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|| Jai Sri Gurudev ||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Instituton under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME, & CV), NIRF-ISF-1500 in 2023, Gold Rated by QS I-Gauge

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

Estd : 1986

VI Semester
Scheme & Syllabus of B.E. Programme
Computer Science & Design
(2024 Scheme)

Core Values

Spiritual, **J**udicious, **C**ommitment, **I**ntegrity, **T**rustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NAAC A+

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL 4-Star Rating



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Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

(An Autonomus Institute Under VTU Belagavi & Approved by AICTE, New Delhi)

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

Post Box #20, B.B. Road, Chikkaballapur - 562 101, Karnataka

Estd.:1986

6th Semester, B.E. programme

Scheme of Teaching and Examinations 2024

Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS) (Effective from the academic year 2026-27)

SJC INSTITUTEOF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous Institution under VTU from 2024 – 2025

AICTE Approved, Accredited by NBA(CSE, ISE, ECE, ME, CV, AE) and NAAC with 'A+' grade, QS – I Gauge Gold Rated

SCHEME OF TEACHING AND EXAMINATION – B.E. – CSD

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

6th Semester

Computer Science and Design													
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	BCG601	Design Processes and Perspectives	PCC	CSD	3	2	0	**3**	**50**	**50**	**100**	**4**
2	BCG602	Artificial Intelligence and Machine Learning	IPCC	CSD	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BXX623x	Professional Elective Course – II	PEC	CSD	3	0	0	**3**	**50**	**50**	**100**	**3**
4	BXX624x	Professional Elective – III	PEC	CSD	3	0	0	**3**	**50**	**50**	**100**	**3**
5	BXX645x	Open Elective Course– I	OEC	CSD	3	0	0	**3**	**50**	**50**	**100**	**3**
6	BCG636	Major Project Phase– I	PROJ	CSD	0	0	4	**-**	**100**	**-**	**100**	**2**
7	BCGL607	UI/UX Lab	PCCL	CSD	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
BCG623B	Cloud Computing and Security	BCG623D	Introduction to Human Centered System

Professional Elective Course- III

Course Code	Course Name	Course Code	Course Name
BCG624A	Game Design	BIS624C	Agentic AI and Applications
BCG624B	Natural Language Processing	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, Physical Education, Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3rd semester. Activities shall be carried out between 3rdsemester 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					
Design Processes and Perspectives					
Course Code	**:**	BCG601	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:2:0	**CIE**	**:**	50Marks
Total Hours	**:**	50L	**SEE**	**:**	50Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	03Hours

Prerequisites:	
Courses	Innovation and Design Thinking
Knowledge on Fundamental Concepts	Basic Design Principles, Elements of Design, Creative Thinking and Problem-Solving Approaches, Basic Aesthetics and Visual Literacy,
Knowledge on Connected Tools (If any)	Sketching and Wire framing Tools, Mind Mapping and Collaboration Tools, Graphic Design Software.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basics of design processes and methods.
CLO2	Implement user needs and design solutions based on those needs.
CLO3	Enhance problem-solving through creative thinking and prototyping**.**
CLO4	Utilize advanced design tools and technologies to develop functional products.
CLO5	Incorporate ethical, cultural, and sustainability considerations into the design process

Module–1	**10Hrs**
Engineering Design : Introduction - Design basics, Engineering design process, Importance of the Engineering Design Process Types of Designs, A Simplified Iteration Model, Design Method Versus Scientific Method, A Problem-Solving Methodology, Description of Design Process, Considerations of a good design, Societal considerations in engineering design, **Problem definition and need identification:** Introduction, Problem Definition **Textbook 1: Ch1:** 1.1, 1.2.1, 1.2.2, 1.3.1-1.3.3, 1.4, 1.5, 1.9, **Ch5:** 5.1, 5.2	
Module–2	**10Hrs**
Gathering Information: Gathering information, data, information and knowledge, Information literacy and the internet, Finding sources of design information, Library sources, **Embodiment design:** Introduction, Product architecture, Steps in developing product architecture. **Textbook 1: Ch4:** 4.1-4.3, **Ch8:** 8.1-8.3	
Module–3	**10Hrs**
Concept Generation: Introduction to creative thinking, Creativity and problem solving, Supports to creative thinking, Barriers to creative thinking, Creative thinking methods, Brainstorming, Quick idea generation tools, Methods for design generation, Generating design concepts, Systematic methods for designing, **Decision Making and Concept Selection**: Introduction, Behavioral aspects of decision making, Evaluation processes, Design selection based on judgment and experience. **Textbook 1: Ch6:** 6.1, 6.2.1, 6.2.2, 6.3.1, 6.3.2, 6.4.1, 6.4.2, **Ch7:** 7.1, 7.2, 7.3.1	
Module–4	**10Hrs**

User Interface Design: The Golden Rules, Place the User in Control, Reduce the User's Memory Load, Make the Interface Consistent, User Interface Analysis and Design, Interface Design Steps, Applying Interface Design Steps, Design Issues, WebApp Interface Design, Interface Design Principles and Guidelines, Interface Design Workflow for WebApps, Design Evaluation, **Pattern Design:** Design Patterns, Kinds of Patterns, Frameworks, Pattern-Based Software Design, Pattern-Based Design in Context, Thinking in Patterns, User Interface Design Patterns, WebApp Design Patterns. **Textbook 2: Ch11:** 11.1, 11.2, 11.4, 11.5, 11.6, **Ch12:** 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.5. 12.6
Module–5 **10Hrs**
Design for Sustainability and The Environment: The environmental movement, Ecosystems and balance, Dependence on fossil fuels, Behavior changes started by the U.S environmental movement, Sustainability, WCED report on sustainability, UN's 2030 agenda for sustainable development, Challenges of sustainability for business, End-of-life product transformations, Tools to aid design for the environment and sustainability. **Textbook 1: Ch15:** 15.1.1, 15.1.4, 15.1.5, 15.2, 15.3, 15.4, 15.6

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the fundamentals of design process
CO2	Analyze user-centered design principles to develop effective and innovative solutions.
CO3	Apply creative thinking and problem-solving skills through prototyping and design generation methods.
CO4	Make use of design tools and technologies to create functional and user-friendly interfaces.
CO5	Design solutions that reflect ethical responsibility, cultural awareness, and sustainability principles.

Text Books	
1	Engineering Design: George E. Dieter, Linda C. Schmidt, 6th edition, 2021, McGraw-Hill, ISBN 978-1-260-57527-9
2	Software Engineering: A Practitioner's Approach, Roger S. Pressman, 7th edition, 2010, McGraw-Hill Higher Education, ISBN**:** 978-0-07-337597-7

Reference Books	
1	The Design of Everyday Things, Don Norman, 2nd Edition, 2013, Basic Books, ISBN: 978-0465050659
2	Design Thinking: Process and Methods, Robert Curedale, 3rd Edition, 2013, Design Community College Inc., ISBN**:** 978-1937522319

CO–PO MAPPING

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

Semester: VI					
Artificial Intelligence and Machine Learning					
Course Code	**:**	BCG602	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40L+20P	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**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	Illustrate adversarial search techniques, and Alpha–Beta pruning, used for decision-making in games.
CLO2	Apply classical planning algorithms to solve planning problems.
CLO3	Interpret machine learning concepts and data analysis techniques for understanding different types of data.
CLO4	Analyze Bayesian and reinforcement learning techniques for classification and decision-making.
CLO5	Apply nearest-neighbor and weighted K-nearest-neighbor algorithms for classification.

Module–1	**08Hrs**
Introduction: What is AI? Foundations of Artificial Intelligence. **Beyond Classical Search:** Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions. **Adversarial Search:** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions. **Textbook 1: Ch. 1:** 1.1,1.2, **Ch. 4:** 4.1-4.3,**Ch.5:** 5.1–5.4	
Module–2	**08Hrs**
Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs. **Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multiagent Planning. **Textbook 1: Ch.10**:10.1-10.3, **Ch.11**:11.1-11.4	
Module–3	**08Hrs**
Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to Other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Application. **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. **Textbook 2: Ch.1:**1.1-1.7, **Ch.2:**2.1-2.6	
Module–4	**08Hrs**

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, Multiple Linear Regression, Polynomial Regression, Logistic Regression. **Textbook 2:Ch.4:** 4.1-4.5,**Ch.5:**5.1-5.7

Module–5	**08Hrs**
Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model. **Reinforcement Learning:** Overview of Reinforcement Learning, Scopeof Reinforcement Learning, Components of Reinforcement Learning, Q-Learning. **Textbook 2: Ch.8:**8.1-8.3,**Ch.14:**14.1,14.2,14.4,14.9	

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate adversarial search techniques and Alpha–Beta pruning, used for decision-making in games.
CO2	Apply classical and real-world planning techniques to solve planning problems.
CO3	Describe machine learning concepts and data analysis techniques for understanding different types of data.
CO4	Use nearest-neighbor and weighted K-nearest-neighbor algorithms for classification.
CO5	Demonstrate Bayesian learning and reinforcement learning techniques for classification and decision-making.

Text Books	
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", ChrishtopherM.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/

PRACTICALCOMPONENTOFIPCC

Sl#	**Experiments**
1.	Implement a program to implement a vacuum cleaner agent with basic functions.

2.	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
3.	Develop a program to implement the A* search algorithm.
4.	Develop a program to implement the AO* search algorithm.
5.	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.
6.	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.
7.	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. a. Label the first 50 points {x1,……,x50} as follows: if (xi ≤ 0.5), then xi ∈ Class1, else xi ∈ Class1 b. Classify the remaining points, x51,……,x100 using KNN. Perform this for k=1,2,3,4,5,20,30
8.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
9.	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.
10.	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.

CO–PO MAPPING

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

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 ecosystemdecentralization, 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 bitcoinnetwork, 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, Contractcreation 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.

Text Book	
1	"Mastering Blockchain", Imran BashirThird 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

Semester: VI					
Cloud Computing and Security					
Course Code	**:**	BCG623B	**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	Operating Systems, Computer Networks.
Knowledge on Fundamental Concepts	Process, memory, and storage management Virtual Machine lifecycle.
Knowledge on Connected Tools (If any)	Google Cloud Console.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the foundational concepts, architectures and enabling technologies of distributed and cloud computing.
CLO2	Demonstrate virtualization techniques for efficient resource management in cloud environments.
CLO3	Examine cloud architectures, service models, and public cloud platforms.
CLO4	Assess cloud security risks and trust management techniques for secure cloud computing.
CLO5	Design cloud-based applications using cloud programming models and software environments.

Module – 1	**08Hrs**
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	**08Hrs**
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	**08Hrs**
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	**08Hrs**
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	**08Hrs**
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	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the concepts, architectures and enabling technologies of distributed and cloud computing.
CO2	Apply virtualization techniques for efficient resource management in cloud environments.
CO3	Analyze the architecture, service delivery models, and industrial platforms used in cloud computing applications.
CO4	Evaluate cloud security risks and trust management mechanisms for secure cloud computing.
CO5	Design cloud-based applications using cloud programming models and software environments.

Text Books	
1	Distributed and Cloud Computing, Morgan Kaufmann,Kai Hwang, Geoffrey C Fox, and Jack J Dongarra, Elsevier, 2012,ISBN-13: 978-0123858801
2	Cloud Computing Theory and Practice, Dan C. Marinescu,Morgan Kaufmann, 2nd Edition, Elsevier, 2018, ISBN-13: 978-0128128107

Reference Books	
1	Mastering Cloud Computing,Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, McGrawHill Education, 1st Edition, 2017 ,ISBN-13: 9781259029950
2	Cloud Computing: A Practical Approach, Toby Velte, Anthony Velte, McGraw-Hill Education, 2017, ISBN-13: 9780070683518
3	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud,George Reese, O'Reilly Publication, 1st Edition, 2009ISBN-13: 978-0596156367

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.geeksforgeeks.org/virtualization-cloud-computing-types/
4	https://www.javatpoint.com/cloud-service-provider-companies

CO – PO MAPPING

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

Semester: VI					
Full Stack Development with MERN					
Course Code	**:**	BIS623C	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50Marks
Total Hours	**:**	40L	**SEE**	**:**	50Marks
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	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	**08Hrs**
PartICore Markup: TraditionalHTMLandXHTML,IntroducingHTML5,HTMLElementReference **PartIICoreStyle** IntroductiontoCSS,CSSSyntaxandPropertyReference. **Textbook 1**: **Ch** 1,2,3,4,5	
Module – 2	**08Hrs**
Javascript: BasicsandIntroduction;Gettingstarted;WorkingwitharraysandRegularExpressions; 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	**08Hrs**
MERNStack-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	**08Hrs**
MERNStack-2: ReactState:Initialstateandupdatingstate,Eventhandling,statelesscomponents;ExpressandGraphQL, MongoDB: Express, REST API, Graph QL, MongoDB Basics, MongoDB CRUD Operations. **Textbook 3: Ch** 4,5,6	
Module – 5	**08Hrs**

MERNStack-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 twonumbers 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 functionisPalindrome(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 componentto 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	Intergrate 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 McGraw-HillJanuary 2017, 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

Semester: VI					
Introduction to Human Centered System					
Course Code	**:**	BCG623D	**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, Computer Graphics, Data Structures and Algorithms.
Knowledge on Fundamental Concepts	Basic Programming Concepts, Mathematical Foundations.
Knowledge on Connected Tools (If any)	IDE's, Blender.

Course Learning Objectives: This course will enable the students to	
CLO1	Explain how human interaction, perception, and cognition influence user interactions.
CLO2	Apply Gestalt principles and visual hierarchy to create intuitive user interfaces.
CLO3	Design responsive interfaces that improve efficiency and satisfy user time requirements.
CLO4	Evaluate error prevention and recovery mechanisms to enhance interface usability.
CLO5	Develop user interfaces that support effective problem-solving and decision-making.

Module-1	**08Hrs**
Our Perception is Biased: Perception Biased by Experience, Perception Biased by Current Context,Perception Biased by Goals, Taking Biased Perception into Account When Designing. **Our Vision Is Optimized to See Structure:** Gestalt Principle, Proximity, Similarity, Continuity,Closure, Symmetry, Figure/Ground, Common Fate, Combined. **We Seek and Use Visual Structure:** Structured Information is Easier to Scan, Visual Hierarchy HelpsPeople Find Relevant Information, Beyond Visual Hierarchy, Information Hierarchy, Chunking HelpsPeople Scan and Enter Data, Even More Structure for Input, Data-specific Controls. **Textbook 1:Ch 1, 2, 3**	
Module – 2	**08Hrs**
Our Color Vision is Limited: How Color Vision Works, Vision is Optimized for Detection of Edges,Not Brightness, Discriminability of Colours Depends on How They are Presented, Color Blindness,External Factors that Influence our Ability to Distinguish Colors, Guidelines for using Color. **Our Peripheral Vision is Poor:** Resolution of the Fovea Compared with the Periphery, is the VisualPeriphery Good for Anything, examples from Computer User Interfaces, Common Methods of Making Messages Visible, Heavy Artillery for Making Users Notice Messages, Visual Search is LinearUnless Targets Pop in the Periphery. **Reading is Unnatural:** Is Reading FeatureDriven or ContextDriven, Poor Information Design Can Disrupt Reading, People Don't Read When Using Software and the Web,They Scan, much of the textin Apps and Websites is Unnecessary.	

Textbook 1:Ch 4, 5, 6

Module –3	**08Hrs**

Our Attention is Limited, Our Memory is Imperfect: A Modern View of Memory, Characteristics of Attentionand Working Memory, Implications of Working Memory Characteristics for User-InterfaceDesign, Characteristics of Long-Term Memory, Implications of Long-Term Memory Characteristics forUser-Interface Design.

Limits on Attention Shape Our Thought and Action - We Notice Things More When They areRelated to our Goals, We Use External Aids to Keep Track of What We Are Doing, We Follow the Information Scent Toward Our Goal, We Prefer Familiar Paths, Our Thought Cycle, Goal, Execute,Evaluate, After We Achieve a Task's Primary Goal, we often Forget Cleanup Steps.

Recognition is Easy Recall is Hard: Recognition Versus Recall, Implications for UserInterfaceDesign.

Textbook 1: **Ch** 7, 8, 9

Module –4	**08Hrs**

Learning from Experience and Performing Learned Actions are Easy Novel Actions, ProblemSolving, and Calculation are Hard: Learning from Experience Is Easy, Performing LearnedActions is Easy, Performing Novel Actions is Hard, Problem Solving and Calculation are Hard,Implications for User-Interface Design.

Many Factors Affect Learning: We Learn Faster When Practice is Frequent, Regular, And Precise, WeLearn Faster When Operation is Task Focused, Simple, Consistent and Predictable, We Learn FasterWhen Vocabulary is Task Focused, Familiar and Consistent.

Our Hand–Eye Coordination Follows Laws: Pointing at Displayed Targets, Steering Law:Moving Pointers Along Constrained Paths.

Textbook 1:Ch 10, 11, 13

Module –5	**08Hrs**

We Have Time Requirements: Responsiveness Defined, The Many Time Constants of The HumanBrain, Engineering Approximations of Time Constants, Orders of Magnitude, Designing to Meet Real-Time Human Interaction Deadlines, Additional Guidelines for Achieving Responsive InteractiveSystems.

We Make Errors: Mistakes Versus Slips, Types of Slips, Design to Prevent Mistakes, Provide Clear, Correct Information, Design to Help People Avoid Slips, Design to Help People Recover from Errors, Voice-Recognition Failure and Misrecognition are Not User Errors.

Textbook 1: **Ch** 14, 15

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the principles of perceptual biases, Gestalt laws, and information hierarchy in the design of user interfaces.
CO2	Analyzethe role of attention, memory, recognition, and recall in enhancing user interaction.
CO3	Apply visual perception principles to develop effective and user-friendly interfaces.
CO4	Design interactive user interfaces incorporating learning and hand–eye coordination principles for enhanced usability.
CO5	Evaluate responsive and error-tolerant user interfaces by incorporating human performance requirements.

Text Books	
1	Designing with the Mind in Mind - Simple Guide to Understanding User Interface Design Guidelines, Jeff Johnson, 3rd Edition, 2020, Morgan Kaufmann Publishers, ISBN:0128182024.

Reference Books

1	Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability, Steve Krug,3rd Edition,2013, Pearson Education, ISBN: 9780321965516.
2	The Design of Everyday Things, Don Norman, Revised and Expanded Edition, 2013, Basic Books,ISBN: 978-0-465-05065-9.

Web links and Video Lectures (e – Resources)	
1	https://viva.pressbooks.pub/introegrdesign/chapter/introduction/
2	https://www.designkit.org/resources/1.html
3	https://www.interaction-design.org/master-classes/how-to-design-with-the-mind-in-mind

CO – PO MAPPING

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

Semester: VI					
Game Design					
Course Code	**:**	BCG624A	**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	Computer Graphics, Data Structures and Algorithms,
Knowledge on Fundamental Concepts	Basic Programming Concepts, Algorithms, Fundamentals of Computer Graphics, Mathematical Foundations, Analytical and Logical Thinking Skills
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand fundamental concepts and components involved in game design and development.
CLO2	Explore the structure of game worlds and storytelling techniques used in modern games.
CLO3	Learn foundational Artificial Intelligence (AI) concepts and techniques such as path finding and decision-making in games
CLO4	movement behaviors using kinematic and steering algorithms in 2D and 3D game environments.
CLO5	Gain the Knowledge of AI behavior for different genres of games including board, shooting, sports, and real-time strategy games.

Module – 1	**08Hrs**
Games and Video Games: What Is a Game?, Conventional Games Versus Video Games, Games for Entertainment, Serious Games. **Designing and Developing Games:** An Approach to the Task, Key Components of Video Games, The Structure of a Video Game, Stages of the Design Process, Game Design Team Roles, Game Design Documents, The Anatomy of a Game Designer. **The Major Genres:** What Is a Genre?, The Classic Game Genres. **Text Book 1: Ch** 1, 2, 3	
Module – 2	**08Hrs**
Game Concepts: Getting an Idea, From Idea to Game Concept. **Game Worlds:** What Is a Game World?, The Purposes of a Game World, The Dimensions of a Game World**.** **Character Development:** The Goals of Character Design, The Relationship Between Player and Avatar, Visual Appearances, Character Depth. **Storytelling:** Why Put Stories in Games? The Storytelling Engine, Linear Stories, Nonlinear Stories, Mechanisms for Advancing the Plot, Emotional Limits of Interactive Stories, Scripted Conversations and Dialogue Trees, When to Write the Story. **Text Book 1: Ch** 7, 8, 10, 11	
Module – 3	**08Hrs**
Introduction to game AI: what is AI?, Game AI, My model of game AI, algorithms, data	

structures, and Representations. **GameAI**: The complexity fallacy, the kind of AI In games, speed and memory, the AI engine,**Pathfinding**: The Pathfinding graph, Dijkstra's, A*. **Decisionmaking**: Overview of decision making, Decision Trees, State Machines. **Text Book 2: Ch 1:** 1.1-1.3, Ch 2: 2.1-2.4, Ch 4: 4.1-4.3, Ch 5: 5.1-5.3

Module – 4	**08Hrs**
Movement: The basics of movement algorithms, Kinematic movement algorithms, Steeringbehaviors ,Combining steering behaviors, Jumping, Movement in the third dimension. **Text Book 2: Ch 3: 3.1-3.3, 3.6, 3.9**	

Module – 5	**08Hrs**
BoardGames: Game theory, Transposition tables and memory, Memory-enhanced test algorithms. **DesigningGameAI**: The design, Shooters, Driving, Real-time strategy, Sports, Turn-based strategy games. **Text Book 2: Ch 8: 8.1, 8.3, 8.4, Ch 12: 12.1-12.6**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental principles and genres of game design and development.
CO2	Analyze storytelling techniques and character development in immersive game worlds.
CO3	Apply game AI algorithms for pathfinding and decision trees to simulate intelligent behavior.
CO4	Implement various movement techniques including kinematic and steering behaviors in games.
CO5	Design and evaluate game AI strategies for different game types.

Text Books	
1	Fundamentals of Game Design, Ernest Adams, 3rd Edition, 2015, Pearson Education, ISBN: *9332540241.*
2	AI for Games, Ian Millington, 3rd Edition, 2019, CRC Press, ISBN: *1138483974.*

Reference Books	
1	Game Design Workshop, A Play centric Approach to Creating Innovative Games, Tracy Fullerton, 4th Edition, 2018, CRC Press, ISBN: 9781138098770.
2	Game Engine Architecture, Jason Gregory, 3rd Edition, 2018, CRC Press, ISBN:*1138035459.*
3	Game Mechanics: Advanced Game Design, Ernest Adams and Joris Dormans, 1stEdition , 2012, New Riders Press, ISBN: 0132946681
4	The Art of Game Design, A Book of Lenses, Jesse Schell, 3rd Edition, 2019, CRC Press, ISBN: *1138632059.*
5	Game Programming in C++: Creating 3D Games, Sanjay Madhav Addison,1st Edition2018, Wesley Professional, ISBN: 0134597206.

Web links and Video Lectures (e – Resources)	
1	https://godotengine.org/

2	https://www.pygame.org
3	https://www.blender.org/
4	https://cs50.harvard.edu/games/
5	https://www.pearson.com/store/p/fundamentals-of-game-design/P100001179962

CO – PO MAPPING

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

Semester: VI					
Natural Language Processing					
Course Code	**:**	BCG624B	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50Marks
Total Hours	**:**	40L	**SEE**	**:**	50Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3Hours

Prerequisites:	
Courses	Theory of Computation, Introduction to AI
Knowledge on Fundamental Concepts	Regular Expressions and Finite Automata, Machine Learning Fundamentals, Basic Linguistics
Knowledge on Connected Tools (Ifany)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamental concepts, linguistic theories, language models and applications of Natural Language Processing.
CLO2	Utilizecomputational techniques to perform lexical, morphological and syntactic analysis of natural language.
CLO3	Implement machine learning algorithms for text classification, sentiment analysis and language modeling.
CLO4	Designinformation retrieval systems and utilize lexical resources for effective NLP applications.
CLO5	Examinemachine translation techniques using neural architectures and evaluate translation systems considering ethical aspects.

Module–1	**08Hrs**
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	**08Hrs**
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	**08Hrs**
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. **Text Book 2: Ch 4**	

Module–4	08Hrs
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	**08Hrs**
Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues. **Text Book 2: Ch 13**	

Course Outcomes: After completing the course ,the students will be able to	
CO1	Understand the fundamentals of Natural Language Processing, language models and linguistic concepts for NLP applications.
CO2	Apply lexical, morphological and syntactic analysis techniques using computational methods.
CO3	Analyze Naive Bayes models for text classification, sentiment analysis and language modeling.
CO4	Develop information retrieval models using lexical resources for NLP applications.
CO5	Evaluate neural machine translation systems based on encoder-decoder architectures and ethical considerations.

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.

Reference Books	
1	Natural Language Processing Recipes - UnlockingText Data with Machine Learning and Deep Learning using Python, Akshay Kulkarni, Adarsha Shivananda,Apress, 2019, ISBN: 9781484242674
2	Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives, T V Geetha, Pearson, 2024, ISBN: 9788119896004

Web links and Video Lectures(e–Resources)	
1	https://onlinecourses.nptel.ac.in/noc23_cs45/preview

CO–POMAPPING

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

Semester: VI					
Agentic AI and Applications					
Course Code	**:**	BIS624C	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50Marks
Total Hours	**:**	40hrs	**SEE**	**:**	50Marks
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	**08Hrs**
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	**08Hrs**
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	**08Hrs**
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	**08Hrs**
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	**08Hrs**
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 Book	
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	

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	**8Hrs**
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	**8Hrs**
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	**8Hrs**
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	**8Hrs**

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	**8Hrs**

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

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

Prerequisites:	
Courses	Introduction to CProgramming
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	Implementsinglylinkedlistsforbasicoperationsandstack/queuestructures.
CLO4	Analyze and construct expression trees for arithmetic expressions.
CLO5	Apply basic sorting and searching algorithms to organize and retrieve datae fficiently.

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. **Textbook1:Ch.1:**1.2,**Ch. 2:**2.1-2.5,2.6-2.9	
Module–2	**08Hrs**
Stacks: Introduction, Stack Operations, Stack Implementation usingArrays, Applications of Stacks, Infix to postfix conversion, Postfix expression evaluation. **Queues:** Introduction, Queue Operations, Queue Implementation usingArrays, Applications of Queues. **Textbook1**:**Ch.3:**3.1-3.5,3.6-3.8,**Ch.4:**4.1-4.5	
Module–3	**08Hrs**
LinkedLists: Introduction,SinglyLinkedList,OperationsonSinglyLinkedLists: Insert-Delete-Display,ImplementationofStacksandQueuesusingLinkedList. **Textbook1**:**Ch.5:**5.1-5.4,5.5-5.6	
Module–4	**08Hrs**
Trees Introduction,BasicConcepts,RepresentationofBinaryTrees, OperationsonBinaryTrees:Insertion-Traversals-Searching-	

CopyingaTree,BinarySearchTrees, OperationsonBinarySearchTrees:Insertion-Searching-FindMaximumandMinimum Value-CountNodes,ExpressionTrees. **Textbook1**:**Ch.6:**6.1-6.7,6.8-6.9,6.10

Module–5	**08Hrs**

Sorting: Introduction,BubbleSort,SelectionSort,andInsertionSort.
Searching: Introduction,LinearSearch,BinarySearch.

Textbook1:**Ch.7:**7.1-7.4,**Ch.8:**8.1-8.3

CourseOutcomes:Aftercompletingthecourse,thestudentswillbeableto	
CO1	Illustratethe concept of linear and nonlineardata structures.
CO2	Implementstackandqueueconceptseffectivelytosolveproblems.
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	Applybasicsortingandsearchingtechniquestoorganizeandretrievedataefficiently.

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

Reference Books	
1	"An Introduction to Data Structures with Applications", Jean-PaulTremblay&PaulG.Sorenson,McGrawHill,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-PSO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1								1	3	2
CO2	3	3	2	2	1						1	3	2
CO3	3	3	3	2	1						1	2	3
CO4	2	3	3	2	1						1	3	2
CO5	2	3	3	2	1						1	3	3

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

Text Book	
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", AkshayKulkarni, 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 – PSO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	1	1								1	2	2
CO2	3	1	1								1	3	2
CO3	3	3	1								1	3	3
CO4	3	3	1		1						1	3	2
CO5	3	3	2		1						1	2	3

Semester: VI					
Mobile Application Development					
Course Code	**:**	BIS645C	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50Marks
Total Hours	**:**	40L	**SEE**	**:**	50Marks
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	**08Hrs**
Get started: Build your first app, Activities, Testing, debugging and using support libraries **TextBook1: Ch. 1:** 1.1 - 1.4, **Ch. 2:** 2.1 **- 2.3, Ch. 3:**3.1-3.3.	
Module – 2	**08Hrs**
User experience: User Interaction, Delightful user experience, Testing your UI **TextBook1: Ch. 4:** 4.1 - 4.4**, Ch. 5:** 5.1 – 5.3**, Ch. 6:**6.1**.**	
Module – 3	**08Hrs**
Working in the background: Background Tasks, Triggering, scheduling and optimizing background tasks **TextBook1: Ch. 7:** 7.1 - 7.4, **Ch. 8:** 8.1 – 8.3.	
Module – 4	**08Hrs**
All about Data: Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders **TextBook1: Ch. 9:** 9.0 - 9.2, **Ch. 10:** 10.0 – 10.1, **Ch. 11:** 11.1, **Ch. 12:** 12.1.	
Module – 5	**08Hrs**
Permissions, Performance and Security, Firebase and AdMob, Publish **TextBook1: 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 Book	
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

Semester: VI					
Introduction to Artificial Intelligence					
Course Code	**:**	BCI645D	**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50Marks
Total Hours	**:**	40L	**SEE**	**:**	50Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	03Hours

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	**08Hrs.**
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. **Textbook1: Ch 1:** 1.1–1.5, **Ch 2:** 2.1–2.4, **Ch3:** 3.1–3.4	
Module–2	**08Hrs.**
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	**08Hrs.**
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	**08Hrs.**
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: Ch1:** 1.1–1.5, **Ch 2:** 2.2–2.7, **Ch 3:** 3.2, 3.3, 3.5, 3.6	
Module–5	**08Hrs.**
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, **Ch9:** 9.4–9.6	

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.

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.

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–POMAPPING

	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

Semester: VI					
Major Project Phase – I					
Course Code	**:**	BCG636	**Credits**	**:**	2
Hours/Week(L:T:P)	**:**	0:0:4	**CIE**	**:**	100
Total Hours	**:**	12	**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, Codeblocks, Visual Studio

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze a real-world problem to define a clear problem statement, project scope, and objectives.
CO2	Evaluate relevant literature, existing research, and technologies to identify suitable approaches for the proposed project.
CO3	Formulate an appropriate project proposal by integrating the problem statement, objectives, literature survey, and proposed methodology.
CO4	Prepare and deliver technical presentations and project documentation using appropriate engineering communication practices.
CO5	Demonstrate teamwork, professional ethics, and self-directed learning during project planning and proposal development.

PROJECT WORK (BCS636): 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	3	2	2	1			1	1	1	1
CO2	3	3	2	3	2			1	1	1	3
CO3	2	2	3	2	2			1	2	3	2
CO4	1	1	1	1	1			1	2	3	2
CO5	1	1				1	1	3	3	2	3

Semester: VI					
UI/UX Lab					
Course Code	**:**	BCGL607	**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	50Marks
Total Hours	**:**	15P	**SEE**	**:**	50Marks
Course Type	**:**	PCCL	**SEE Duration**	**:**	3Hours

Prerequisites:	
Courses	Innovation and Design Thinking.
Knowledge on Fundamental Concepts	Design thinking process.
Knowledge on Connected Tools(If any)	Canva, Adobe Photoshop

Course Learning Objectives: This course will enable the students to	
CLO1	UnderstandfundamentalUI/UXdesignprinciplessuchasusability,accessibility,andvisualhierarchy.
CLO2	Analyzedifferentinterfacesolutionsforeffectiveness,aesthetics,andusersatisfaction.
CLO3	Createlow-fidelitywireframes(hand-drawnordigital)forvarioustypesofwebandmobileapplications
CLO4	Design high-fidelity user interfaces using industry-standard tools such as Figma or Adobe XD.
CLO5	Buildinteractiveprototypesthatsimulateuserflowsandinteractionsforreal-timeusabilityevaluation.

Sl.NO	**Experiments**
NOTE:Wireframescanbehand-drawnandrecordedbythestudents.Designingand Prototyping can be done using Figma.	
1	ChatAppRedesign:CreateaWireframeandredesign any popularchat app.
2	FoodApp:CreateaWireframe,DesignandPrototypetheUIPagesforthefoodapplication.
3	RatingandReviewUI:CreateaWireframe,Designandprototypethepageswith a 5-star rating UI, User comments with profile image and timestamp, Submit review form.
4	SocialMediaApp:DesignandPrototypesocialmediaphotosharing app.
5	ProductWebsite:DesignandPrototypeaproductwebsitepage.Createwebpagesand rollovers for the web pages
6	Travel Agency Website: Design and Prototype the UI for the website including design for HomePagewithsearchbar,Activitiespage,ClientTestimonialPage,ImageGallery
7	UI/UXDesignerPortfolio:DesignandPrototypeaUIforaportfolioincludingdesignfor About page, Work showcase page, Blog page, contact page
8	DashboardDesign:DesignandPrototypeDashboardUIpage,addsomeDashboard details, statistics and graphs, Add dropdown options for some dashboard details

9	E-Commerce Website: Design and Prototype Web pages including product category pages (example: mobiles, gaming consoles, Speakers), product pages in each category, buynow page, add to cart page
10	EducationalWebsite:DesignandPrototypetheUIforaneducationalwebsite – Include aHomepagewithfooter,AboutUsPage,Programspage,Instructorspage,Pricing page, Payments page with radial buttons. Design dropdowns for programs button
11	Quizinterface:DesignandPrototypeauser-friendlyquizUI by adding Quiz Detail screen and Quiz attempt screen and Dashboard.
12	Music Player App: Design and Prototype the pages with a background and a Rollover button, and Song Selection Page with a Home Rollover button. The third page may include animated play and pause button, play music animation, timer animation.

CourseOutcomes:Aftercompletingthecourse,thestudentswillbeable to	
CO1	Understand fundamentalUI/UXprinciplestodesignuser-friendlyandaccessibleinterfaces.
CO2	Analyzeuserrequirementsandtranslatethemtodesignprototypes.
CO3	Create wireframes for various types of web and mobile applications.
CO4	DemonstratetheUI/UXconceptsappliedwhendesigningtheprototypeofappsandWebsites.
CO5	Redesign the existing apps & websites with customized design

TextBook	
1	The UX Book: Agile UX Design for a Quality User Experience, Rex Hartson, Pardha S. Pyla, 2nd edition, 2018, Morgan Kaufmann, ISBN-13: 978-0128053423

WeblinksandVideoLectures(e–Resources)	
1	https://www.figma.com/education/
2	https://www.udemy.com/course/learn-figma-web-design
3	https://www.udemy.com/course/figma-2023-master-class-realtime-uiux-web-projects

CO-PO Mapping

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

Semester: VI					
Competency Enhancement Course-4					
Course Code	**:**	BCE608	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:2:0	**CIE**	**:**	100Marks
Total Hours	**:**	40Hrs	**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	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	**8Hrs**
Data Structures Overview of Data Structures, Searching and Sorting Algorithms, Stack, Queue, Linked, List, Trees, Graphs **Textbook-1: Ch1.**15	
Module – 2	**8Hrs**
Algorithms Analysis of Algorithms, Pattern Matching, Bit Algorithms, Mathematical Algorithms, Randomized Algorithms, Dynamic Programming, Backtracking Algorithms, Greedy Algorithms, Sliding Window Approach **Textbook-2: Ch8.**3	
Module-3	**8Hrs**
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. Ritchie2nd Edition, Pearson Education India – 2015, (ISBN-978-9332549449)
2	**Let Us C,** YashavantKanetkar, 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					

Semester: VI					
Indian Knowledge System **Stream: CSE/ECE/ME/CV**					
Course Code	**:**	BIK609	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	1:0:0	**CIE**	**:**	100 Marks
Total Hours	**:**	15	**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	**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	**5Hrs**
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	**5Hrs**
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

Semester: VI					
National Service Scheme **Stream: CSE/ECE/ME/CV**					
Course Code	**:**	BNS610	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	100Marks
Total Hours	**:**	24	**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 tothe 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 and social harmony events /workshops /seminars. (Minimum 02 programs).	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
3	Govt. school Rejuvenati	May be individual or team	Villages/ City Areas / Grama panchayat/ public	Place selection/proper	Report should be submitted by individual to the	Evaluation as per the rubrics Of

	on and helping them to achieve good infrastructure.		associations/Government Schemes officers/ campus etc.	consultation/ Continuous monitoring / Information board	concerned evaluation authority	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.

CourseOutcomes:Aftercompletingthe course,thestudentswillbe ableto	
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 Matrix

COs	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

Semester: VI						
Physical Education (PE) (Sports & Athletics) **Stream: CSE/ECE/ME/CV**						
Course Code	**:**	BPE610		**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	100 Marks
Total Hours	**:**	24		**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	**4Hrs**
Orientation 1. Postural deformities. **2.** Stress management	
Module – 2	**16Hrs**
Specific games (Any one to be selected by the student) 1. Throw ball 2. Table Tennis 3. Athletics (Field Events- Jumps) – Any event as per availability of Ground.	
Module-3	**4Hours**
Aerobics	

CourseOutcomes:Aftercompletingthe course,thestudentswillbe ableto	
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

SchemeandAssessmentforauditingthecourseandGrades:

Sl.No.	**Activity**	**Marks**
1.	Participationofstudentinallthemodules	20
2.	Quizzes–2,eachof15marks	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		

Semester: VI					
Yoga **Stream: CSE/ECE/ME/CV**					
Course Code		BYO610	**Credits**	**:**	0
Hours/Week(L:T:P:S)	**:**	0:0:2	**CIE**	**:**	100Marks
Total Hours	**:**	15 Hrs	**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	

CourseOutcomes:Aftercompletingthe course,thestudentswillbe ableto	
CO1	Describethe 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	Applyyogic principles to promote physical and mental well-being.

Text Books	
1.	**Light on Yoga** by BKS Iyengar, Thorsons Publishers, ISBN-10 : 8172235011
2.	**Teaching Methods for Yogic practices** by Dr. M L Gharote & Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245
3.	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

Semester: III-VI					
Music **Stream: CSE/ECE/CV/ME**					
Course Code	**:**	BMU310/410/509/610	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	**100Marks**
Total Hours	**:**	26	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Objectives: This course will enable the students to	
1	Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
2	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.
3	Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
4	Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.
5	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 **Textbook1, 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. **Textbook2 – Ch. 4-7**	
Module –III	**03 Hrs**
Composers Biography and contributions of Purandaradasa, Thyagaraja, Mysoroasudevacharya, Kanakadasa **Textbook3 – 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. **Textbook1,V-4 – Ch. 2-6**	
Module –V	**14 Hrs**
Abhyasa Gana Singing the swara exercises (Sarale Varase Only), Botatio writing for saralevarase and sulafisapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathiswara, oekrithi in a mela raga **Textbook1,V-1&2**	

Course Outcomes: After completing the course, the students will be ablet o

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, MunshiramManoharlal 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

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

Building up-skilled Computer Professionals, enriched with interactive design skills as to serve the dynamic needs of the Industry and Society.

DEPARTMENT MISSION

- Develop Innovative, Proficient and ethically strong Computer Design Engineers with design skills to meet Universal Challenges.
- Nurture competence as well as Applied Research activities to solve concrete problems.
- . Aspire for constant up-gradation of engineering skills to cater the needs of the Corporate and Society.
- Imbibing the spirit of teamwork, core skills, professionalism and confidence to take the Leadership role.
- Inculcate Research culture to design and develop smart computing solutions for Humanity and Nation.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institute under VTU from 2024-25

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