML to Foundation Models, Definition and Characteristics of AI Agents: Agentic AI vs Chatbots vs RAG Systems vs Workflows, Core Properties of Agents: Autonomy, Reasoning, Planning, Tool Usage, Adaptability, Types of Agents: Conversational Agents ,Research Agents, Analytics Agents, Developer Agents ,Domain-Specific Agents Real-world Applications of Agentic AI : Customer support, Healthcare triage, Legal assistance, Logistics. **Textbook1: Ch 1**	
Module – 2	**08 Hrs**
Designing Agent Systems: Architecture of Agent Systems , Core Components , Foundation Models : Tools, Memory, Orchestration , Model Selection Criteria: Cost, Accuracy, Latency Agent Design Trade-offs : Speed vs Accuracy ,Cost vs Performance, Reliability vs Complexity, Agent Design Patterns : Single-agent systems , Multi-agent systems, Best Practices in Agent Design, Frameworks for Agent Development :LangGraph, AutoGen, CrewAI, OpenAI Agents SDK. **Textbook1: Ch 2–3**	
Module – 3	**08 Hrs**
Tools, Memory and Orchestration: Tool Use in Agentic Systems: Local tools and API tools Memory in Agents: Short-term and Long-term Memory, Vector Databases and RAG, Agent Planning Strategies: Reflex and ReAct Agents, Execution Models: Sequential and Parallel execution. **Textbook1: Ch 4 - 6**	

Module – 4	08 Hrs
Multi-Agent Systems and Learning: Learning in Agentic Systems: Reflexion and Fine-Tuning, Single Agent vs Multi-Agent Systems, Multi-Agent Coordination: Manager-Worker, Hierarchical Coordination, Agent Communication, Human-Agent Collaboration. **Textbook1: Ch 7-8,13**	
Module – 5	**08 Hrs**
Applications, Deployment and Security: Agent Evaluation Metrics: Accuracy, Robustness, Hallucination, Monitoring and Improvement Loops, Security and Privacy in Agent Systems, Ethical and Responsible AI, Applications of Agentic AI: Healthcare, Finance, Education, Cybersecurity. **Textbook1: Ch 9-12**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the fundamentals, architecture, and core components of Agentic AI systems.
CO2	Design intelligent AI agents by integrating tools, memory, and orchestration strategies.
CO3	Develop single-agent and multi-agent systems for solving real-world problems.
CO4	Analyze agent performance using validation, monitoring, and improvement techniques in production environments.
CO5	Apply Agentic AI solutions in domains such as healthcare, finance, education, and customer support.

Text Books	
1	Building Applications with AI Agents: Designing and Implementing Multiagent Systems, Albada, M., 1st Edition, O'Reilly Media, 2025, ISBN-13: 978-1-098-17650-1
Reference Books	
1	The Agentic AI Handbook: Concepts, Design Patterns, and Future Directions, Bar, K., 1st Edition, Amazon Digital Services LLC – KDP, 2025, ISBN-13: 979-8265898487.
2	The Art of Prompt Engineering with ChatGPT: A Hands-on Guide (Learn AI Tools the Fun Way!), Hunter, N., 1st Edition, Independently Published, 2023, ISBN-13: 978-1739296711.
3	"Ethics of Artificial Intelligence and Robotics," in The Stanford Encyclopedia of Philosophy, edited by Edward N. Zalta and Uri Nodelman, Stanford University, revised edition, 2026.
4	"Responsible AI in Practice" by Microsoft (Online Guide)
Web links and Video Lectures (e – Resources)	
1	https://github.com/joaomdmoura/crewAI
2	https://github.com/openai/openai-cookbook
3	https://plato.stanford.edu/entries/ethics-ai

CO-PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2			1					1	
CO2	2	2	2		3				1	1	
CO3	2	3	2	2	3			1	2	2	
CO4	2	3	2	2	3				2	2	2
CO5	1	2			2	2	2	3	1	1	

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Semester : VI					
DevOps					
Course Code	**:**	BIS624D	**Credits**	**:**	03
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	UNIX, Software Engineering
Knowledge on Fundamental Concepts	AWS, Shell Programming
Knowledge on Connected Tools (If any)	AWS, Azure, Google cloud Shell

Course Learning Objectives: this course will enable the students to	
CLO1	Describe the agile relationship between development and IT operations.
CLO2	Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
CLO3	Implement automated system update and DevOps lifecycle.
CLO4	Analyze DevOps tools for code management, testing, and deployment.
CLO5	Evaluate DevOps practices and deployment strategies in software development.

Module 1	**8 Hrs**
Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples. **Textbook 1: Ch 1, 2**	
Module 2	**8 Hrs**
Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience. **Textbook 1: Ch 3**	
Module 3	**8 Hrs**
Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab. **Textbook 1: Ch 4**	

Module 4	8 Hrs
Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures. **Textbook 1: Ch 5**	
Module 5	**8 Hrs**
Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker. **Textbook 1: Ch 6, 7**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the concepts of DevOps to identify and utilize the components of a DevOps environment.
CO2	Examine software development models and DevOps architectures.
CO3	Apply different project management, integration, testing and code deployment tool.
CO4	Investigate different DevOps Software development models.
CO5	Evaluate various DevOps practices and effectively collaborate to adopt DevOps in real-time projects.

Text Book	
1	Practical Devops, Joakim Verona, 2nd Edition, 2018, Ingram short title, ISBN10: 1788392574 2.

Reference Books	
1	DevOps Tools from Practitioner's Viewpoint, Deepak Gaikwad, Viral Thakkar, 2nd Edition, Wiley publications. ISBN: 9788126579952.

Web links and Video Lectures (e – Resources)	
1	https://www.geeksforgeeks.org/devops-tutorial/
2	https://www.javatpoint.com/devops
3	https://www.youtube.com/watch?v=2N-59wUIPVI
4	https://www.youtube.com/watch?v=87ZqwoFeO88

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3				3					2	2
CO2	3	2	3		2					2	2
CO3	3	2	3	2	3				2	3	2
CO4	3	2	2	3	3					2	2
CO5	2	2	2	2	3	1		3	3	3	3

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Semester: VI					
Introduction to Data Structures					
Course Code	**:**	BCS645A	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to C Programming
Knowledge on Fundamental Concepts	Data types, Arrays, Structures, Functions, Recursion
Knowledge on Connected Tools (If any)	GCC, Code Blocks, Visual Studio

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamental concepts of data structures.
CLO2	Analyze stack and queue data structures for problem-solving.
CLO3	Implement singly linked lists for basic operations and stack/queue structures.
CLO4	Analyze and construct expression trees for arithmetic expressions.
CLO5	Apply basic sorting and searching algorithms to organize and retrieve data efficiently.

Module – 1	**08Hrs**
Introduction: Data and Information, Data Structure, Classification of Data Structures, Operations on Data Structure. Pointers: Pointer Concepts, Accessing Variables through Pointers, Pointer Applications, Dynamic Memory Allocation Functions. **Arrays and Structures**: Arrays, One-Dimensional Arrays, Two-Dimensional Arrays, Initializing Two-Dimensional Arrays, Multidimensional arrays, Structures and Unions, Declaring Structures, Giving Values to Members, Structure Initialization. **Textbook 1: Ch. 1: 1.2, Ch. 2: 2.1-2.5,2.6-2.9**	
Module – 2	**08Hrs**
Stacks: Introduction, Stack Operations, Stack Implementation using Arrays, Applications of Stacks, Infix to postfix conversion, Postfix expression evaluation. **Queues:** Introduction, Queue Operations, Queue Implementation using Arrays, Applications of Queues. **Textbook 1**: **Ch. 3:3.1-3.5, 3.6-3.8, Ch. 4:4.1-4.5**	
Module – 3	**08Hrs**
Linked Lists: Introduction, Singly Linked List, Operations on Singly Linked Lists: Insert-Delete-Display, Implementation of Stacks and Queues using Linked List. **Textbook 1**: **Ch. 5:5.1-5.4,5.5-5.6**	

Module – 4	08Hrs
Trees: Introduction, Basic Concepts, Representation of Binary Trees, Operations on Binary Trees: Insertion-Traversals-Searching-Copying a Tree, Binary Search Trees, Operations on Binary Search Trees: Insertion-Searching-Find Maximum and Minimum Value-Count Nodes, Expression Trees. **Textbook 1**: **Ch. 6:6.1-6.7,6.8-6.9,6.10**	
Module – 5	**08Hrs**
Sorting: Introduction, Bubble Sort, Selection Sort, and Insertion Sort. **Searching:** Introduction, Linear Search, Binary Search. **Textbook 1: Ch. 7:7.1-7.4, Ch. 8:8.1-8.3**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the concept of linear and nonlinear data structures.
CO2	Implement stack and queue concepts effectively to solve problems.
CO3	Analyze the practical uses of linked lists in various computing applications.
CO4	Design binary search trees to efficiently perform insertion, searching, deletion, and traversal operations."
CO5	Apply basic sorting and searching techniques to organize and retrieve data efficiently.

Textbook	
1	"Data Structures: A Pseudo-code approach with C", Gilberg & Forouzan, Cengage Learning, 2nd edition, 2014, ISBN-10: 8131503143.

Reference Books	
1	"An Introduction to Data Structures with Applications", Jean-Paul Tremblay & Paul G. Sorenson, McGraw Hill, 2nd edition, 2013.
2	"Fundamentals of Data Structures in C", Ellis Horowitz and Sartaj Sahni, Universities Press, 2nd edition, ISBN-13: 978-8173714939, 2017.

Web links and Video Lectures (e – Resources)	
1	http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
2	https://nptel.ac.in/courses/106/102/106102064/
3	https://nptel.ac.in/courses/106/105/106105171/
4	http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
5	https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s

CO-PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1								1
CO2	3	3	2	2	1						1
CO3	3	3	3	2	1						1
CO4	2	3	3	2	1						1
CO5	2	3	3	2	1						1

Semester: VI					
Fundamentals of Operating Systems					
Course Code	**:**	BCS645B	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Organization and Architecture, Programming in C.
Knowledge on Fundamental Concepts	Computer fundamentals, Arrays, Structures
Knowledge on Connected Tools (If any)	UNIX/Linux Environment

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the need of OS architecture and different types of OS.
CLO2	Illustrate the techniques for management of different system resources
CLO3	Analyze the different memory and file system management strategies.
CLO4	Demonstrate the virtual memory, paging and segmentation concepts.
CLO5	Analyze the importance of file system mechanisms.

Module – 1	**08Hrs**
Introduction: What operating systems do; Computer System organization; Computer System Organization, Computer System architecture; Operating System operations; Resource Management **Operating System Structures:** Operating System Services, User and Operating System interface; System calls, Application Program Interface, Types of system calls; **Textbook 1: Ch. 1: 1.1, 1.2, 1.3,1.4, 1.5, Ch. 2: 2.1, 2.2 (2.2.1, 2.2.2), 2.3 (2.3.2, 2.3.3)**	
Module – 2	**08Hrs**
Process Management: Process concept; Process scheduling; Operations on processes; Interprocess Communication. **Multi-threaded Programming:** Overview; Multithreading models, Thread Libraries. **Textbook 1: Ch. 3:3.1-3.4, Ch. 4:4.1, 4.3 5, 4.4**	
Module – 3	**08Hrs**
CPU Scheduling: Basic Concepts, Scheduling criteria, Scheduling algorithms, Thread Scheduling. **Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Semaphores; Classical problems of synchronization. **Textbook 1: Ch. 5:5.1, 5.2,5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.4 Ch. 6: 6.1, 6.2.,6.3, 6.6**	
Module – 4	**08Hrs**
Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management:** Background; Contiguous memory allocation; Paging; Structure of page table.	

Textbook 1: Ch. 8: 8.1-8.8 Ch. 9: 9.1-9.4 (9.4.1, 9.4.2)	
Module – 5	**08Hrs**
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; **File System Interface:** File concept; Access methods; Directory Structure, Protection, File System Implementation: File System Structure, File System Operations, **File System Internals**: File Systems, File System Mounting; Partition and Mounting, File sharing; **Textbook 1: Ch. 10: 10.1-10.3, 10.4 (10.4.1, 10.4.2, 10.4.4.) Ch. 13: 13.1, 13.2, 13.3 (13.3.1, 13.3.2, 13.3.3), 13.4 (13.4.1, 13.4.2) Ch. 15: 15.1-15.4**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the structure and functionality of operating system
CO2	Illustrate the appropriate CPU scheduling algorithm for the given scenarios
CO3	Analyze the various techniques for process synchronization and deadlock handling
CO4	Apply the different techniques for memory management
CO5	Demonstrate the importance of File System Mounting and File Sharing

Textbook	
1	"Operating System Principles", Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 978–0–470–12872–5, 8th edition, Wiley-India, 2015.

Reference Books	
1	"Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python", Akshay Kulkarni, Adarsha Shivananda, Apress, 2019.
2	"Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives", T V Geetha, Pearson, 2024.
3	"Information Storage and Retrieval systems", Gerald J. Kowalski and Mark.T. Maybury, Kluwer Academic Publishers.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=vBURTt97EkA
2	https://www.iemdaily.com/2020/05/operating-system-by-gate-smashers.html?utm

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	1	1								1
CO2	3	1	1								1
CO3	3	3	1								1
CO4	3	3	1		1						1
CO5	3	3	2		1						1

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Semester: VI					
Mobile Application Development					
Course Code	**:**	BIS645C	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving through Programming, Object-Oriented Programming
Knowledge on Fundamental Concepts	Understanding of core programming concepts (variables, loops, functions, OOP),Basic UI/UX principles, Database fundamentals
Knowledge on Connected Tools (If any)	SQL

Course Learning Objectives: This course will enable the students to	
CLO1	Learn to setup Android application development environment
CLO2	Illustrate user interfaces for interacting with apps and triggering actions
CLO3	Interpret tasks used in handling multiple activities.
CLO4	Identify options to save persistent application data
CLO5	Appraise the role of security and performance in Android applications

Module – 1	**08 Hrs**
Get started: Build your first app, Activities, Testing, debugging and using support libraries **Text Book1: Ch. 1: 1.1 - 1.4, Ch. 2: 2.1 - 2.3, Ch. 3:3.1-3.3.**	
Module – 2	**08 Hrs**
User experience: User Interaction, Delightful user experience, Testing your UI **Text Book1: Ch. 4: 4.1 - 4.4, Ch. 5: 5.1 – 5.3, Ch. 6:6.1.**	
Module – 3	**08 Hrs**
Working in the background: Background Tasks, Triggering, scheduling and optimizing background tasks **Text Book1: Ch. 7: 7.1 - 7.4, Ch. 8: 8.1 – 8.3.**	
Module – 4	**08 Hrs**
All about Data: Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders **Text Book1: Ch. 9: 9.0 - 9.2, Ch. 10: 10.0 – 10.1, Ch. 11: 11.1, Ch. 12: 12.1.**	
Module – 5	**08 Hrs**

Permissions, Performance and Security, Firebase and AdMob, Publish **Text Book1: Ch. 13: 13.1, Ch. 14: 14.1, Ch. 15: 15.1.**

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop Android applications using activities, support libraries, testing, and debugging techniques.
CO2	Design user interfaces by incorporating user interaction principles and user experience testing methods.
CO3	Implement background processing using task scheduling, triggering, and optimization techniques.
CO4	Apply application data using preferences, SQLite databases, content providers, and loaders.
CO5	Evaluate application security, permissions, performance optimization, and deployment using Firebase, AdMob, and publishing tools.

Text Books	
1	"Android Developer Fundamentals Course – Concept Reference", Google Developer Training, 2017, Google Developer Training Team.

Reference Books	
1	"Android Programming – Pushing the Limits", Erik Hellman, 1st Edition, , 2014,Wiley India Pvt Ltd. ISBN 978-1-118-71737-0
2	"Head First Android Development", Dawn Griffiths and David Griffiths, 1st Edition, 2015, O'Reilly SPD Publishers. ISBN-978-1-449-36218-8
3	"Beginning Android Programming with Android Studio", J F DiMarzio, 4th Edition, 2016,Wiley India Pvt Ltd,. ISBN-13: 978-8126565580

Web links and Video Lectures (e – Resources)	
1	https://onlinecourses.swayam2.ac.in/nou21_ge41/
2	https://nptel.ac.in/courses/106/106/106106156/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	2	3	1			1	2	2
CO2	2	2	3	1	2	2		1	2	2	2
CO3	2	2	2	2	3	1			1	1	2
CO4	2	2	2	2	3	2		1	2	1	2
CO5	3	3	2	2	2	2	2		2	2	3

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Semester: VI					
Introduction to Artificial Intelligence					
Course Code	**:**	BCI645D	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Program
Knowledge on Fundamental Concepts	Background in linear algebra, data structures and algorithms, and probability
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the foundations of Artificial Intelligence, intelligent agents, problem formulation, and the characteristics of intelligent environments.
CLO2	Apply uninformed and informed search techniques, game-playing algorithms, and heuristic methods to solve AI problems efficiently.
CLO3	Analyze various knowledge representation techniques and reasoning methods for intelligent decision-making under certainty and uncertainty.
CLO4	Examine first-order logic, inference mechanisms, machine learning approaches, and reinforcement learning techniques for solving AI problems.
CLO5	Illustrate the architecture, components, and real-world applications of expert systems and knowledge-based systems.

Module – 1	**08 Hrs.**
Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. **Textbook 1: Ch 1: 1.1–1.5, Ch 2: 2.1–2.4, Ch 3: 3.1–3.4**	
Module – 2	**08 Hrs.**
Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions **Textbook 1: Ch 3: 3.5–3.6, Ch 4: 4.1–4.7, Ch 5: 5.1–5.4, Ch 7: 7.1–7.5**	
Module – 3	**08 Hrs.**
Representation of Knowledge: Knowledge representation issues, predicate logic- logic	

programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules-based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempstershafer theory. **Textbook 1: Ch 8: 8.1–8.5, Ch 9: 9.1–9.6, Ch 10: 10.1–10.5**

Module – 4	**08 Hrs.**
Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning. **Textbook 2: Ch 1: 1.1–1.5, Ch 2: 2.2–2.7, Ch 3: 3.2, 3.3, 3.5, 3.6**	
Module – 5	**08 Hrs.**
Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells. **Textbook 2: Ch7: 7.1–7.2, 7.4, Ch 8: 8.3–8.5, Ch 9: 9.4–9.6**	

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

CO1	Interpret the concepts of Artificial Intelligence, intelligent agents, and problem-solving methodologies
CO2	Apply search algorithms and game-playing techniques to solve complex AI problems.
CO3	Analyze knowledge representation and reasoning techniques for intelligent systems.
CO4	Apply logical inference, machine learning, and reinforcement learning concepts in AI applications.
CO5	Design and evaluate expert systems for real-world problem-solving.

Text Books	
1	Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 4th Edition, Pearson, 2022. ISBN: 9780134610993.
2	Artificial Intelligence, Elaine Rich, Kevin Knight and Shivashankar B. Nair, 3rd Edition (SIE), McGraw Hill Education. ISBN: 9781259029974.

Reference Books	
1	Artificial Intelligence: Structures and Strategies for Complex Problem Solving, George F. Luger, 6th Edition, Pearson. ISBN: 9789332581982.
2	Artificial Intelligence: A New Synthesis, Nils J. Nilsson, Morgan Kaufmann. ISBN: 9781558604674.

Web links and Video Lectures (e – Resources)	
1	https://ai.google/
2	https://swayam.gov.in/nd1_noc19_me71/preview

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2			2						1
CO2	3	3	2	2	3						1
CO3	3	3	2	3	2						1
CO4	3	2	2	2	3						2
CO5	3	2	3	2	3				1	1	2

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Semester: VI					
Major Project Phase – I					
Course Code	**:**	BIS636	**Credits**	**:**	2
Hours/Week(L:T:P)	**:**	0:0:4	**CIE**	**:**	100 Marks
Total Hours	**:**	25 P	**SEE**	**:**	--
Course Type	**:**	PROJ	**SEE Duration**	**:**	--

Prerequisites:	
Courses	Fundamental of Concepts Programming
Knowledge on Fundamental Concepts	Programming concepts on C,DSA,JAVA,DBMS,PYTHON
Knowledge on Connected Tools (If any)	Eclipse, Edit plus, GCC, Code blocks, Visual Studio

Course Learning Objectives: This course will enable the students to	
CLO1	Conceptualize, design and implement solutions for specific problems.
CLO2	Communicate the solutions through presentations and technical reports.
CLO3	Apply project and resource managements skills, professional ethics, societal concerns.
CLO4	Develop, test, and evaluate the solution using appropriate techniques.
CLO5	Synthesize self-learning, sustainable solutions and demonstrate life-long learning

PROJECT WORK (BIS636): The objective of the Project work is
(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To instil responsibilities to oneself and others.
(viii)To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college.
Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and

question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	2	3			2	2	2	2
CO2	2	3	2	2	3			2	2	2	2
CO3	2	2	2	1	3			2	2	2	2
CO4	2	2	2	2	3			2	2	2	3
CO5	2	2	3	2	3			2	2	2	3

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Semester: VI					
Machine Learning Lab					
Course Code	**:**	BCSL607	**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	15P	**SEE**	**:**	50 Marks
Course Type	**:**	PCCL	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to Python Programming, Foundations of AI
Knowledge on Fundamental Concepts	Probability & Statistics
Knowledge on Connected Tools(If any)	Jupyter Notebook

Course Learning Objectives: This course will enable the students to	
CLO1	Become familiar with data characteristics and formats for effective analysis.
CLO2	Visualize univariate, bivariate, and multivariate data using appropriate statistical techniques.
CLO3	Apply dimensionality reduction methods to simplify complex datasets.
CLO4	Understand various machine learning algorithms such as similarity-based learning, regression, decision trees, and clustering.
CLO5	Familiarize with learning theories, probability-based models and developing the skills required for decision-making in dynamic environments.

Sl No.	**Experiments**
1	Develop a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset.
2	Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heatmap to know which variables have strong positive/negative correlations. Create a pair plot to visualize pairwise relationships between features. Use California Housing dataset.
3	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.
4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples.
5	Develop a program to implement k-Nearest Neighbour algorithm to classify the randomly generated 100 values of x in the range of [0,1]. Perform the following based on dataset generated. 1. Label the first 50 points {x1,……,x50} as follows: if (xi ≤ 0.5), then xi ∈ Class1, else xi ∈ Class1 2. Classify the remaining points, x51,……,x100 using KNN. Perform this for k=1,2,3,4,5,20,30
6	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
7	Develop a program to demonstrate the working of Linear Regression and Polynomial Regression. Use Boston Housing Dataset for Linear Regression and Auto MPG

	Dataset (for vehicle fuel efficiency prediction) for Polynomial Regression.
8	Develop a program to demonstrate the working of the decision tree algorithm. Use Breast Cancer Data set for building the decision tree and apply this knowledge to classify a new sample.
9	Develop a program to implement the Naive Bayesian classifier considering Olivetti Face Data set for training. Compute the accuracy of the classifier, considering a few test data sets.
10	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the fundamental principles of multivariate data analysis to interpret datasets using appropriate visualization techniques.
CO2	Demonstrate dimensionality reduction techniques such as PCA and t-SNE to simplify complex datasets while preserving essential patterns.
CO3	Apply similarity-based learning approaches, including k-NN, and perform regression analysis using appropriate evaluation metrics.
CO4	Construct decision trees for classification and regression tasks, and develop Bayesian models for probabilistic inference.
CO5	Develop clustering algorithms to group data effectively and optimize shared computing resources in distributed environments.

Text Books	
1	Machine Learning, S Sridhar, M Vijayalakshmi, First Edition. 2021, OXFORD University Press, ISBN: 978-0190127275.
2	Machine Learning: Theory and Practice, M N Murty and Ananthanarayana V S, Universities Press (India) Pvt. Limited, 2024,ISBN: 9789393330697

Web links and Video Lectures (e – Resources)	
1	https://www.drssridhar.com/?page_id=1053
2	https://www.universitiespress.com/resources?id=9789393330697
3	https://onlinecourses.nptel.ac.in/noc23_cs18/preview

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2		2	3						2
CO2	3	3		2	3						2
CO3	3	3		2	3						2
CO4	3	3	3	3	3						2
CO5	3	3	2	2	3	2		2	2		2

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Semester: VI					
Competency Enhancement Course-4					
Course Code	**:**	BCE608	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:2:0	**CIE**	**:**	100 Marks
Total Hours	**:**	40L	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Competency Enhancement Course 3, Fundamentals of Data Structures & Algorithms
Knowledge on Fundamental Concepts	Complexity analysis, competitive programming paradigms, and algorithmic problem solving
Knowledge on Connected Tools(If any)	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Understand and apply fundamental data structures.
CLO2	Analyze and design algorithms using various paradigms.
CLO3	Evaluate the time and space complexity of algorithms using asymptotic notations.
CLO4	Develop problem-solving strategies for competitive programming.
CLO5	Apply algorithmic thinking in real-world applications through hands-on coding labs, group exercises, and simulations.

Module – 1	**8 Hrs**
Data Structures Overview of Data Structures, Searching and Sorting Algorithms, Stack, Queue, Linked, List, Trees, Graphs **Textbook-1, Ch1-15**	
Module – 2	**8 Hrs**
Algorithms Analysis of Algorithms, Pattern Matching, Bit Algorithms, Mathematical Algorithms, Randomized Algorithms, Dynamic Programming, Backtracking Algorithms, Greedy Algorithms, Sliding Window Approach **Textbook -2, Ch8-13**	
Module-3	**8 Hrs**
Time Complexity Big O Notation, Omega Notation, Theta Notation, Best, Worst, and Average Case Analysis, Asymptotic Analysis, Amortized Analysis, Time Complexity of Common Algorithms, Sorting (e.g., QuickSort, MergeSort), Searching (e.g., Binary Search), Graph Algorithms (e.g., BFS, DFS), Space Complexity Basics **Textbook -3, Ch1-6**	
Module-4	**8 Hrs**

Foundation of Competitive Coding

Importance of Competitive Coding for interviews and placements, Problem decomposition & edge case identification, Basics of time and space complexity, Story-based introduction to problem-solving, Brainstorm real-world scenarios & translate to problems, Identify edge cases via mini-quizzes, Live walkthroughs (e.g., parking fee calculator), Coding warm-up challenge

Textbook -3, Ch7-10

Module-5	**8 Hrs**

Data Structures Simplified

Arrays, Linked Lists, Stacks, Queues, Hashing, Trees, Graphs, Mapping DS to real-life systems (e.g., ticket booking, social feeds), Trade-offs in DS selection, Implement DS in hands-on coding labs, Real-life simulation: Airline or hospital queue system, Use case discussions, Group exercises with efficiency comparisons

Algorithmic Paradigms & Optimization

Greedy, Divide & Conquer, DP, Backtracking, Practical applications with real-world stories, Efficiency and trade-offs, Debugging complex logic, Group challenge: Route optimization using Dijkstra, Hands-on: Knapsack, Fibonacci DP, Game simulations, Compare multiple approaches for the same problem, Debugging hackathons

R-1, C1-10, 20,21&22

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply fundamental data structures such as arrays, stacks, queues, linked lists, trees and graphs to solve real-life computational problems.
CO2	Analyze and implement algorithmic strategies and backtracking for optimized problem-solving.
CO3	Evaluate the time and space complexity of algorithms using asymptotic notations to ensure computational efficiency.
CO4	Design and implement algorithms for searching, sorting and graph traversal with appropriate time complexity.
CO5	Demonstrate proficiency in competitive coding practices by identifying edge cases, decomposing problems and debugging logical errors.
CO6	Relate data structures and algorithmic techniques to real-world applications and industry use-cases such as routing, scheduling and transaction systems.

Text Books	
1	The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie 2nd Edition, Pearson Education India – 2015, (ISBN- 978-9332549449)
2	Let Us C, Yashavant Kanetkar, 15th Edition, BPB Publications- 2016, (ISBN- 978-8183331630)
3	Object-Oriented Programming with C++, E. Balagurusamy, 8th Edition, Tata McGraw-Hill – 2020, (ISBN- 978-9389949186)
4	Data Structures and Algorithms, Narasimha Karumanchi, 2023 Edition (latest available), paperback, CareerMonk Publications, (ISBN: 9788193245279)

Web links and Video Lectures (e – Resources)	
1	https://www.sanfoundry.com/best-reference-books-programming-language-c/?utm_source.com

2	https://studylib.net/doc/27609260/addison-wesley-c-primer-plus-6th-edition-2014?utm_source.com
3	https://books.dwf.dev/docs/c-programming-language/first-edition/types-operators-expressions?utm_source.com
4	https://www.geeksforgeeks.org/types-of-database-management-systems/?utm_source.com
5	https://faculty.kutztown.edu/shim/356CHAPTER%205.pdf?utm_source.com

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2								
CO2	3	3	2								
CO3	3	2		2							
CO4	3	2	3								
CO5		3			1						1
CO6	2		2			1					

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Semester: VI					
Indian Knowledge System					
Course Code	**:**	BIK609	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	1:0:0	**CIE**	**:**	100 Marks
Total Hours	**:**	15L	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Environmental Studies, Indian Philosophy or Ethics
Knowledge on Fundamental Concepts	Basic understanding of ancient Indian civilization, literature
Knowledge on Connected Tools(If any)	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the foundational concepts of Indian Knowledge Systems (IKS)
CLO2	Explore the contributions of traditional Indian knowledge to various fields in the humanities and sciences
CLO3	Recognize the relevance and applications of traditional knowledge in professional domains
CLO4	Develop an appreciation for the interdisciplinary nature of IKS
CLO5	Analyze the integration of IKS with contemporary academic and professional practices

Module – 1	**5 Hrs**
Introduction to Indian Knowledge Systems (IKS) Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge. **Textbook-1, Ch.1,2&3** **Textbook-2: Ch. 2&3**	
Module – 2	**5 Hrs**
Traditional Knowledge in Humanities and Sciences Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology. **Textbook-1, Ch.4,5,6&7** **Textbook-2: Ch. 3&4**	
Module-3	**5 Hrs**
Traditional Knowledge in Professional domain Town planning and architecture Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.	

Textbook-1, Ch.8,9,10,11&12
Textbook-2: Ch. 5,6&7

Course Outcomes: After completing the course, the students will be able to	
CO1	Elucidate the scope, significance and philosophical foundations of Indian Knowledge Systems (IKS).
CO2	Compare traditional knowledge systems with indigenous and western knowledge frameworks.
CO3	Identify the applications of traditional Indian knowledge in humanities and scientific domains.
CO4	Demonstrate an understanding of traditional Indian contributions to professional domains.
CO5	Relate traditional knowledge systems to contemporary global frameworks such as Sustainable Development Goals (SDGs).

Text Books	
1	Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
2	Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230

Reference Book	
1	Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=LZP1StpYEPM
2	http://nptel.ac.in/courses/121106003/
3	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7	https://unfoundation.org/whatwedo/issues/sustainabledevelopmentgoals/?gclid=EAIaIQobChMInpJtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2					3					1
CO2	2	2				2	1				2
CO3	3					1					1
CO4	3	2									1
CO5	2					3	2				2

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Semester: VI					
National Service Scheme(NSS)					
Course Code	**:**	BNS610	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	24P	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the community in general in which they work
CLO2	Identify the needs and problems of the community and involve them in problem –solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions t
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Activity– 1	**08Hrs**
Plantation and adoption of plants. Know your plants.	
Activity – 2	**08 Hrs**
Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	
Activity – 3	**08 Hrs**
Govt. school Rejuvenation and helping them to achieve good infrastructure.	

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution

Sl.	**Topic**	**Group Size**	**Location**	**Activity Execution**	**Reporting**	**Evaluation of the Topic**
1	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Place selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2	Organize National integration	May be individual or team	Villages/ City Areas / Grama panchayat/ public	Place selection /proper consultation/	Report should be submitted by individual to	Evaluation as per the rubrics Of

	and social harmony events /workshops /seminars. (Minimum 02 programs).		associations/Government Schemes officers/ campus etc.	Continuous monitoring/ Information board	the concerned evaluation authority	scheme and syllabus by NSS officer
3	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities for 6th Semester)

Sl. No.	**Practice Session Description**
1.	Lecture session by NSS Officer
2.	Selection of topic, Commencement of activity and its progress
3.	Execution of Activity
4.	Case study based Assessment, Individual performance
5.	Sector wise study and its consolidation
6.	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In the 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 6th semester, consolidated report of all activities compiled report should be submitted as per the instructions.

Course Outcomes: After completing the course, the students will be able to	
CO1	Exploit the importance of his / her responsibilities towards society.
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field of societal problems.
CO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Assessment Details for CIE (100 Marks)

Weightage	CIE- 100 Marks
Selection of Topic, Commencement of activity and its progress	**40 Marks**
Case study based Assessment	**20 Marks**
Sector wise study and its consolidation	**20 Marks**
Video based seminar for 10 minutes by each student at the end of semester with Report	**20 Marks**
Total Marks for the course in the semester	**100 Marks**

Suggested Learning Resources: **Books:**	
1	NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2	Government of Karnataka, NSS cell, activities reports and its manual.
3	Government of India, NSS cell, Activities reports and its manual.

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						3					3
CO2						3					3
CO3						3					3
CO4						3					3
CO5						2	3	3			3

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Semester: VI					
Physical Education (PE) **(Sports and Athletics)**					
Course Code	**:**	BPE610	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	24P	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students to	
CLO1	Develop awareness about common postural deformities and equip students with techniques for stress management to enhance physical and mental well-being.
CLO2	Enable students to acquire the basic rules, techniques, and motor skills of selected games such as Throw Ball, Table Tennis, or Athletics, and to encourage regular participation in physical activities.
CLO3	Improve cardiovascular fitness, flexibility, and coordination through structured aerobic exercises.

Module – 1	**4 Hrs**
Orientation A. Postural deformities. B. Stress management	
Module – 2	**16 Hrs**
Specific games (Any one to be selected by the student) A. Throw ball B. Table Tennis C. Athletics (Field Events- Jumps) – Any event as per availability of Ground.	
Module-3	**4 Hours**
Aerobics	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify common postural deformities and suggest corrective measures
CO2	Apply basic stress management techniques to enhance physical and mental well-being
CO3	Demonstrate fundamental skills, rules and techniques of a selected game (Throw Ball / Table Tennis / Athletics – Field Events)
CO4	Exhibit improved coordination, flexibility, endurance and cardiovascular fitness through aerobic exercises
CO5	Integrate principles of physical fitness, posture correction and stress management into daily routines for holistic health

Scheme and Assessment for auditing the course and Grades:

Sl. No.	**Activity**	**Marks**
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2					2	3		2		
CO2	2					3	3	2	2		
CO3	2	1				2			3		
CO4	3					2			2		
CO5	3	2				3	3	2	3		

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Semester: VI					
YOGA					
Course Code	**:**	BYO610	**Credits**	**:**	0
Hours/Week(L:T:P:S)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	15P	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students to	
CLO1	Adopt healthy lifestyle practices and maintain mental hygiene to promote physical and mental well-being
CLO2	Develop emotional intelligence and foster emotional stability through self-awareness and mindfulness practices.
CLO3	Impart moral values and enhance self-awareness to facilitate personal growth and attain higher levels of consciousness.

Module - 1	**03 Hrs**
Higher Ashtanga Yoga: Ashtanga Yoga – last three limbs: Dharana (Concentration), Dhyana (Meditation), Samadhi (Absorption), Importance in spiritual and mental well-being	
Module - 2	**03 Hrs**
Sitting & Standing Asanas: Sitting Asanas: Bakasana, Hanumanasana, Ekapada Rajakapotasana, Yogamudra in Vajrasana, Standing Asanas: Vatayanasana, Garudasana, Technique, precautions & benefits	
Module - 3	**03 Hrs**
Balancing & Supine Asanas: Balancing Asanas: Veerabhadrasana, Sheershasana, Supine Asanas: Sarvangasana, Setubandha Sarvangasana, Shavasana (Relaxation), Asana meaning, method, safety tips & benefits	
Module - 4	**03 Hrs**
Pranayama & Kapalabhati: Pranayama: Bhastrika, Bhramari, Kapalabhati revision – 80 strokes/min, 3 rounds, Technique, precautions & benefits	
Module - 5	**03 Hrs**
Shatkriyas: Meaning, need & types of Shatkriyas, Techniques, safety & benefits of: Jalaneti & Sutraneti, Nouli (only for men), Sheetkarma Kapalabhati	

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the origin, history, objectives, and fundamental concepts of Yoga and its various schools.
CO2	Demonstrate Suryanamaskara and various types of Asanas with correct techniques, precautions, and benefits.
CO3	Differentiate between yogic and non-yogic practices

CO4	Apply yogic principles to promote physical and mental well-being.

Text Books
Light on Yoga by BKS Iyengar, Thorsons Publishers, ISBN-10 : 8172235011
Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245
Yoga Instructor Course hand book published by SVYASA University, Bengaluru

Reference Books	
1	Yogapravesha in Kannada by Ajitkumar
2	Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=KB-TYlgd1wE
2	https://www.youtube.com/watch?v=aa-TG0Wg1Ls

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1						2			2		
CO2						2			2		
CO3						2	2	3	2		2
CO4						2			2		
CO5						2	2	3	2		2

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Semester: VI					
Music					
Course Code	**:**	BMU610	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	26P	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Objectives: This course will enable the students to	
CLO1	Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
CLO2	Recognize and describe various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system.
CLO3	Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
CLO4	Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.
CLO5	Demonstrate basic vocal proficiency through the practice of Sarale Varase exercises, notations for Suladi Sapta Tala in Mayamalavagowla raga and performance of selected compositions such as Geethe, Jathi Swara and Krithi.

Module -I	**03 Hrs**
Preamble Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition. Origin of the Indian Music: Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela **Textbook 1, V-1 Ch. 1-4**	
Module – II	**03 Hrs**
Compositions Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. **Textbook 2 – Ch. 4-7**	
Module –III	**03 Hrs**
Composers Biography and contributions of Purandaradasa, Thyagaraja, Mysoro asudevacharya, Kanakadasa **Textbook 3 – Ch. 2-5**	
Module –IV	**03 Hrs**
Music Instruments Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments. **Textbook 1,V-4 – Ch. 2-6**	
Module –V	**14 Hrs**

Abhyasa Gana

Singing the swara exercises (Sarale Varase Only), Botatio writing for sarale varase and sulafi sapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathi swara, oe krithi in a mela raga

Textbook 1, V-1&2

Course Outcomes: After completing the course, the students will be able to	
CO1	Outline the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala.
CO2	Identify and interpret basic Carnatic compositions using standard notation.
CO3	Summarize the contributions of composers.
CO4	Classify Indian musical instruments and describe their construction and use.
CO5	Demonstrate basic Carnatic vocal skills through selected exercises and compositions.

Text Books	
1	"South Indian Music – Vol. I to VI", Prof. P. Sambamoorthy, The Indian Music Publishing House, Chennai.
2	"A Textbook of Carnatic Music", Dr. S. Bhagyalekshmy, CBH Publications
3	"Karnataka Sangeetha Charitre", Dr. V. S. Sampathkumaracharya, Kannada University, Hampi.

Reference Books	
1	"Music of India", B. Chaitanya Deva, Munshiram Manoharlal Publishers
2	"Essentials of Musicology in South Indian Music", Prof. S. R. Janakiraman, Asian Educational Services

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3		1		1		1	1	1		1
CO2	3		3	1	2	1	2	1	1		1
CO3	1				1	1	1		1		
CO4	2		2		3	1	1	1	1		1
CO5	3			1	2	1	1	1	1		1

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Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Department Vision

Educating Students to Engineer Information Science and Technology for Advancing the Knowledge as to Best Serve the Real World.

Department Mission

- Focusing on Fundamentals and Applied aspects in both InformationScience Theory and Programming practices.
- Training comprehensively and encouraging R&D culture in trending areas of Information Technology.
- Collaborating with premier Institutes and Industries to nurture Innovation and learning, in cutting edge Information Technology.
- Preparing the students who are much Sought-after, Productive and Well-respected for their work culture having Lifelong Learning practice.
- Promoting ethical and moral values among the students so as to enable them emerge as responsible professionals.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

P.B. No.20, B.B Road,

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