DAYANANDA SAGAR ACADEMY OF TECHNOLOGY & MANAGEMENT

CURRICULUM

Scheme and Syllabus

Outcome Based Education

(Academic Year 2025-2026)

Department of Computer Science and Engineering

5th and 6th Semester B.E

ABOUT THE INSTITUTE

Dayananda Sagar Academy of Technology and Management- DSATM was established in 2011 with 5 UG Programmes and 1 PG Program, the programmes are approved by All India Council for Technical Education (AICTE) New Delhi, Affiliated to Visvesvaraya Technological University (VTU), Belagavi and DSATM is an autonomous institute from 2023-2024.

The Dayananda Sagar Institutions is one of pioneer institutions in India and abroad with six decades of excellence in Academic and Research. The newer campuses were necessary to accommodate the growing need of the technology and innovation.

DSATM nurtures the students in academic, research, sports, cultural and extracurricular activities.

- Creating an academic environment to nurture and develop competent entrepreneurs, leaders and professionals who are socially sensitive and environmentally conscious.
- Integration of Outcome Based Education and cognitive teaching and learning strategies to enhance learning effectiveness.
- Developing necessary infrastructure to cater to the changing needs of Business and Society.
- Optimum utilization of the infrastructure and resources to achieve excellence in all areas of relevance.
- Adopting learning beyond curriculum through outbound activities and creative assignments.
- Imparting contemporary and emerging techno-managerial skills to keep pace with the changing global trends.
- Facilitating greater Industry-Institute Interaction for skill development and employability enhancement.
- Establishing systems and processes to facilitate research, innovation and entrepreneurship for holistic development of students.
- Implementation of Quality Assurance System in all Institutional processes.

VISION OF THE INSTITUTE

To strive at creating the institution a centre of highest calibre of learning, so as to create an overall intellectual atmosphere with each deriving strength from the other to be the best of engineers, scientists with management & design skills.

MISSION OF THE INSTITUTE

- To serve its region, state, the nation and globally by preparing students to make meaningful contributions in an increasing complex global society challenge.
- To encourage, reflection on and evaluation of emerging needs and priorities with state-of-the-art infrastructure at institution.
- To support research and services establishing enhancements in technical, economic, human and cultural development.
- To establish interdisciplinary centre of excellence, supporting/ promoting student's implementation.
- To increase the number of Doctorate holders to promote research culture on campus.
- To establish IIPC, IPR, EDC, innovation cells with functional MOU's supporting student's quality growth**.**

QUALITY POLICY

Dayananda Sagar Academy of Technology and Management aims at achieving academic excellence through continuous improvement in all spheres of Technical and Management education. In pursuit of excellence cutting – edge and contemporary skills are imparted to the utmost satisfaction of the students and the concerned stakeholders.

ABOUT THE DEPARTMENT

Computer Science Engineering (CSE) is an Engineering discipline that encompasses a variety of topics related to Computation, Algorithms, Programming Languages, Program Design, Computer Hardware, Computer Software, Operating System, Networking, Machine Learning, Computer Graphics, Computer Vision , Internet of Things, Big Data etc. The CSE Department is committed for creating a community of students that reflects the diversity of the world we live in, contributing to educational excellence and a dynamic campus environment. Our goal is not only to teach students, how to use current computer applications, but rather to educate them so that they understand how these applications work and can design and build the computer applications of the future.

VISION OF THE DEPARTMENT

Epitomize CSE graduate to carve a niche globally in the field of computer science to excel in the world of information technology and automation by imparting knowledge to sustain skills for the changing trends in the society and industry.

MISSION OF THE DEPARTMENT

M1: To educate students to become excellent engineers in a confident and creative environment through world-class pedagogy.

M2: Enhancing the knowledge in the changing technology trends by giving hands-on experience through continuous education and by making them to organize & participate in various events.

M3: Impart skills in the field of IT and its related areas with a focus on developing the required competencies and virtues to meet the industry expectations.

M4: Ensure quality research and innovations to fulfill industry, government & social needs.

M5: Impart entrepreneurship and consultancy skills to students to develop self-sustaining life skills in multi-disciplinary areas.

PROGRAM EDUCATION OBJECTIVES (PEO'S):

PEO1: Engage in professional practice to promote the development of innovative systems and optimized solutions for Computer Science and Engineering.

PEO2: Adapt to different roles and responsibilities in interdisciplinary working environment by respecting professionalism and ethical practices within organization and society at national and international level.

PEO3: Graduates will engage in life-long learning and professional development to acclimate the rapidly changing work environment and develop entrepreneurship skills

PROGRAM OUTCOMES (PO's)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: **Foundation of Mathematical Concepts:** Ability to use mathematical methodologies to solve the problem using suitable mathematical analysis, data structure and suitable algorithm.

PSO2: **Foundation of Computer System:** Ability to interpret the fundamental concepts and methodology of computer systems. Students can understand the functionality of hardware and software aspects of computer systems.

PSO3: **Foundations of Software Development:** Ability to grasp the software development lifecycle and methodologies of software systems. Possess competent skills and knowledge of software design process. Familiarity and practical proficiency with a broad area of programming concepts and provide new ideas and innovations towards research.

PSO4: **Foundations of Multi-Disciplinary Work:** Ability to acquire leadership skills to perform professional activities with social responsibilities, through excellent flexibility to function in multi-disciplinary work environment with self-learning skills.

PROPOSED UG CREDIT STRUCTURE IN ALIGNMENT WITH VTU

Sl. No	Semester	No. of Credits
1	1st Semester	20
2	2nd Semester	20
3	3rd Semester	21
4	4th Semester	21
5	5th Semester	22
6	6th Semester	22
7	7th Semester	20
8	8th Semester	14
	Total	**160**

PROPOSED UG SCHEME

Sl. No	Course Category	BOS	TD	Teaching Hours/Week					Credits
				Lecture	Tutorial	Practical	Project	Total (Hrs/week)	
				L	T	P	S		
1	BSC	MAT	MAT	3	0	0	0	3	3
2	IPCC-1	CSE	CSE	3	0	2	0	5	4
3	IPCC-2	CSE	CSE	3	0	2	0	5	4
4	PCC-1	CSE	CSE	3	0	0	0	3	3
5	PCC-2	CSE	CSE	3	0	0	0	3	3
6	PBL	CSE	CSE	0	0	2	2	4	2
7	AEC	CSE	CSE	0	0	2	0	2	1
8	SCR	CSE	CSE	0	0	2	0	2	1
9	NCMC	NSS / YOGA / PED							
10	AICTE Activity Points								
								Total	**21**

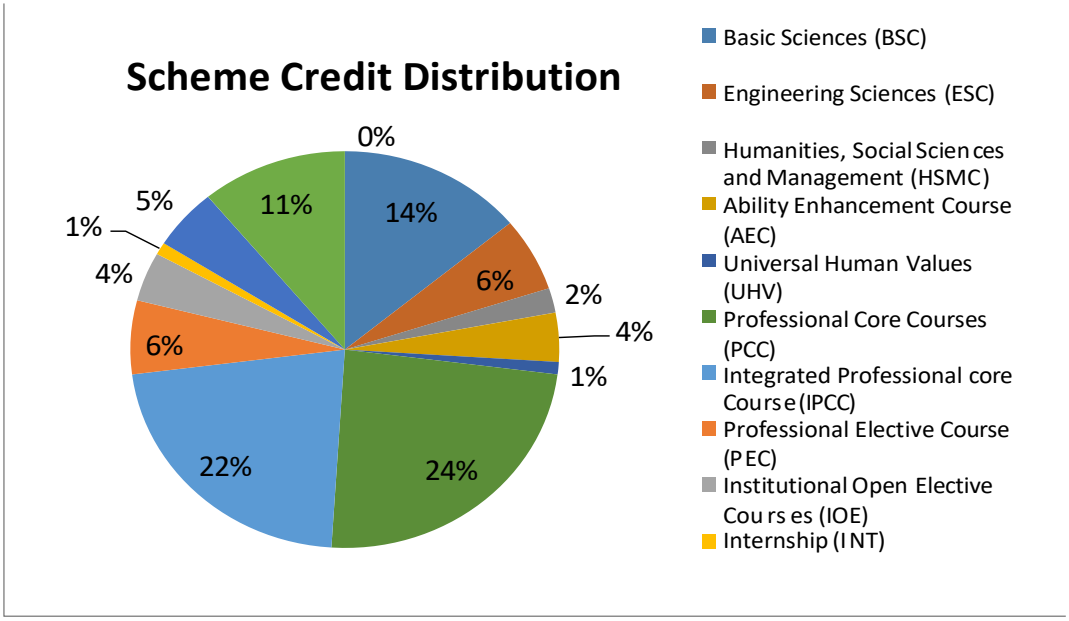
Percentage of Mapping– Theory & Practical - Scheme & Syllabus-

Sl. No	Course Category	Component			
		Theory	Practical	Outreach	YOGA/SPORTS
1	BSC	100%	--	--	--
2	IPCC-1	60%	40%	--	--
3	IPCC-2	60%	40%	--	--
4	PCC-1	100%	--	--	--
5	PCC-2	100%	--	--	--
6	PBL	--	100%	--	--
7	AEC	--	100%	--	--
8	SCR	--	--	100%	--
9	NCMC	--	--	--	100%

Scheme Distribution

Department of Computer Science & Engineering

Course Component	Credits	%of Credits
Basic Sciences (BSC)	22	14
Engineering Sciences (ESC)	9	6
Humanities, Social Sciences and Management (HSMC)	3	2
Ability Enhancement Course (AEC)	7	4
Universal Human Values (UHV)	2	1
Professional Core Courses (PCC)	39	24
Integrated Professional core Course (IPCC)	36	22
Professional Elective Course (PEC)	9	6
Institutional Open Elective Courses (IOE)	6	4
Internship (INT)	1	1
Project based Learning / Mini Project	8	5
Project Work (PW)	18	11
Non-credit Mandatory Courses (NCMC)	0	0
Total Credits	**160**	**100**



SEMESTER WISE CREDIT BREAKDOWN FOR B.E. DEGREE CURRICULUM

BATCH 2023-2027

Course Category	Semester								Total Credits
	1st	2nd	3rd	4th	5th	6th	7th	8th	
Basic Sciences (BSC)	8	8	3	3	0	0	0	0	**22**
Engineering Sciences (ESC)	3	6	0	0	0	0	0	0	**9**
Humanities, Social Sciences and Management (HSMC)	1	2	0	0	0	0	0	0	**3**
Ability Enhancement Course (AEC)	2	1	1	1	0	0	0	2	**7**
Universal Human Values (UHV)	0	0	1	1	0	0	0	0	**2**
Professional Core Courses (PCC)	6	3	6	6	6	6	6	0	**39**
Integrated Professional core Course (IPCC)	0	0	8	8	8	8	4	0	**36**
Professional Elective Course (PEC)	0	0	0	0	6	3	0	0	**9**
Institutional Open Elective Courses (IOE)	0	0	0	0	0	3	3	0	**6**
Internship (INT)	0	0	0	0	0	0	1	0	**1**
Project based Learning / mini-Project	0	0	2	2	2	2	0	0	**8**
Project Work (PW)	0	0	0	0	0	0	6	12	**18**
Non-credit Mandatory Courses (NCMC)	0	0	0	0	0	0	0	0	**0**
Total Credits	**20**	**20**	**21**	**21**	**22**	**22**	**20**	**14**	**160**

Scheme of Teaching and Examinations – 2025-26
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from 2024-25)

Scheme of Teaching and Examinations – 2025-26
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from 2024-25)

5thSEMESTER: Computer Science & Engineering (CSE)

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S						
1	BCS501	Fundamentals of Computer Graphics	IPCC1	CSE	CSE	3	-	2	-	5	4	3	50	50	100
2	BCS502	Machine Learning	IPCC2	CSE	CSE	3	-	2	-	5	4	3	50	50	100
3	BCS503	Theory of Computation and Compiler Design	PCC	CSE	CSE	3	-	-	-	3	3	3	50	50	100
4	BCS504X	Professional Elective Course	PEC-1	CSE	CSE	3	-	-	-	3	3	3	50	50	100
5	BCS505	Mobile Application Development	PBL	CSE	CSE	-	2	-	4	6	3	3	50	50	100
6	BCSL506	Next Generation Embedded Laboratory	PCCL	CSE	CSE	-	-	2	2	4	2	2	50	50	100
7	BRM507X	Ability Enhancement Course	AEC	CSE	CSE	1	-	-	-	1	1	2	50	50	100
8	BESK508	Environmental Studies and E-waste management	HSMS	HSMS	HSMS	2	-	-	-	2	2	2	50	50	100
9	BNSK509 BPEK509 BYOK509	National Service Scheme -NSS Physical Education -PE YOGA	NCMC	CSE	CSE	-	-	2	-	2	0	-	100	-	100
** AICTE Activity points mandatory to be covered				Total		15	2	8	6	31	22	21	500	400	900

6thSEMESTER: Computer Science & Engineering (CSE)

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S						
1	BCS601	Cloud Computing	IPCC 1	CSE	CSE	3	-	2	-	5	4	3	50	50	100
2	BCS602	Software Engineering, Design Patterns and Project Management	IPCC 2	CSE	CSE	3	-	2	-	5	4	3	50	50	100
3	BCS603	Artificial Intelligence	PCC	CSE	CSE	3	-	-	-	3	3	3	50	50	100
4	BCS604X	Professional Elective Course	PEC -2	CSE	CSE	3	-	-	-	3	3	3	50	50	100
5	BXX605X	Course Open Elective Course	OEC-1	CSE	CSE	3	-	-	-	3	3	3	50	50	100
6	BCS606	Project Work phase – 1	PWP-1	CSE	CSE	-	-	-	4	4	2	3	100	-	100
7	BCSL607	Generative AI	PCCL	CSE	CSE	-	2	2	-	4	2	2	50	50	100
8	BCS608X	Ability Enhancement Course	AEC	CSE	CSE	-	-	2	-	1	1	2	50	50	100
9	BNSK609 BPEK609 BYOK609	National Service Scheme -NSS Physical Education -PE YOGA		CSE	CSE	-	-	2	-	2	0	-	100	-	100
** AICTE Activity points mandatory				Total		15	2	10	4	30	22	22	550	350	900

5th Sem Professional Elective Course

1. NoSQL- BCS515A	2. Cryptography and Network Security - BCS515B
3. Data Warehousing - BCS515C	4. Distributed Systems - BCS515D

5th Sem Ability Enhancement Course

1. Research Methodology and IPR - BRM507A	2. UI/UX - BCS507B

6th Sem Professional Elective Course

1. Blockchain Technology - BCS604A	2. **Bigdata Analytics - BCS604B**
3. Advanced Java - BCS604C	4. Time Series Analysis - BCS604D

6th Sem Open Elective Course

1. Occupational Safety & Health Engineering – BCV605D	2. Renewable Energy Plant- BME605B	3. Basic VLSI Design- BEC605B
Open Elective offered from CSE – AI in Project Management – BCS605A		

6th Sem Ability Enhancement Course

1. **Devops - BCS608A**	2. Tosca – Automated Software Testing - BCS608B

Semester	:	**5th**				
Course Title	:	**Fundamentals of Computer Graphics**				
Course Code	:	**BCS501**				
Course Type (Theory/ Practical/ Integrated)	:	**Integrated**				
Category	:	**IPCC**				
Stream	:	**CSE**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:2:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 + 20 Hours**		**SEE Duration**	:	**3 Hours**
Credits	:	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Explain the concepts of Computer Graphics and Visualization.
2	Illustrate the concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.
3	Demonstrate the Geometric transformations, viewing on both 2D and 3D objects.
4	Design and Implement algorithms for 2D/3D graphics primitives and attributes.
5	Infer suitable hardware and software for developing graphics packages using suitable software

Teaching-Learning Process
Pedagogical Initiatives:
Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Overview: Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms- DDA and Bresenham's Algorithm, Circle generation algorithms (Bresenham's).	8
Pedagogy	**Demonstration and Practical Based Learning**	
2	2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformation function, Clipping Algorithms: Cohen-Sutherland 3D Geometric Transformations: Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions, Projections: Perspective and Parallel (Orthographic)	8
Pedagogy	**Demonstration, Presentation and Practical Based Learning**	
3	Color Models: Properties of light, Color models, Standard Primaries and the Chromaticity Diagram, RGB color models, The CMY and CMYK Color Models, The HSV Color Model. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.	8
Pedagogy	**Demonstration, Presentation, Practical Based Learning and collaborative learning**	
4	Interactive Input Methods and Graphical User Interfaces: Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data, Interactive Picture-Construction Techniques, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions, Designing a Graphical User Interface.	8
Pedagogy	**Demonstration, Presentation, Practical Based Learning, collaborative learning and Case Study**	
5	Computer Animation: Raster Methods for Computer Animation, Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Key Frame systems, Motion Specification, Character Animation, Periodic Motions, OpenGL Animation Procedures.	8

	CASE STUDY: Suggested CCA 2 ACTIVITY: Design and animate a simple 3D desk workspace that includes essential objects like a table, laptop, coffee mug, lamp, books, and a chair. The final scene should include basic lighting, materials, camera positioning, and a short camera animation (5–10 seconds) that showcases the scene. (Open source software like Blender can be used)
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications. • **Demonstration:** exhibits the implementation process.

List of Programs:

Sl. No.	Experiments/Programs	COs
1	Implement Brenham's line drawing algorithm for all types of slope	**CO5**
2	Develop a program to demonstrate basic geometric operations on the 2D object	**CO5**
3	Draw a colour cube and spin it using OpenGL transformation matrices	**CO5**
4	Develop a program to clip a lines using Cohen-Sutherland algorithm	**CO5**
5	Develop a program to demonstrate Animation effects on simple objects: Flag, Bouncing Ball or Pendulum	**CO5**
6	Develop a program to plot the basic shapes like square, Star, Circle and Rainbow Benzene using turtle	**CO5**
7	Develop a program to Draw a House Using Turtle	**CO5**
8	Draw a square using OpenGL and animate it to **rotate continuously** around its center using PyOpenGL	**CO5**
Open ended : Mini Project		
	Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project. (During the practical exam: the students should demonstrate and answer Viva-Voce for open ended section) Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.	**CO5**

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011
2	Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition, Pearson Education, 2008
Reference Books	
1	James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education
2	Xiang, Plastock : Computer Graphics , sham's outline series, 2nd edition, TMG.
3	M M Raikar & Shreedhara K S Computer Graphics using OpenGL, Cengage publication
4	Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning
5	Blender Manual: Official documentation for detailed explanations of Blender's features.
6	"Blender for Dummies" by Jason van Gumster – Wiley

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand** and **Explain** the concepts of Computer Graphics, visualization and OpenGL functions.	**U**	**L1/L2**
CO2	**Apply** the concepts of clipping, visible surface detection and Illumination Models in 2D and 3D viewing	**Ap**	**L3**
CO3	**Analyze** the effects of geometric transformations on 2D and 3D objects using mathematical representations and OpenGL functions	**An**	**L4**
CO4	**Evaluate and investigate** hardware, software and tools for computer graphics applications through assignment and case studies	**E**	**L5**
CO5	**Design and implement** algorithms for 2D/3D graphics primitives and attributes using suitable graphics packages using suitable software	**C**	**L6**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	3												1			
CO3		3												1		
CO4				3	2				2	2		1			1	
CO5			3		2				2	2		1				1

Weblinks and Video Lectures (e-Resources)	
1	https://www.geeksforgeeks.org/computer-graphics-2/
2	https://www.tutorialspoint.com/computer_graphics/computer_graphics_basics.htm?
3	https://onlinecourses.nptel.ac.in/noc24_cs82/preview?
4	https://www.youtube.com/watch?v=ICBP-7x7Chc
5	https://renderguide.com/blender-interface-tutorial-for-beginners/

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory				Practical
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)		Practical Test
	IAT-1	IAT-2	CCA-1	CCA-2	
	50 Marks	50 Marks	50 Marks	50 Marks	
Remember		-			
Understand	20	15	10		10
Apply	25	25	20	10	20
Analyse	5	10	10	15	10
Evaluate	-	-	10	10	
Create	-	-		15	10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	5	5	5	5	5	35	35%
CO2	10	10	5	5	10	10	50	50%
CO3		5			5	5	15	15%
CO4								
CO5								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember+ Understand	10%+2%
Apply	20%+2%
Analyse	40%+4%
Evaluate	20%+2%
Create	

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module 3	Module-4	Module-5		
CO1	20	10	10			40	40%
CO2		10	10	10	10	40	40%
CO3				10	10	20	20%
CO4							-
CO5							-
Total	20	20	20	20	20	100	100%

Semester	**:**	**5**				
Course Title	**:**	**Machine Learning**				
Course Code	**:**	**BCS502**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Integrated**				
Category	**:**	**IPCC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:2:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40 + 20**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the fundamental concepts of Machine Learning
2	Apply the concepts of Machine Learning for the given dataset
3	Analyse given scenario and use appropriate Machine Learning Technique
4	Evaluate Machine Learning models and choose the best model for a given application
5	Implement a Machine Learning application for a given real world problem.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts in C.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to Machine Learning and Concept Learning**: **Introduction to Machine Learning-** Well posed Learning Problems, Designing Learning System, Perspectives and Issues. **Concept Learning and the General-to-Specific Ordering**– Introduction, A concept Learning Task, Concept learning as Search, FIND-S and Candidate Elimination Algorithm, Inductive Bias. **Textbook1: Chapter-1 (1.1-1.3) Textbook2: Chapter-2 (2.1-2.5,2.7)**	**8**
Pedagogy	**Presentation, Quiz**	
2	**Performance Metrics:** Accuracy, Precision, Recall, Sensitivity, Specificity, F1-Score, ROC Curve, AUC, and Confusion Matrix. **Supervised Learning – Regression and Decision Trees**: Introduction to Regression, Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression. **Textbook3: Chapter-3 (3.3) Textbook2: Chapter-5** (5.1-5.3, 5.5-5.7)	**8**
Pedagogy	**Collaborative Learning, Presentation**	
3	**Decision Tree Learning** – Representation, ID3 Algorithm, Hypothesis Space Search, and Inductive Bias – Issues in Decision Tree Learning. **Bayesian Learning and Unsupervised Learning**: Bayes Theorem, Maximum Likelihood Estimation, Bayes Optimal Classifier, Naive Bayes Classifier, Bayesian Belief Networks. **Textbook1: Chapter-3 (**3.1-3.7**) Textbook1: Chapter-6** (6.1-6.7,6.9,6.11)	**8**
Pedagogy	**Practical Based Learning, Project Based Learning**	
4	**Unsupervised Learning**: K-Means Clustering, Association Rule Learning using Apriori Principle. **Dimensionality Reduction Techniques:** Principal Component Analysis and Singular Value Decomposition. **Instance-based Learning-**K-Nearest Neighbour. **Textbook3: Chapter-9 (**9.1**) Textbook3: Chapter-8 (8**.1,8.3**)** **Textbook1: Chapter-8 (8.1,8.2)**	**8**
Pedagogy	**Practical Based Learning, Project Based Learning**	
5	**Artificial Neural Networks and Support Vector Machines**: Artificial Neural Networks – Perceptrons **Support Vector Machines** – Linear and Non-Linear SVMs. **Textbook1: Chapter-4 (4.2-4.4) Textbook3: Chapter-5 (5.1,5.2)**	**8**

	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

List of Programs:

Sl. No.	Experiments/Programs	COs
1	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.	**CO2**
2	Develop a program to demonstrate Logistic Regression on the Pima Indian Diabetes Dataset. Use accuracy, precision, recall, and F1-score to evaluate the model performance. Plot the ROC curve.	**CO4**
3	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	**CO3**
4	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.	**CO3**
5	Develop a program to demonstrate the working of the decision tree algorithm. Use Breast Cancer Data set for building the decision tree and apply this knowledge to classify a new sample.	**CO3**
6	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.	**CO4**
7	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result.	**CO3**
8	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.	**CO3**
9	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 $\{x_1,\ldots\ldots,x_{50}\}$ as follows: if ($xi \leq 0.5$), then $xi \in$ Class1, else $xi \in$ Class1 b. Classify the remaining points, $x_{51},\ldots\ldots,x_{100}$ using KNN. Perform this for k=1,2,3,4,5,20,30	**CO2**
10	Develop a program to demonstrate SVM classifier to classify iris flower species and evaluate the performance.	**CO4**
	Open ended Programs	
1	Develop a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset.	**CO3**
2	Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heatmap to know which variables have strong positive/negative correlations. Create a pair plot to visualize pairwise relationships between features. Use California	**CO3**

	Housing dataset.	
3	Develop a program to generate n two-dimensional points randomly in the range [0,10][0, 10][0,10]. Perform the following tasks: 1. Display the generated 2D points. 2. Compute the **Euclidean distance** between each pair of points. 3. Display the distance matrix in a tabular format. 4. (Optional): Plot the points on a 2D scatter plot using different colors for each point.	**CO3**

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Tom Mitchell, "Machine Learning", McGraw Hill, 1997.
2	S Sridhar, M Vijayalakshmi, "Machine Learning", OXFORD University Press 2021, First Edition.
3	Aurelien Geron , "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'reilly ,2nd Edition,2019
Reference Books	
1	Peter Harrington, "Machine Learning in Action", Dreamtech Press (India), 1st Edition, 2012
2	Christopher Bishop, "Pattern Recognition and Machine Learning", Springer (2nd Printing), 2011.
3	Vasilev, Ivan, "Advanced Deep Learning with Python_- Design and Implement Advanced Next- Generation AI Solutions using TensorFlow.

Course Outcomes: At the end of the course, the student will be able to:

CO	**Course Outcomes**	**RBT Level**	**RBT Level Indicator**
CO1	Understand the concepts of Machine Learning	**L2**	**U**
CO2	Apply the concepts of Machine Learning for the given dataset	**L3**	**Ap**
CO3	Analyze given scenario and use appropriate Machine Learning Technique	**L4**	**An**
CO4	Evaluate Machine Learning models and choose the best model for a given application	**L5**	**E**
CO5	Implement a Machine Learning application for a given real-world problem	**L6**	**C**

Mapping of Course Outcomes to Program Outcomes:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	**3**												3	**2**		
CO3		**2**												**2**		
CO4			**2**							**2**	**2**					
CO5					**2**					**2**	**2**			**3**	**3**	**2**

Weblinks and Video Lectures (e-Resources)	
1	https://www.geeksforgeeks.org/machine-learning/
2	https://www.youtube.com/watch?v=h0e2HAPTGF4
3	https://www.scaler.com/topics/machine-learning/
4	https://www.youtube.com/watch?v=jGwO_UgTS7I&list=PLoROMvodv4rMiGQp3WXShtMGgzqpfVfbU
5	https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-machine-learning1

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Theory**				**Practical**
	Continuous Assessment Tests		**Continuous Comprehensive Assessment (CCA)**		**Practical Test**
	IAT-1	**IAT-2**	**CCA-1**	**CCA-2**	
	50 Marks	**50 Marks**	**50 Marks**	**50 Marks**	
Remember	20	10			
Understand	20	10	10		10
Apply	10	20	10		10
Analyse		10	10		10
Evaluate				10	10
Create				10	10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module-2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10		5		5	5	35	35%
CO2	10	10	5	5	5	10	40	40%
CO3		10		5	10	5	25	25%
CO4								
CO5	--	--	--	--	--	--	--	--
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10% + 2%
Understand	20% + 2%
Apply	40% + 4%
Analyse	20% + 2%
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	20	10	10			40	40%
CO2	--	10	10	10	10	40	40%
CO3	--	--	--	10	10	20	20%
CO4	--	--	--	--	--	--	--
CO5	--	--	--	--	--	--	--
Total	20	20	20	20	20	100	100%

PROFESSIONAL CORE COURSE (PCC)

PCC Course - Professional Core Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0
Total Hours of Pedagogy	40 hours
Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Professional Core Course (PCC)

Assessment Details (both CIE and SEE)

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (20 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks. Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
  - The first test will be administered after 40-50% of the syllabus has been covered, and
  - The second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods

of assessment.

- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students must answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,
    - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
    - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Professional Core Course (PCC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	----	----	**20**	
	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	(50+50) / 2	**25**	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory					**50**	20	Total Marks of IAT and CCA is 50

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
			CIE + SEE	100	----	----	40	

Semester	**:**	**5**				
Course Title	**:**	**Theory of Computation and Compiler Design**				
Course Code	**:**	**BCS503**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PCC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce the mathematical foundations of computation including automata theory, formal languages, and grammars.
2	To develop the ability to design computational models like finite automata, pushdown automata, and Turing machines for solving language recognition problems.
3	To understand the working principles and structure of a compiler
4	To relate the concepts of computation
5	To equip students with engineering skills necessary for understanding the working of efficient language processors.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Introduction to Finite Automata, Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions. **TEXT BOOK 1: Sections 1.1, 1.5, 2.2,2.3,2.4,2.5**	**8**
Pedagogy	**Role play**	
2	Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata, **TEXT BOOK 1: Sections 3.1, 3.2 (Except 3.2.1), 4.1, 4.2, 4.4**	**8**
Pedagogy	**Problem Solving**	
3	Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Ambiguity in Grammars and Languages, Definition of the Pushdown Automaton, The Languages of a PDA, Deterministic Pushdown Automata. Introduction to Turing Machines, The Turing Machine, **TEXT BOOK 1: Sections 5.1, 5.2, 5.4, 6.1,6.2,6.4,8.2**,	**8**
Pedagogy	**Presentation**	
4	**Introduction:** Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology. **Lexical Analysis:** The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens. **Text book 2:Chapter 1 1.1-1.5 Chapter 3: 3.1 – 3.4**	**8**
Pedagogy	**Poster Presentation**	
5	Syntax Analysis: Introduction, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers **Text book 2: Chapter 4 4.1, 4.2 4.3 4.4 4.5**	**8**
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Textbooks

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Second Edition, Pearson.
2	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman , Compilers-Principles, Techniques and Tools, Pearson, 2nd edition, 2007
Reference Books	
1	Elain Rich, "Automata,Computability and complexity", 1st Edition, Pearson Education,2018
2	K.L.P Mishra, N Chandrashekaran , 3rd Edition , 'Theory of Computer Science",PHI,2012.
3	Compiler Design, K Muneeswaran, Oxford University Press 2013.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understanding formal language classes and corresponding computational models and concepts of compiler design	L2	U
CO2	Apply the complexity of computational problems using different theoretical models	L3	AP
CO3	Analyze different types of grammars using ToC classes and compiler structure	L4	AN
CO4	Evaluate the grammars with proper approach and method.	L5	EV
CO5	Design solution for given problem using appropriate techniques and tools	L6	CR

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	3												2			
CO3		3												2		
CO4			3													
CO5				2	3			1	2							

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	25 Marks	25 Marks
Remember	20	10		
Understand	20	10	10	
Apply	10	20	10	
Analyse		10	5	
Evaluate				15
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	5	5	5	5	5	35	35%
CO2	10	10	5	5	10	10	50	50%
CO3		5			5	5	15	15%
CO4								
CO5								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	12%
Understand	23%
Apply	44%
Analyse	21%
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module 3	Module-4	Module-5		
CO1	20	10	10			40	40%
CO2		10	10	10	10	40	40%
CO3				10	10	20	20%
CO4							-
CO5							-
Total	20	20	20	20	20	100	100%

Professional Core Laboratory Course (PCCL)

Teaching Hours/Week (L: T:P: S)	0:0:2:2
Total Hours of Pedagogy	20 hours Practical + 20 hours project
Credits:	03
Programs / Experiments	10 + 1 mini project
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	2
Examination nature (SEE)	Practical Exams -External

Semester	:	5				
Course Title	:	Next Generation Embedded Laboratory				
Course Code	:	BCSL506				
Course Type (Theory/ Practical/ Integrated)	:	Practical + Mini Project				
Category	:	PCCL				
Stream	:	CSE		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	0:0:2:2		**SEE**	**:**	**50 Marks**
Total Hours	:	40 hours		**SEE Duration**	:	2 hrs
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand ARM7TDMI/LPC2148 architecture and program it using Embedded C.
2	Interface motors, sensors, and actuators with ARM7 and Arduino.
3	Implement external interrupts to control devices dynamically.
4	Build IoT-based real-time monitoring systems using cloud platforms.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Develop and debug Embedded C programs for ARM7TDMI/LPC2148 using Keil Uvision-4.	L3	Apply
CO2	Interface and control motors, sensors, and actuators with ARM7 and Arduino.	L4	Analyze
CO3	Implement real-time sensor monitoring systems on cloud platforms (ThingSpeak, Firebase, AWS IoT).	L5	Evaluates
CO4	Design an open-ended embedded IoT solution for a real-world problem.	L6	Create

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3															
CO2		2														
CO3				2												
CO4			2		2	2	2	1	2	2	1	1	1	2		

Weblinks and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=mhHJV21CDjs
2	https://www.youtube.com/watch?v=tileHx1hPCk
3	https://www.tinkercad.com/projects?product=circuits
4	https://www.youtube.com/watch?v=1LVTs1CeHe0

CIE- Continuous Internal Evaluation (50 Marks)

Evaluation		Allotted Marks		TOTAL CIE (50M)
Continuous Evaluation - 10 Marks	Record	10	Average Score of all experiments - 30 Marks- scale down to 10 marks	10
	Observation	10		
	Viva	10		
Lab IA- 15 Marks	Procedure write up	10	LAB IA-50 Marks- scale down to 15 marks	15
	Conduction and Results	30		
	Viva Voce	10		
Mini Project	Phase 1	20	Mini Project- Marks- scale down to 25 marks	25
	Phase 2	30		

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	
Understand	**10**
Apply	**20**
Analyse	**20**
Evaluate	
Create	

List of Programs:

Warmup Programs:

- Simulate a program in C for ARM microcontroller using KEIL to sort the numbers in ascending/descending order using bubble sort.
- Simulate a program in C for an ARM microcontroller to find factorials of a number.

Sl. No.	Experiments/Programs	COs
1	Conduct the experiment on an ARM7TDMI/LPC2148 evaluation board using the evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler to display "Hello World" message using Internal UART.	CO1
2	Conduct the experiment on an ARM7TDMI/LPC2148 evaluation board using the evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	CO1 CO2
3	Conduct the experiment on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler to demonstrate the use of an external interrupt to toggle an LED On/Off.	CO1 CO2
4	Conduct the experiment on an ARM7TDMI/LPC2148 evaluation board using the evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler to Interface a 4x4 keyboard and display the key code on an LCD.	CO1 CO2
5	Implement the following using Arduino Uno: a. Controlling the Light Emitting Diode (LED) with a push button. b. Interfacing of the Active Buzzer	CO2
6	Implement the following using Arduino Uno: a. Detection of the light using a photo resistor. b. Interfacing of temperature sensor LM35	CO2
7	Implement the following using Arduino Uno: a. Interfacing Servo Motor. b. Building Intrusion Detection System using Ultrasonic Sensor	CO2
8	Directional Control of the DC motor using Arduino Uno.	CO2
9	IoT-Based Real-Time Temperature Monitoring using suitable cloud platforms.	CO3
10	IoT-Based Real-Time Sensor data monitoring using suitable cloud platforms.	CO3

Open ended Programs/ Mini Project Problem statements-Societal/ Research/ Industry Problems		
1	Projects using Arduino Uno-Plant monitor	CO4
2	Projects using ARM controller Kit- Analog to Digital Conversion Digital to Analog Conversion	CO4
3	Any other real time problems to be solved using Arduino/ Arm controller kit	CO4

CIE for (Practical):

CIE marks for the practical course are 50 Marks.

For CIE marks

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up, along with the Observation and Viva (open ended questions) will be evaluated for 10 marks each in every lab session.
- At the semester end, the average marks scored for 30 marks by the students are scaled down to 10 marks.
- Weightage to be given for neatness and submission of record/write-up on time.
- The department shall conduct a test of 50 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge shall carry marks according to the split-up mentioned in the table ***CIE- Continuous Internal Evaluation.***
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The IA is conducted for 50 marks and shall be scaled down to 15 marks.
- During the 1st and 2nd week of the semester mini Project titles to be fixed for each teams, consisting of 3-4 students.(minimum 2 per team)
- Internal guide allocation shall be done within the 3rd week of the semester.
- Mini project phase 1 review shall be held during the 5th week of the semester covering the Introduction, Literature review, Problem statement, Objectives and Methodology.
- Student-guide interaction to be done every 15 days once and discussions to be documented in a standard format.

- Mini Project Phase 2 (which may include Methodology, Requirements, Design, implementation, testing, results, conclusion and future scope) and final review with demonstration shall be held during 9th to 12th week of the semester.
- Each team shall submit 1 softbound hardcopy of the report at the completion of the project duly signed by the guide, lab Incharge and the Head of the department.
- The evaluation of mini projects shall be done as mentioned in the table ***CIE- Continuous Internal Evaluation***.
- The Sum of scaled-down marks scored in the report write-up/journal , IA marks and the mini project marks is the total CIE marks scored by the student.

SEE for (Practical)

- SEE marks for the practical course are 50 Marks
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- All laboratory experiments are to be included for practical examination and mini projects to be presented.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours

Note: L- Theory Lecture, T- Tutorial, P-Practical, S-Project, IPCC: Integrated Professional Core Course, CIE Continuous Internal Evaluation, SEE: Semester End Examination.

PROFESSIONAL ELECTIVE COURSE (PEC)

PEC Course - Professional Elective Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0
Total Hours of Pedagogy	40 hours
Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Professional Elective Course (PEC)

Assessment Details (both CIE and SEE)

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (20 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks. Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
  - The first test will be administered after 40-50% of the syllabus has been covered, and
  - The second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods

of assessment.

- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students must answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,
    - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
    - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Professional Elective Course (PEC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	----	----	**20**	
	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	(50+50) / 2	**25**	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory					**50**	20	Total Marks of IAT and CCA is 50

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
			CIE + SEE	100	----	----	40	

Semester	**:**	**5**				
Course Title	**:**	**NoSQL**				
Course Code	**:**	**BCS504A**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PEC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the four types of NoSQL Databases, the Document-oriented, Key Value Pairs, Column-oriented and Graph databases useful for diverse applications.
2	Apply performance tuning on Column-oriented NoSQL databases and Document-oriented NoSQL Databases
3	Differentiate the detailed architecture of column-oriented NoSQL database, Document database and Graph Database and relate usage of processor, memory, storage and file system commands.
4	Design various applications for location-based service and recommendation services. Devise an application using the components of NoSQL.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A)Mostly(Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL. Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access,	**8**
Pedagogy	**Presentation, Quiz**	
2	Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes	**8**
Pedagogy	**Collaborative Learning, Presentation**	
3	Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce. Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets	**8**
Pedagogy	**Demonstration**	
4	Document Databases, What Is a Document Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E- Commerce Applications, When Not to Use, Complex Transactions Spanning Dif erent Operations, Queries against Varying Aggregate Structure	**8**

Pedagogy	Active Learning	
5	Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.	8
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
Reference Books	
1	Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015.)ISBN- 13: 978-9332557338(
2	Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013.)ISBN-13: 978-9351192022(
3	Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013.)ISBN-13: 978-9351102694(

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the concepts of Column Oriented NoSQL databases, Document Databases, Graph Databases.	**L2**	**U**

CO2	Apply the concepts pertaining to all the types of databases.	**L3**	**AP**
CO3	Analyze the structural Models of NoSQL.	**L4**	**AN**
CO4	Develop various applications using NoSQL databases.	**L6**	**C**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-		-	-	-	-	-	-	-	-	3	-	-
CO3	3	-		-		-	-	-	-	-	-	-	-	3	-	-
CO4	-	2	-	-	2	-	-	-		-	-	-	-	-	2	-

Weblinks and Video Lectures (e-Resources)	
1	https://www.geeksforgeeks.org/introduction-to-nosql/) and related links in the page(
2	https://www.youtube.com/watch?v=0buKQHokLK8)How do NoSQL databases work? Simply explained(
3	https://www.techtarget.com/searchdatamanagement/definition/NoSQL-Not-Only-SQL)What is NoSQL and How do NoSQL databases work(
4	https://www.mongodb.com/nosql-explained)What is NoSQL(

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Theory**			
	Continuous Assessment Tests (IAT)		**Continuous Comprehensive Assessment (CCA)**	
	IAT-1	**IAT-2**	**CCA-1**	**CCA-2**
	50 Marks	**50 Marks**	**50 Marks**	**50 Marks**
Remember	20	10		
Understand	20	10	10	

Apply	10	20	10	
Analyse		10	10	
Evaluate				10
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	**10**	**5**	**5**	**5**	**5**	**5**	**35**	**35%**
CO2	**10**	**10**	**5**	**5**	**10**	**10**	**50**	**50%**
CO3		**5**			**5**	**5**	**15**	**15%**
CO4								
CO5								
Total	**20**	**20**	**10**	**10**	**20**	**20**	**100**	**100%**

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	**10% + 2%**
Understand	**20% + 2%**
Apply	**40% + 4%**
Analyse	**20% + 2%**
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module 3	Module-4	Module-5		
CO1	**20**	**10**	**10**			**40**	**40%**
CO2		**10**	**10**	**10**	**10**	**40**	**40%**
CO3				**10**	**10**	**20**	**20%**
CO4							**-**
CO5							**-**
Total	**20**	**20**	**20**	**20**	**20**	**100**	**100%**

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**5th**				
Course Title	**:**	**Cryptography and Network Security**				
Course Code	**:**	**BCS504B**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PEC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/week (L: T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	**Understand and Explain Cryptography and Network Security principles.**
2	**Demonstrate Public and Private key Cryptographic algorithms with suitable examples**
3	**Analyze real world Network security scenarios**
4	**Apply cryptographic algorithms to provide Network Security**
5	**Implement different Encryption and decryption Techniques**

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Program -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to Network Security:** Attacks, Services and Mechanisms, Security Attacks, Security Services, A model for Internetwork Security. **Classical Encryption Techniques** Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key Schedule algorithm	**08**
Pedagogy	**Video Demonstration and Visualization.**	
2	**Public-Key Cryptography and RSA:** Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, desription of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems	**08**
Pedagogy	**Demonstration of Algorithms**	
3	**Key Management and Distribution:** Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates. X-509 certificates. Certificates, X-509 version 3, public key infrastructure.	**08**
Pedagogy	**Presentation**	
4	**User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication. **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality,	**08**

	S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow	
Pedagogy	**Poster Presentation**	
5	**IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service **Web and System Security:** Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.	**08**
Pedagogy	**Video demonstration and Simulation**	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	William Stallings: Network Security Essentials Applications and Standards , person 2000.
2	Behrouz A. Forouzan : Cryptography and Network security, Tata McGraw-Hill 2007.
Reference Books	
1	Michael E. Whiteman and Herbert J. Mattord: Principles of Information Security , 2nd Edition , Cengage Learning, 2005.
2	Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand and Explain Public and Private Key Cryptographic Concepts.**	**L2**	**U**
CO2	**Apply different cryptographic techniques and algorithms to solve problems.**	**L3**	**AP**
CO3	**Analyze the given situation/scenario and use appropriate cryptographic algorithms.**	**L4**	**AN**
CO4	**Design solution for real time network security issues using cryptographic algorithms.**	**L5**	**E**
CO5	**Demonstrate the developed solution using Modern Tools.**	**L6**	**C**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	3												2			
CO3		3														
CO4				3					2							
CO5					2					2					2	

Weblinks and Video Lectures (e-Resources)	
1	http://nptel.ac.in/courses/106105031/ lecture by Dr. Debdeep Mukhopadhyay IIT Kharagpur
2	https://onlinecourses.nptel.ac.in/noc22_cs90/preview By Prof. Sourav Mukhopadhyay | IIT Kharagpur
3	https://www.geeksforgeeks.org/network-security/
4	https://www.netacad.com/courses/network-security?courseLang=en-US

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	20	10		
Understand	20	10	10	
Apply	10	20	10	
Analyze		10	10	
Evaluate				10
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	5	5	5	5	5	35	35%
CO2	10	10	5	5	10	10	50	50%
CO3		5			5	5	15	15%
CO4								
CO5								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10% + 2%
Understand	20% + 2%
Apply	40% + 4%
Analyze	20% + 2%
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module 3	Module-4	Module-5		
CO1	20	10	10			40	40%
CO2		10	10	10	10	40	40%
CO3				10	10	20	20%
CO4							-
CO5							-
Total	20	20	20	20	20	100	100%

PROFESSIONAL ELECTIVE COURSE (PEC)

PEC Course - Professional Elective Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0
Total Hours of Pedagogy	40 hours
Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Professional Elective Course (PEC)

Assessment Details (both CIE and SEE)

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (20 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks. Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
  - The first test will be administered after 40-50% of the syllabus has been covered, and
  - The second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods

of assessment.

- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students must answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,
    - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
    - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Professional Elective Course (PEC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	----	----	**20**	
	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	(50+50) / 2	**25**	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory					**50**	20	Total Marks of IAT and CCA is 50

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
			CIE + SEE	100	----	----	40	

Semester	**:**	**5**				
Course Title	**:**	**Data Warehousing**				
Course Code	**:**	**BCS504C**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PEC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To understand the need of data warehousing.
2	To understand the planning a data warehouse based on business requirements
3	To understand the architectural components of Data warehouse
4	To understand the data modelling approaches in Data Warehousing
5	To understand OLAP operations and use them effectively to improve data quality

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

DSATM

COURSE CURRICULUM

Module No.	Topics	Hours
1	Escalating Need for Strategic Information, Failures Of Past Decision-Support Systems, Operational Versus Decision-Support Systems, Data warehousing—The Only Viable Solution, Data Warehouse Defined. The Data warehousing Movement, Evolution of Business Intelligence **Data Warehouse**: The Building Blocks: Defining Features, Data Warehouses and Data Marts, **Architectural Types, Components**: Source Data Component, Data Staging Component, Data Storage Component, Information Delivery Component, Metadata Component, Management and Control Component, Metadata In The Data Warehouse. Text Book : Chapter 1 , 2	**8**
Pedagogy	**Presentation, Quiz**	
2	**Planning And Project Management**: Planning Your Data Warehouse, The Data Warehouse Project, The Development Phases, The Project Team, Project Management Considerations **Defining The Business Requirements**: Dimensional Analysis, Information Packages: Requirements Not Fully Determinate, Business Dimensions, Dimension Hierarchies and Categories, Key Business Metrics Or Facts, Requirements Gathering Methods, Data Sources, Data Transformation, Data Storage, Information Delivery, Information Package Diagrams. **Requirements As The Driving Force For Data warehousing** : Data Design , The Architectural Plan , Data Storage Specifications , Information Delivery Strategy Text Book:Chapter 4, 5,6	**8**
Pedagogy	**Collaborative Learning, Presentation**	
3	**Architectural Components** : Understanding Data Warehouse Architecture , Distinguishing Characteristics , Architectural Framework , Technical Architecture , Architectural Types . **Infrastructure As The Foundation For Data warehousing**: Infrastructure Supporting Architecture , Hardware And Operating Systems , Database Software , Collection Of Tools , Data Warehouse Appliances . **The Significant Role Of Metadata** : Why Metadata Is Important , Metadata Types By Functional Areas , Business Metadata , Technical Metadata , How To Provide Metadata . Text Book:Chapter 7,8,9	**8**
Pedagogy	**Demonstration**	
4	**Principles Of Dimensional Modelling** : From Requirements To Data Design , The Star Schema , Star Schema Keys , Advantages Of The Star Schema , Star Schema: Examples , **Dimensional Modelling**: Advanced Topics : Updates To The Dimension Tables , Miscellaneous Dimensions ,The Snowflake Schema , Aggregate Fact Tables	**8**

	,Families Of Stars . **Data Extraction, Transformation, And Loading**: ETL Overview, ETL Requirements And Steps, Data Extraction, Data Transformation, Data Loading, ETL Tool Options Reemphasizing ETL Metadata, ETL Summary And Approach. Text Book:Chapter 10,11,12	
Pedagogy	**Active Learning**	
5	**Data Quality**: A Key To Success: Why Is Data Quality Critical? Data Quality Challenges, Data Quality Tools, Data Quality Initiative, Master Data Management (Mdm) . **Matching Information To The Classes Of Users**: Information From The Data Warehouse, Who Will Use The Information? Information Delivery. Information Delivery: Business Activity Monitoring (Bam) , **Dashboards And Scorecards OLAP In the Data Warehouse**: Demand for Online Analytical Processing, Major Features And Functions, OLAP Models, OLAP Implementation Considerations. **Data Warehousing And the Web**: Web-Enabled Data Warehouse, Web-Based Information Delivery, OLAP And The Web, Building A Web-Enabled Data Warehouse. Text Book:Chapter 13,14,15,16.	**8**
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Data Warehousing Fundamentals for IT Professionals, Second Edition, PAULRAJ PONNIAH, Wiley 2010.

Course Outcomes: At the end of the course, the student will be able to:

CO	**Course Outcomes**	**RBT Level**	**RBT Level Indicator**
CO1	Understand the need for strategic information and data warehousing and how they support decision-making processes in organizations..	**L2**	**U**
CO2	Apply project planning and management skills to effectively organize and execute data warehouse development projects.	**L3**	**AP**

CO3	Apply metadata management techniques to ensure consistency, traceability, and integration within a data warehouse environment..	**L3**	**AP**
CO4	Analyze data modeling techniques and evaluate the role of data quality and master data management in effective data warehousing.	**L4**	**AN**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	2												1			
CO3		2												2		
CO4		3	2		2								2		3	1

Weblinks and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/106/105/106105191/
2	https://www.youtube.com/watch?v=m-aKj5ovDfg
3	https://onlinecourses.swayam2.ac.in/cec19_cs01/preview
4	http://textofvideo.nptel.iitm.ac.in/video.php?courseId=106106093&p=4

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	20	10		
Understand	20	10	10	
Apply	10	20	10	
Analyse		10	10	
Evaluate				10
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	5	5	5	5	5	35	35%
CO2	10	10	5	5	10	10	50	50%
CO3		5			5	5	15	15%
CO4								
CO5								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10% + 2%
Understand	20% + 2%
Apply	40% + 4%
Analyse	20% + 2%
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	20	10	10			40	40%
CO2	--	10	10	10	10	40	40%
CO3	--	--	--	10	10	20	20%
CO4	--	--	--	--	--	--	--
Total	20	20	20	20	20	100	100%

Semester	**:**	**5th**				
Course Title	**:**	**Distributed Systems**				
Course Code	**:**	**BCS504D**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PEC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**50**		**SEE Duration**	**:**	**3Hrs**
Credits	**:**	**3**				

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**CHARACTERIZATION OF DISTRIBUTED SYSTEMS**: Introduction, Focus on resource sharing, Challenges. REMOTE INVOCATION: Introduction, Request-reply protocols, Remote procedure call, Introduction to Remote Method Invocation. **Textbook: Chapter- 1.1,1.4,1.5, 5.1-5.5**	**8**
2	**DISTRIBUTED FILE SYSTEMS:** Introduction, File service architecture. NAME SERVICES: Introduction, Name services and the Domain Name System, Directory services. **Textbook: Chapter- 12.1,12.2, 13.1-13.3**	**8**
3	**TIME AND GLOBAL STATES:** Introduction, Clocks, events and process states, Synchronizing Physical clocks, Logical time and logical clocks, Global states **Textbook: Chapter- 14.1-14.5**	**8**
4	**COORDINATION AND AGREEMENT**: Introduction, Distributed mutual exclusion, Elections, Coordination and agreement in group communication, Consensus and related problems.	**8**

	Textbook: Chapter -15.1-15.5	
5	**DISTRIBUTED TRANSACTIONS**: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. REPLICATION: Introduction. **Textbook: Chapter -17.1-17.6, 18.1**	**8**

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Demonstrate the remote invocation techniques for communication	**L2**	**U**
CO2	Identify the goals and challenges of distributed systems	**L3**	**AP**
CO3	Apply clock synchronization algorithms to monitor and order the events.	**L3**	**AP**
CO4	Analyze the performance of mutual exclusion, election and consensus algorithms	**L4**	**AN**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	2												1			
CO3		2												2		
CO4		3	2		2								2		3	1

Weblinks and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/106/105/106105191/
2	https://www.youtube.com/watch?v=m-aKj5ovDfg
3	https://onlinecourses.swayam2.ac.in/cec19_cs01/preview
4	http://textofvideo.nptel.iitm.ac.in/video.php?courseId=106106093&p=4

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2

	50 Marks	50 Marks	50 Marks	50 Marks
Remember	20	10		
Understand	20	10	10	
Apply	10	20	10	
Analyse		10	10	
Evaluate				10
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	**10**	**5**	**5**	**5**	**5**	**5**	**35**	**35%**
CO2	**10**	**10**	**5**	**5**	**10**	**10**	**50**	**50%**
CO3		**5**			**5**	**5**	**15**	**15%**
CO4								
CO5								
Total	**20**	**20**	**10**	**10**	**20**	**20**	**100**	**100%**

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	**10% + 2%**
Understand	**20% + 2%**
Apply	**40% + 4%**
Analyse	**20% + 2%**
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	**20**	**10**	**10**			**40**	**40%**
CO2	**--**	**10**	**10**	**10**	**10**	**40**	**40%**
CO3	**--**	**--**	**--**	**10**	**10**	**20**	**20%**
CO4	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Total	**20**	**20**	**20**	**20**	**20**	**100**	**100%**

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**5th Sem**				
Course Title	**:**	**Mobile Application Development**				
Course Code	**:**	**BCS505**				
Course Type (Theory/ Practical/Integrated)	**:**	**Practical & Project**				
Category	**:**	**PBL**				
Stream	**:**	**CSE**		**CIE**	**:**	**50**
Teaching hours/ week (L:T:P:S)	**:**	**0:2:0:4**		**SEE**	**:**	**50**
Total Hours	**:**	**24**		**SEE Duration**	**:**	**3 hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To equip students with foundational knowledge of the Android platform and development tools, enabling them to build, run, and debug mobile applications using Android Studio.
2	To develop the ability to design responsive, user-centric mobile interfaces and implement core Android components such as Activities, Services, Intents, Notifications, and Broadcast Receivers.
3	To enable students to integrate persistent data storage using SQLite and Firebase, apply runtime permissions, and publish fully functional Android applications aligned with industry practices.

Teaching-Learning Process
Pedagogical Initiatives:

To enhance the effectiveness of the Teaching–Learning Process and facilitate the attainment of Course Outcomes (COs), the following strategies may be adopted:

- Employ diverse teaching methodologies tailored to meet specific course outcomes.
- Integrate video demonstrations to visually reinforce core concepts, particularly in programming and UI/UX design.
- Promote collaborative (group-based) learning to build teamwork, communication, and peer learning.
- Pose at least three HOTS (Higher-Order Thinking Skills) questions per module to nurture critical thinking and problem-solving.
- Implement Problem-Based Learning (PBL) to encourage analysis, evaluation, and application of knowledge in real-world contexts.
- Demonstrate multiple solution paths to a problem and motivate students to think creatively and strive for optimal solutions.
- Incorporate relevant case studies that relate course concepts to industry scenarios, aiding deeper conceptual understanding.
- Explore and implement innovative pedagogical approaches to continuously improve the Teaching–Learning Process (TLP).

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System
(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Module 1: Android – Fundamentals & First App** **Concepts Covered:** Android architecture, tools (Android Studio, SDK) Activities and lifecycle Building your first app Debugging and testing basics **Project 1: Hello Campus App** **Objective:** To create a "**Hello Campus**" app that shows college details (logo, intro screen, mission/vision) using activity switching and basic layouts.	5
Pedagogy	Exploration	
2	**Module 2: UI/UX & Event Handling** **Concepts Covered:** Layouts: Linear, Relative, Constraint Views: Buttons, TextViews, EditTexts, ImageView Event handling (clicks, input) Toasts and notifications **Project 2: Login & Registration App** **Objective:** Build a **Login & Registration** App with form validation, toast messages, and screen transitions.	5
Pedagogy	Design	
3	**Module 3: Intents, Fragments & Background Tasks** **Concepts Covered:** Explicit & Implicit Intents Fragment lifecycle, fragment transactions Background processing using WorkManager or Handlers **Project 3: To-Do List App** **Objective:** Develop a **To-Do List** App with fragment-based UI and background syncing simulation (using delays or WorkManager).	5
Pedagogy	Integration	

4	**Module 4: Data Storage & Sharing** **Concepts Covered:** SharedPreferences (local key-value storage) SQLite Database (tables, CRUD) Content Providers (basic use) File Storage (Internal/External basics) **Project 4: Notes Keeper App with SQLite** **Objective:** An app that lets users create, edit, delete and save notes using local SQLite DB with persistence across app restarts.	**5**
Pedagogy	Implementation	
5	**Module 5: Deployment, APIs & Firebase** **Concepts Covered:** App Permissions (Manifest & Runtime) Firebase Basics: Authentication, Firestore DB AdMob (introductory) App Optimization & Best Practices **Objective:** Students build a **fully functional mobile app** (ideas below) using concepts from all modules and deploy as an APK **Description**: A cloud-connected app where users log daily expenses. Auth via Firebase, data stored and retrieved using Firestore.	**5**
Pedagogy	Deployment	
	Summary of Modules: **Module 1:** Focuses on setting up Android Studio, understanding app structure, and building the first basic app with activities. **Module 2:** Centers on UI design using layouts and views, handling user events, and enhancing interaction. **Module 3:** Emphasizes intents, fragments, and background tasks using WorkManager for seamless navigation and processing. **Module 4:** Covers local data storage with SharedPreferences and SQLite, including data sharing via content providers. **Module 5:** Combines permissions, Firebase integration, performance tuning, and app deployment to the Play Store.	
Text Books		

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developerfundamentals-course-concepts/details (Download pdf file from the above link)
2	Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand** the fundamental concepts, architecture, and development environment of the Android platform, including its core components and development tools.	L2	U
CO2	**Apply** the learned concepts to implement interactive user interfaces, handle user input, and integrate core Android components such as Activities, Intents, and Fragments.	L3	AP
CO3	**Analyze** mobile application requirements to effectively integrate persistent data storage using local and cloud solutions.	L4	AN
CO4	**Design, develop, and deploy** a production-ready mobile application incorporating secure authentication, data persistence, and adhering to industry best practices for optimization and user experience.	L5	CR

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3												2			
CO2	2		3													
CO3		3	2	2										3		
CO4		2	3		**2**	2		2	**2**	**2**		**1**		3	3	3

Weblinks and Video Lectures (e-Resources)	
1	**Android Developers Official Documentation** https://developer.android.com/guide *Comprehensive resource for Android development fundamentals and advanced topics.*
2	**Android Basics with Compose (by Google)** https://developer.android.com/courses/pathways/android-basics-compose *Hands-on tutorials for beginners to build modern Android apps using Jetpack Compose.*
3	**Firebase for Android** https://firebase.google.com/docs/android/setup *Official guide to integrating Firebase services like authentication, database, and analytics.*
4	**Publishing Your App on Google Play** https://developer.android.com/studio/publish *Step-by-step instructions to test, sign, and release your Android apps.*

Dayananda Sagar Academy of Technology & Management
Autonomous Institute under VTU)

Affiliated to VTU
Approved by AICTE
Accredited by NAAC with A+ Grade
6 Programs Accredited by NBA
(CSE, ISE, ECE, EEE, MECH, CV)

Project Based Learning – Student(s) – Guide – Interaction

Date		
PBL Batch No.		
Title of the project		
Week No.		
Content of the Discussion		
Suggestion by the guide		
Name of Signature of students		

Signature of the Guide **Signature of PBL Coordinator** **Signature of HOD**

Project Based Learning- Continuous Evaluation

Batch No.	Name	USN	Marks assigned	Remarks by the guide on the progress of the project

Signature of the Guide
Signature of HOD

Signature of PBL Coordinator

Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Affiliated to VTU
Approved by AICTE
Accredited by NAAC with A+ Grade
6 Programs Accredited by NBA
(CSE, ISE, ECE, EEE, MECH, CV)

Project Based Learning – Review

CONTINIOUS INTERNAL ASSESSMNET

Batch No.	Name of the Student	USN	**Phase I (25 Marks)**		**Phase II (25 Marks)**		**Final CIE Marks (Phase I & Phase II) (50 Marks)**
			Abstract / Understanding of the Project (5 Marks)	Analysis & Design (20 Marks)	Implementation (20 Marks)	Demonstration (5 Marks)	

Signature of the Guide
Signature of HOD

Signature of PBL Coordinator

Project Based Learning Outcomes

Sl. No	Batch No.	Name of Students	USN	Domain	Outcomes

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**V**				
Course Title	:	**Research Methodology and Intellectual Property Right (RMIPR)**				
Course Code	:	**BRM507A**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Category	:	**AEC**				
Stream	:	**Common to all branches**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**1:0:0:0**		**SEE**	:	**50**
Total Hours	:	**15 Hours**		**SEE Duration**	:	**1 Hour**
Credits	:	**01**				

Course Learning Objectives: Students will be able to:

1.	Understand the knowledge on basics of research and its types.
2.	Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
3.	Learn Ethics in Engineering Research.
4.	Discuss the concepts of Intellectual Property Rights in engineering

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts in C.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Scheme of Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction**: Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship. **Tools:** Undermind, Litmaps, Bohrium, Perplexity.	3
	Textbook1: Chapter1	
Pedagogy	**Think-Pair-Share**	
2	**Literature Review and Technical Reading**, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading. **Tools:** Google Scholar, IEEE Xplore, ACM Digital Library, PubMed, Scopus, Web of Science, arXiv, bioRxiv, Semantic Scholar, Connected Papers / Research Rabbit	3
	Textbook 1: Chapter2	
Pedagogy	**Literature Review Paper Writing and Demo of the same**	
3	**Paper Writing:** Identification of research problem, Paper writing as per IEEE format, Introduction to LaTeX, Plagiarism Checking **Attributions and Citations**: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations. **Tools:** Grammarly, QuillBot,LaTeX , Jenni.AI, Turnitin , Mendeley , Zotero, Scite.ai, PubMed, ResearchRabbit, Scispace, Speechify.	3
	Text Book1: Chapter 3.	
Pedagogy	**Case study, Patent Proposal Writing**	
4	**Introduction to Intellectual Property:** IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. **Patents:** Rights Associated with Patents, Enforcement of Patent Rights, Inventions Eligible for Patenting, Non-Patentable Matters, Patent Infringements, Avoid Public Disclosure of an Invention before Patenting. Process of Patenting, Prior Art Search. Choice of Application to be Filed. Patent Application Forms, Jurisdiction of Filing Patent Application, Publication, Pre-grant Opposition, Examination. Grant of a Patent, Validity of Patent Protection, Post-grant Opposition, Commercialization of a Patent, Need for a Patent Attorney/Agent. **Tools:** PatentPal, WIPO Lex/GPT-based querying, Google Patents, IPfolio/TurboPatent,WIPO, TrademarkNow Advisor, DesignSearch.ai, DesignShelf, Legal Robot	3
	Text Book1: Chapter 4,5,6	
5	**Copyrights and Related Rights**: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement **Trademarks**: Designation of Trademark Symbols. Classification of Trademarks. Registration	3

	of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India, Process for Trademarks Registration, Case Study: Coca-Cola Company vs. Bisleri International Pvt. Ltd. **Tools:** WIPO Lex, Google Scholar (Case Law), HeinOnline, LexisNexis / Westlaw, SCOPUS / Web of Science, Plagscan / Turnitin, WIPO Copyright Registration Tools, Scholarcy, Elicit	
	Text Book1: Chapter 7,8	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1.	Research Methodology and Intellectual Property Rights , Dr. Santosh M Nejakar, Dr. Harish Bendigeri, ISBN 978-93-5987-928-4, Edition: 2023-24.
Reference Books	
1.	Research Methods for Engineers, David V. Thiel , Cambridge University Press, 978-1-107-03488-4
2.	Intellectual Property Rights, N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
3.	Research Methodology – Methods and Techniques., C. R Kothari, Gourav Garg, New Age International Publishers.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Acquire the knowledge of research and conduct a literature review.	**Understand**	**L2**
CO2	Apply the knowledge of research design, Citations, and the concepts of research methodology to a problem.	**Apply**	**L3**
CO3	Write an effective research paper for a given problem statement and Analyze data collection methods.	**Analyze**	**L4**
CO4	Choose Indian patent applications, Patent laws, Gain the requirements about registration and infringements related to trademarks, & copyrights.	**Evaluate**	**L5**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	2	-	-	3	-	3	-	3	2	-	-	
CO2	-	-	-	2	2	-	-	3	-	3	-	3	-	-	-	
CO3	-	-	-	2	3	-	-	3	-	2	-	3	-	-	-	
CO4	-	-	-	-	2	-	-	3	-	3	-	3	-	2	2	

Weblinks and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc24_ge21/preview
2	https://archive.nptel.ac.in/content/syllabus_pdf/121106007.pdf
3	https://onlinecourses.nptel.ac.in/noc21_hs08/preview

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	-	-	-	-
Understand	20	-	10	-
Apply	20	10	20	20
Analyse	10	20	10	20
Evaluate	-	20	5	5
Create	-		5	5

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1(50)			Test-2(50)				
	Module -1	Module -2	Module 2 to 2.5	Module -2.5 to 3	Module -4	Module -5		

CO1	10	10	-	-	-	-	20	50 Marks
CO2	5	5	10	-	-	0	20	
CO3	5	5	-	10	10		30	
CO4	-	-	-	-	10	5	15	
CO5	-	-	-	-	-	15	15	
Tota l	20	20	10	10	20	20	100	

SEE- Semester End Examination (50 Marks)

Bloom's Category	**SEE Marks**
	(90% Theory+10% Practical Questions)
Remember	-
Understand	20
Understand	20
Understand	30
Understand	15
Understand	15

SEE Course Plan

CO's	**Marks Distribution**						**Total Marks**	**Weightage**
	Module -1	**Module -2**	**Modul e 2 to 2.5**	**Module -2.5 to 3**	**Module -4**	**Module -5**		
CO1	5	5	5	0	**0**	0	15	50 Marks
CO2	5	5	5	0	**5**	0	20	
CO3	5	5	0	5	**5**	5	25	
CO4	5	5	0	5	5	5	25	
CO5	**0**	0	0	0	5	10	15	
Tota l	20	20	10	10	20	20	100	

COs Mapped with POs and PSOs:

CO	**PO**	**PSO**
CO1	-	-
CO2	PO1,PO2,PO5	PSO1
CO3	PO1,PO2,PO5	-
CO4	PO1,PO3	PSO2
CO5	PO1,PO2,PO3,PO5,PO12	PSO1

Semester	**:**	**5**				
Course Title	**:**	**UI/UX**				
Course Code	**:**	**BCSL558B**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**AEC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**1:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**20**		**SEE Duration**	**:**	**2 Hours**
Credits	**:**	**1**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand user experience design requirements, with design goals, metrics and targets.
2	Explore different prototyping methods, UX design principles with case examples.
3	Understand the role of design thinking concepts and mental models in UX design.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Introduction: Usability to user experience, Emotional impact as part of user experience, User experience needs a business case. Extracting Interaction Design Requirements: Needs & Requirements, Formal requirement extraction, Methods for requirement extraction.	4
Pedagogy	**Presentation, Quiz**	
2	Design Thinking, Ideation, and Sketching: Design Thinking, Design Perspectives, User Personas, Ideation, Sketching. Mental Models and Conceptual Design: Storyboards, Design influencing user behaviour.	4
Pedagogy	**Collaborative Learning, Presentation**	
3	Design Production: Detailed Design, Wireframes. UX Goals, Metrics and Targets: UX Goals, UX Measures, Measurement instruments, UX Metrics.	4
Pedagogy	**Demonstration**	
4	Prototyping: Depth & breadth of a prototype, Fidelity of prototypes, Paper prototypes. Connections with Software Engineering: Foundations for success in SE-UX development, The challenge of connecting SE and UX.	4
Pedagogy	**Active Learning**	
5	UX Design Guidelines: Using and interpreting design guidelines, Human memory limitations, UX design guidelines & examples, Planning, Translation, Physical action, Outcomes, Assessment, Overall.	4
	Pedagogical Initiatives (Not limited to): **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another **Problem Solving:** encourages cognitive thinking and enables creative problem solving **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. **Case studies:** maps different domains in real time applications **Demonstration:** exhibits the implementation process	

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**

1	REX HARTSON and PARDHA S. PYLA, The UX Book-Process and Guidelines for Ensuring a Quality User Experience, Morgan Kaufmann, Elsevier, 2012.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain the user experience design requirements and UX design principles with case examples.	L3	Apply
CO2	Relate design thinking concepts and mental models to UX design.	L4	Analyze
CO3	Illustrate UX design in line with design goals, metrics and targets.	L5	Evaluates
CO4	Demonstrate different prototyping in relation with software engineering.	L6	Create

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3															
CO2		2														
CO3				2												
CO4			2		2	2										

Weblinks and Video Lectures (e-Resources)	
1	https://www.freecodecamp.org/news/ui-ux-design-tutorial-from-zero-to-hero-with- wireframe-prototype-figma/
2	https://www.edureka.co/blog/ui-ux-design-tutorial/
3	https://www.udemy.com/course/introtoux/

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	20	10		
Understand	20	10	10	

Apply	10	20	10	
Analyse		10	10	
Evaluate				10
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	**10**	**10**	**2.5**	**2.5**	**5**	**10**	**40**	**26.5%**
CO2	**10**	**10**	**2.5**	**2.5**	**5**	**10**	**40**	**26.5%**
CO3	**5**	**5**	**5**	**5**	**10**	**20**	**50**	**35%**
CO4			**2.5**	**2.5**	**5**	**10**	**20**	**14%**
Total	**25**	**25**	**12.5**	**12.5**	**25**	**50**		

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	**10% + 2%**
Understand	**20% + 2%**
Apply	**40% + 4%**
Analyse	**20% + 2%**
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution						Total Marks	Weightage
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	**20**	**10**	**5**	**5**			**40**	**40%**
CO2	**--**	**10**	**5**	**5**	**10**	**10**	**40**	**40%**
CO3	**--**	**--**	**--**	**--**	**10**	**10**	**20**	**20%**
CO4	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Total	**20**	**20**	10	**10**	**20**	**20**	**100**	**100%**

Semester	**:**	**6**				
Course Title	**:**	**Cloud Computing**				
Course Code	**:**	**BCS601**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Integrated**				
Category	**:**	**IPCC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L: T:P:S)	**:**	**3:0:2:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**50**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	**Understanding Cloud Fundamentals:** Gain a comprehensive **understanding** of the core principles, architecture, and business drivers behind cloud computing and distributed systems.
2	**Mastering Virtualization: Apply** the ability to implement and manage virtualization technologies, including virtual machines, data centre automation, and resource optimization.
3	**Ensuring Network Support and Cloud Security: Analyze** the network support and cloud security best practices, including risk assessment, data protection, encryption techniques, and Defense mechanisms against cyber threats
4	**Designing Cloud Architectures: Design and evaluate** cloud-native applications, focusing on service models, data-centre infrastructure, and inter-cloud resource management
5	**Cloud Technologies: Build** hands-on skills in deploying and managing cloud-based applications using platforms like Google Cloud, AWS, and Microsoft Azure through real-world projects and experiments

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts in C.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction**: Distributed System Models and Enabling Technologies Introduction, Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency.	8
Pedagogy		
2	**Virtual Machines and Virtualization of Clusters and Data Centres** 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-Centre Automation	8
Pedagogy		
3	**Cloud Platform Architecture over Virtualized Data Centres** Cloud Computing and Service Models - Data-Centre Design and Interconnection Networks- Architectural Design of Compute and Storage Clouds - Public Cloud Platforms: GAE, Aws, And Azure - Inter-Cloud Resource Management.	8
Pedagogy		
4	**Cloud Programming and Software Environments** Features of Cloud and Grid Platforms, Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment.	8
Pedagogy		
5	**Cloud Security**- Cloud Security Risks -Security: The Top Concern for Cloud Users – Privacy and Privacy Impact Assessment – Trust - Operating System Security- Virtual Machine Security – Security of Virtualization - Security Risks Posed by Shared Images – Security Risks Posed by a Management OS	8
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving	

	• **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

List of Programs:

Sl. No.	Experiments/Programs	COs
1	Install VirtualBox or VMware Workstation and any operating systems as virtual machine, install a C compiler on a virtual machine created using VirtualBox and execute simple C programs	**CO5**
2	Find a procedure to transfer the files from one virtual machine to another virtual machine.	
3	To demonstrate a simple cloud computing task using R by uploading and downloading a file from Google Drive.	**CO5**
4	To fetch the current date and time, real-time weather data from an online cloud API (Open Weather Map API).	
5	Exploring AWS Cloud Shell and the AWS Cloud9 IDE	**CO5**
6	Working with Amazon S3. Developing Storage Solutions.	**CO5**
7	Introduction to AWS databases. Working with Dynamo Database.	**CO5**
8	Developing Rest API's and controlling access to Rest Api's.	**CO5**
9	Creating event driven serverless functions using AWS SDK.	**CO5**
10	Migrating Docker and Docker containers with AWS Container Services,	**CO5**
	Open ended Programs	
1	Create and Manage Cloud Resources: Challenge Lab: In this lab, Students will use the Google Cloud Console and the cloud command-line tool to create and manage various cloud resources. Start by provisioning virtual machines with specific configurations, such as CPU and memory requirements, and setting up storage buckets for data persistence. Students also manage IAM roles to control access to these resources, ensuring that only authorized users can perform actions. The lab emphasizes the importance of understanding the relationships between different Google Cloud services and how to configure them to work together effectively. Successful completion requires a careful approach to resource management, including monitoring, security settings, and cost optimization.	
2	**Set Up an App Dev Environment on Google Cloud: Challenge Lab:** This lab focuses on setting up a complete development environment on Google Cloud, starting with configuring Cloud Shell and installing the necessary development tools. Students work with Cloud SDK and other programming languages or frameworks required for your application. After setting up the environment, deploy a sample application to test the configuration and ensure that the environment is fully functional. This lab highlights the importance of creating a robust and scalable environment that can support continuous development and deployment processes. Additionally, you must ensure that the environment is optimized for performance and ready to handle real-world application development and testing on Google Cloud.	

Continuous Internal Evaluation (CIE) for the Theory component of the IPCC (Maximum marks 50)

Internal Assessment Test (IAT):

IPCC means practical portion integrated with the theory of the course. CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.

- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 50 Marks with 01-hour 30 minutes" duration, are to be conducted and average of two tests to be reduced to 15 marks) and 10 marks for Two Conti Comprehensive Assessment (CCA) methods

The first Internal test at the end of 40-50% coverage of the syllabus

- The second Internal test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student must secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Revised Blooms Taxonomy (RBT) Levels. Emphasis to be given for Higher order Thinking Skills (HOTS).

Continuous Internal Evaluation (CIE) for the practical component of the IPCC

On completion of every experiment/program in the laboratory, the students shall be evaluated, and Marks shall be awarded on the same day.

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report, 05 Marks are for conducting the experiment, 05 Marks for preparation of the laboratory record, 5 Marks for conducting Open Experiments Each experiment. Marks of all experiments" write-ups are added to 15 marks.
- The Practical laboratory test (duration 03 hours) at the end of the 15th week of the semester/after completion of all the experiments (whichever is early) shall be conducted for 50 Marks and scaled down to 5 Marks.
- The open-ended experiment after completion of all the experiments shall be conducted for 20 marks with a split-up for 5 Marks for writeup, 10 Marks for Execution, and 5 Marks for Viva-Voce. Marks for writeup, Execution and Viva-Voce is added and scaled down to 05 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks student must secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks** Marks scored will be (CCA1+CCA2)/2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The Assessment will be through rubrics.
- CCA as project-based learning, o CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes demonstration/competition and report submission.

The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report Total score for CCA is **10 Marks** Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks** **Po**

Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/ Poster presentation), Case studies, Think-Pair-Share, flipped classroom.
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method for implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Kai Hwang, Geoffrey C Fox, and Jack J Dongarra, Distributed and Cloud Computing, Morgan Kaufmann, Elsevier 2012
2	Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, 2nd Edition, Elsevier 2018

Reference Books

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

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand** the fundamental concepts, models, and enabling technologies of stributed and cloud computing environments.	U	L2
CO2	**Apply the techniques of virtualization and resource management in data centers and cloud platforms.**	A	L3
CO3	**Analyze cloud platform architectures, service models, and inter-cloud resource management strategies for efficient application deployment.**	An	L4
CO4	**Evaluate** cloud security challenges, including data privacy, encryption, and intrusion detection mechanisms, to ensure secure cloud operations.	E	L5
CO5	**Develop and deploy** cloud-based applications, VM's using platforms like Google Cloud, AWS, and Azure, applying practical skills in real-world scenarios	D	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1													2		1	
CO2	3															
CO3		3														
CO4				3	3				2	2				1	1	
CO5			3		3				2	2		2				

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

Semester	**:**	**6**				
Course Title	**:**	**Software Engineering, Design Patterns and Project Management**				
Course Code	**:**	**BCS602**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Integrated**				
Category	**:**	**PCC**				
Stream	**:**	**ICSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:2:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**50**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand Software Process Models, Software Engineering.
2	Illustrate the Requirements Process. Apply Requirement Engineering techniques to develop Requirement specification model as per standards
3	Design Software using UML Models and Design Patterns
4	Design Project Management Techniques to Manage Software Development and Software Quality Management
5	Resolve bugs with Debugging techniques and System Test Software using Test Cases

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts in C.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Module 1:Software Engineering Overview** Introduction to Software Engineering Software Engineering Fundamentals: Defining software engineering, the role of software in modern systems, and the importance of a systematic approach. Software Development Processes: Exploring different process models (e.g., Waterfall, Iterative, spiral, Incremental) and their applicability. Agile Software Development: Principles and practices of agile development (e.g., Scrum, Kanban).	**8**
Pedagogy		
2	**Module 2: Software Requirements** Requirements Engineering, Requirements Elicitation and Analysis: Techniques for gathering functional and non-functional requirements from stakeholders, using interviewing, prototyping, and use case analysis. Requirements Specification: Formalizing requirements using various notations (e.g., use case diagrams, Domain diagrams). Documenting Requirements Requirements Validation and Verification and Management, Pair Reviews	**8**
Pedagogy		
3	**Module 3: Software Design** Software Design UML Diagrams: Learning and applying UML diagrams (e.g., class diagrams, sequence diagrams, State diagrams) for modelling software systems. Application of Models on Real world Applications Design Patterns: Studying and applying common design patterns (e.g., Creator, Information Expert, Factory, Singleton, Observer) to solve recurring design problems. Understanding different architectural styles and patterns (e.g., layered architecture, Client Server architecture)	**8**
Pedagogy		
4	**Module 4: Software Project Management** Project Management Basics Introduction to PM, Project and activity Planning Project Monitoring and Control Managing Tasks, People and Teams	**8**

	Software Quality Management Software Metrics: Using metrics to measure software quality and identify areas for improvement. Software Configuration Management: Managing different versions of software and its components.	
Pedagogy		
5	**Module 5: Software Testing** Software Debugging and Testing Debugging: Identifying and resolving software defects. Testing Strategies: Different types of testing (e.g., unit testing, integration testing, system testing, acceptance testing). Test Case Design: Creating effective test cases to verify the functionality and quality of software. Real world examples Test Driven Development,	**8**
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

List of Programs:

Sl. No.	Experiments/Programs	COs
1	Conduct customer Interviews and develop Requirements for a case study given. Get Functional, Non Functional requirements and document the same using Standard template (Group)	**CO5**
2	Use of Agile Process in Software Development (Any program development)	**CO5**
3	Use of Test Driven Development (Any application Development) (Paired)	**CO5**
4	Use of UML tool/ for developing Use case diagram (Paired activity)	**CO5**
5	Use of UML tool for developing System Sequence Diagrams (Paired activity)	**CO5**
6	Use of UML tool for developing Class diagrams (Paired activity)	**CO5**
7	Develop program for Design Patterns using Agile approach, Test the same (Group)	**CO5**
8	Develop software programs in Java/ Python for Design Patterns using Waterfall Model. Test the same (Paired activity)	**CO5**
9	Use of Configuration Management/ version control in software development (paired)	**CO5**
10	Develop test case and use the same for System testing software. Generate Test Reports (Paired activity)	**CO**
Open ended Programs		
1	Conduct a Requirement document Review in a team consisting of roles (5) Author (meeting coordinator), BA, PM, Designer, and Coder roles, Produce MOM of the meeting. (Group activity)	
2	Conduct Project Plan Review meeting to understand status of Project with roles Produce MOM of the meeting. The roles (5) are PM (coordinator), BA, Designer, Coder and Tester, Produce report of the meeting (Group activity)	

CIE (Integrated Professional Core Course (IPCC)):
This Course refers to professional theory core course integrated with practical. Credit for this course can be 03 and its Teaching Learning hours (L : T : P: S) can be considered as (2 : 0 : 2 : 0).
15 marks for the conduction of practical experiment and preparation of the Laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
On completion of every program in the laboratory, the student shall be evaluated including viva-voce and marks shall be awarded on the same day.
Each program report can be evaluated for **15 marks** (Write-up – 3 marks, Execution – 8 marks .and Viva – 4 marks)
The Laboratory test (duration 2 hours / 3 hours) after completion of all the programs shall be conducted for 50 marks and scaled down to **10 marks.**
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. This course is common to all branches of first year B.E/B.Tech. 2023-24 regulation.
Note: L- Theory Lecture, T- Tutorial, P-Practical, S-Project, IPCC: Integrated Professional Core Course, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Ian Sommerville, (2016). Software Engineering (10th ed.). Addison-Wesley.
2	Hughes, Cotterell, Software Project Management, 2011, (5^{th} edition), McGraw Hill (India),
Reference Books	
1	Booch, G., Rumbaugh, J., & Jacobson, I. (1999). UML User Guide. Addison-Wesley.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand and Apply Software Engineering Principles and Software Process Models,	**Understand**	**L2**
CO2	Illustrate the Requirements Process. Apply Requirement Engineering techniques to develop Requirement specification model as per standards	**Apply**	**L3**
CO3	Analyse and Design Software using UML Models and Design Patterns	**Analyse**	**L4**
CO4	Design Project Management Techniques to Manage Software Development and Apply Software Quality Management principles	**Analyse/ Create**	**L4 / L5**
CO5	Apply Testing Principles to Resolve bugs with Debugging techniques and System Test Software also Creating Test Cases	**Create**	**L5**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2						1	1					2	
CO2	3	2	2						1	1					2	
CO3	3	3	2						2	2				2	3	
CO4	3	3	2						2	2	2				1	
CO5	3	2	3	2	1				2	2				2	2	

Weblinks and Video Lectures (e-Resources)	
1	**Software Engineering Video Lectures from NPTEL, IIT, MIT, Stanford** NPTEL Software Engineering Video Lectures
2	**Requirements and Design Videos Supporting Software Engineering Concepts** Software Engineering Book - Video Lectures on Requirements and Design
3	**Software Engineering: Software Design and Project Management | Courser** Coursera - Software Engineering: Software Design and Project Management
4	**Project Quality Management Video Lecture by Prof. Rushikesh K Joshi of IIT Bombay** Free Video Lectures - Project Quality Management
5	**Software Engineering Tutorial | GeeksforGeeks** GeeksforGeeks - Software Engineering Tutorial

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**6th**				
Course Title	**:**	**Artificial Intelligence**				
Course Code	**:**	**BCS603**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PCC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Introduce the basic principles and theories underlying artificial intelligence, including machine learning, neural networks, natural language processing, and robotics.
2	Apply AI techniques to solve real-world problems, including search algorithms, optimization, and decision-making processes.
3	Appraise the ethical, legal, and societal implications of AI, including topics such as bias, fairness, accountability, and the impact of AI on the workforce and privacy.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction:** What is AI? Foundations and History of AI Intelligent Agents: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents. Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4	**8**
Pedagogy	**Role play**	
2	**Problem-solving:** Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search; Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4	**8**
Pedagogy	**Problem Solving**	
3	**Informed Search Strategies:** Heuristic functions, Greedy best first search, A*search. Heuristic Functions Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic Text book 1: Chapter 3-3.5,3.6 Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5	**8**
Pedagogy	**Presentation**	
4	**First Order Logic:** Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. Inference in First Order **Logic:** Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution Text book 1: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5	**8**
Pedagogy	**Poster Presentation**	
5	**Uncertain Knowledge and Reasoning**: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited **Expert Systems:** Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6 Text Book 2: Chapter 20	**8**
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Stuart J. Russell and Peter Norvig, Artificial Intelligence, 3rd Edition, Pearson,2015
2	Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill,2013
Reference Books	
1	George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
2	Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3	Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand and explain** the architecture and components of intelligent agents, including their interaction with the AI environment	**L2**	**U**
CO2	**Apply** problem-solving agents and various search strategies to solve a given problem.	**L3**	**AP**
CO3	**Analyse** logical reasoning and knowledge representation using propositional and first-order logic.	**L4**	**AN**
CO4	**Demonstrate** proficiency in representing knowledge and solving problems using first-order logic.	**L5**	**EV**
CO5	**Implement** expert system in the context of artificial intelligence, including its goals, constraints, and applications in problem-solving**.**	**L6**	**CR**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	**3**													**2**		
CO3		**3**												**2**		
CO4				**3**	**3**										**2**	
CO5			**3**						**3**	**3**					**2**	

Weblinks 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/

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	25 Marks	25 Marks
Remember+ Understand	20	10		
Apply	20	10	10	
Analyse	10	20	10	
Evaluate		10	5	15
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	5	5	5	5	5	35	35%
CO2	10	10	5	5	10	10	50	50%
CO3		5			5	5	15	15%
CO4								
CO5								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember+ Understand	12%
Apply	23%
Analyse	44%
Evaluate	21%
Create	

SEE Course Plan

CO's	Marks Distribution						Total Marks	Weightage
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	20	10	5	5			40	40%
CO2	--	10	5	5	10	10	40	40%
CO3	--	--	--	--	10	10	20	20%
CO4	--	--	--	--	--	--	--	--
CO5	--	--	--	--	--	--	--	--
Total	20	20	10	10	20	20	100	100%

Semester	**:**	**6**				
Course Title	**:**	**Blockchain Technology**				
Course Code	**:**	**BCS604A**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PCC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Explain the fundamentals of distributed computing and blockchain
2	Discuss the concepts in bitcoin
3	Appraise the concept of Hyperledger
4	Illustrate the different decentralised algorithms
5	Demonstrate Ethereum platform

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts in C.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.

5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

COURSE CURRICULUM

Module No.	Topics	Hours
1	Blockchain 101: Distributed systems, History of blockchain, How blockchain works, Types of Blockchain,CAP theorm and blockchian, Benefits and limitations of blockchain. Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency	**8**
Pedagogy	**Chalk and Board, Oral Presentation, Demonstration**	
2	Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations. How Bitcoin Achieves Decentralization: Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work	**8**
Pedagogy	**Chalk and Board, Demonstration**	
3	Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets	**8**
Pedagogy	**Chalk and Board, Problem Based Learning**	
4	Smart contracts and Ethereum 101: smart contracts: definition, Ricardian contracts, Etherium 101: introduction, Etherem blockchain, Elements of the ethereum blockchain, precompiled contracts.	8

Pedagogy	Chalk and Board, Handson Learning	
5	Hyperledger: Architecture, Projects under Hyperledger, Hyperledger Fabric, Hyperledger Sawtooth. Block chian - outside of currencies: Internet of things, Government, Health, Finance, Media.	8
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017.
2	Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016.
3	Andreas M. Antonopoulos and Dr. Gavin Wood m: Mastering Ethereum Building Smart Contracts and DApps , First edition , O'Reilly, 2018
Reference Books	
1	Mastering Bitcoins: Unlocking Digital Cryptocurrencies by Andreas Antonopoulos. O'Reilly Media, Inc, 2013.
2	Diedrich, H., Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations, 2016, 1st Edition, Wildfire publishing, Sydney.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the fundamentals of blockchain and cryptocurrencies	U	L1, L2
CO2	Apply the fundamentals, technologies and models of blockchain	A	L3
CO3	Analyze the function of Blockchain as a method of securing distributed ledgers in different case studies	An	L4
CO4	Design secure decentralization algorithm using block chains for real time use cases	An	L4
CO5	Develop decentralised systems using bitcoin and Etherum platform to implement the Block chain Application	An	L4

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3												1	
CO3		2											1	
CO4				2	1				2	2			1	
CO5			2		1				2	2			1	

Weblinks and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2	https://www.mygreatlearning.com/academy/learn-for-free/courses/blockchain-basics
3	https://www.simplilearn.com/tutorials/blockchain-tutorial
4	https://www.geeksforgeeks.org/blockchain/

Computer Science & Engineering

3 Credits – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	----	----	**20**	
		Internal Assessment Test	Module - 3 & 4	50				
		Internal Assessment Test (IAT) - III	Module - 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives	Considering all the Modules	50	(50+50) / 2	**25**	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives		50				
	Total CIE Theory					**50**	20	Scale down Marks of IAT and CCA to 50

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	18	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
CIE + SEE				100	----	----	40	

- The Minimum Marks to be secured in CIE to appear for SEE shall be 10 (40% of Maximum Marks – 25) in the Theory Component and 10 (40% of Maximum Marks – 25) in the Practical component.
- The Laboratory Component for the IPCC shall be for CIE only.
- However, in SEE, the Questions from the Laboratory Component shall be included in the respective Modules only.

Note: If few of the 3 Credit Courses are Integrated course type, for such courses the method suggested for 4 Credit IPCC Course shall be followed

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory				
	Continuous Assessment Tests			Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	IAT-3	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks	50 Marks
Remember	10	10			
Understand	10	10	10		
Apply	20	15	30		
Analyse	10	15	10	25	25
Evaluate				25	25
Create					

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1		Test-2		Test-3			
	Module-1	Module-2	Module-3	Module-4	Module-4	Module-5		
CO1	10	5	5	5	5	5	35	35%
CO2	10	10	5	5	10	10	50	50%
CO3		5			5	5	15	15%
CO4								
CO5								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember+ Understand	15%
Apply	60-70%
Analyse	10-15%
Evaluate	-
Create	-

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	15	10		5	5	35	35
CO2	05	10	10	10	10	45	45
CO3			10	5	5	20	20
CO4							
CO5							
Total	20	20	20	20	20	100	100

3 Credit Course – Theory

The Minimum Marks to be secured in CIE to appear for SEE shall be 10 (40% of Maximum Marks – 25) in the Theory Component and 10 (40% of Maximum Marks -25) in the Practical Component. The Laboratory Component of the IPCC shall be for CIE only. However, in SEE the questions from the Laboratory Component shall be included in the respective Modules only.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum Marks (20 Marks out of 50).
The minimum passing mark for the SEE is 35% of the maximum Marks (18 Marks out of 50).
A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 Marks out of 100) in the total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Possible continuous and comprehensive assessment:
Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom, storytelling. The assessment of these techniques can be either based on Quiz or rubrics.
The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Continuous Internal Evaluation (CIE):
The CIE Marks for the theory component of the IC shall be **25 Marks** and for the laboratory component **25 Marks**.

CIE for the theory component of the IC
Internal Assessment test:

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Three Tests each of **50 Marks** scaled down to **25 Marks**

- First test after 6th week of the semester (syllabus completion of 35 – 40%)
- Second test after 10th week of semester (syllabus completion of 65 – 70%)
- Third test after 14th week of semester (syllabus completion of 90 – 100%)

The average score of three test is taken and scaled down to **15 Marks.**

Continuous and Comprehensive Assessment (CCA):
Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,

- CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
- The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

CIE for the practical component of the IC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and Marks shall be awarded on the same day. The **10 Marks** are for conducting the experiment and preparation of the laboratory record, the other **10 Marks shall be for the test** conducted at the end of the semester and **5 Marks** for conducting Open Ended Experiments.
- The CIE Marks awarded in the case of the practical component shall be based on the continuous evaluation of the laboratory report and the conduction. Each experiment report can be evaluated for 05 Marks conduction(Observation Book) and 5 Marks for Record Book. Marks of all experiments' write-ups and conduction are added and scaled to **10 Marks.**
- The Practical laboratory test **(duration 03 hours)** at the end of the 15th week of the semester/after completion of all the experiments (whichever is early) shall be conducted for **50 Marks** and scaled down to **10 Marks.**
- Open Ended Experiments are conducted after the completion of regular Experiments/Programs for 20 Marks and scaled down to **5 Marks**
- Scaled-down Marks of write-up, evaluations and tests, will be added as CIE Marks for the laboratory component of IC/IPCC for **25 Marks**.
- The minimum Marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum Marks) in the theory component and 10 (40% of maximum Marks) in the practical component.
- The laboratory component of the IC/IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 05 questions is to be set from the practical component of IC/IPCC, the total Marks of all questions should not be more than 25 Marks.

The theory component of the IC shall be for both CIE and SEE.

Semester End Examination (SEE):

- Theory SEE will be conducted as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**
- The question paper shall be set for 100 Marks. The medium of the question paper shall be English. The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 Marks. The student has to answer 5 full questions, selecting one full question from each module summing up to maximum score of 100 Marks. Marks **scored out of 100 shall proportionally be reduced to 50 Marks**.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module. The two questions should be of same course outcome, program outcome and Blooms RBT level. Emphasis to be given for higher order RBT levels

Semester	**:**	**6**				
Course Title	**:**	**Big Data Analytics**				
Course Code	**:**	**BCS604B**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PCC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Credits (L: T:P:PJ)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40h**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives: Students will be taught

Sl.No	Course Objectives The students will be able to
1	Understand fundamentals and applications of Big Data analytics
2	Explore the Hadoop framework and Hadoop Distributed File system and essential Hadoop Tools
3	Illustrate the concepts of NoSQL using Spark for Big Data
4	Employ MapReduce programming model to process the big data
5	Understand various machine learning and Data Mining Concepts for Big Data Analytics

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.

7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.

DSATM

Scheme of Teaching and Examinations for BE Programme -2023-24
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2023-24)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module1: Introduction to Big Data Analytics** Classification of Data, Big Data Definitions,Big Data types ,characteristics,Big Data classification,scalability and parallel processing,Big Data architecture,Data Sources, Data quality,Data Preporcessing, Big data Analytics reference model,Berkley Data Analytics Stack(BDAS),Cloud and Bigdata,Apppications and casestudies. **Textbook 2:** : **Chapter 1- 1.1; Chapter 2- 2.1, 2.2, 2.3, 2.4,2.5,2.7,2.9,2.10,2.11; Chapter 3- 3.2, 3.5,3.8,3.12; Chapter 4- 4.1, 4.2.**	**5hrs**
Pedagogy	**Chalk and board, practical based learning**	
2	**Module 2: Introduction to Hadoop** **Introduction to Hadoop:** Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools**.** Hadoop Distributed File System Basics **:** HDFS Design Features, Components, HDFS User Commands. **Textbook 2: Chapter 5- 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.10,5.11,5.12; Chapter 8- 8.1,8.2,8.3,8.4,8.5,8.6,8.7,8.8.**	**5hrs**
Pedagogy	**Chalk and board, Demonstration, presentation, practical based learning, collaborative learning**	

3	**Module 3: Introduction to MongoDB and Cassandra Databases** NoSQL introduction, No SQL Data stores ,ACID properties ,CAP theorem in Big Data Solutions, Schemaless models, BASE properties,No SQL Data Structure pattern s,No SQL to manage Big Data, Types of Bigdata problems due to limitations of SQL,Comparison between NoSQL and SQL/RDBMS ,Shared Nothing Architecture Mongo DB Features, Data Types, commands, Cassandra Databases **Textbook 2 : Chapter 3: 3.1,3.2,3.4** **Textbook 1 : Chapter 6: 6.1,6.2,6.3,6.4,6.5.**	**5hrs**
Pedagogy	**Chalk and board, Demonstration, problem solving,video/Animation, practical based learning, collaborative learning**	
4	**Module 4: Map reduce , Hive and Pig** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Introduction to Hive,Hive Architectue,Hive Installation,Hive Data Types,Hive builtin functions, HiveQL, Hive DDL,Hive QL DML,Hive QL for querying data ,Introduction to Pig,Pig architecture,Apache Pig,Pig Data Types ,Pig latin data model,order of processing pig data model, Pig latin scripts**,** Relational operations in Pig **Textbook 2: Chapter 4: 4.2.1 – 4.2.8; 4.3.1-4.3.4** **Textbook 1: Chapter 9: 9.1,9.2,9.3,9.4,9.5,9.6,9.8;** **Chapter 10: 10.1-10.15,10.22;**	**5hrs**
Pedagogy	**Chalk and board, Practical based learning,Higher order thinking**	
5	**Module 5:** **Spark and Big Data analytics**: Spark, Introduction to Data Analysis with Spark **Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics: **Textbook 2: Chapter 5: 5.1,5.2,5.3** **Chapter 9: 9.1,9.2,9.3,9.4**	**5hrs**
Pedagogy	**Chalk and board, practical based learning,Higher order thinking,**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Seema Acharaya and Subhashini Chellappan “Big Data Analytics” Wiley India Publishers,2nd Edition,2019
2	Rajkamal and Preeti Saxena,”Big data Analytics,Introduction to Hadoop,Spark and Machine learning”,McGraw Hill Publication,2019
3	Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1 stEdition, Pearson Education, 2016. ISBN13: 978-9332570351
4	Tom White, “Hadoop: The Definitive Guide”, 4 th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672
5	Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1 stEdition, Wrox Press, 2014ISBN-13: 978-8126551071

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand fundamentals and applications of Big Data analytics	UNDERSTAND	L1,L2
CO2	Explore the Hadoop framework and Hadoop Distributed File system and essential Hadoop Tools	UNDERSTAND	L2
CO3	Illustrate the concepts of NoSQL using Spark for Big Data	APPLY.ANALYSE	L3,L4
CO4	Employ MapReduce programming model to process the big data	APPLY	L4
CO5	Understand various machine learning and Data Mining Concepts for Big Data Analytics	UNDERSTAND	L1

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2	**2**											

CO3		**2**									
CO4				**1**					**1**	**1**		
CO5			**2**		**1**				**1**	**1**		

PSO1	PSO2	PSO3	PSO4
1	**1**		
1	**1**		
1	**1**		
1	**1**		
1	**1**		

Weblinks and Video Lectures (e-Resources)	
1	1. https://www.youtube.com/watch?v=n_Krer6YWY4
2	2. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
3	3. https://www.digimat.in/nptel/courses/video/106104189/L01.html
4	and Video Lectures (e-Resources):

Assessment Pattern (both CIE and SEE)

4 Credit Course – IPCC

Assessment Method	Component	Type of Assessment	Assessment Type used	Max. Marks	Evaluation Details	Reduced Marks	Min. Marks	Total
	Theory	AAT	Pedagogical Initiatives	10	Any two assessment Methods as per VTU Clause 22OB4.2 of regulations (If assessment is Project Based Learning,	10	4	10

CIE					then one assessment method may be adopted).			
		Test-1	Theory	25	Average of two Internal Assessment Tests each of 25 Marks, scale down the Marks to 15 Marks	15	6	15
		Test-2	Theory	25				
						Total CIE Theory	**10**	**25**
	Lab	Conduction of Experiments	Performance with Record & Observation Book	15	Conduction of Experiments and Preparation of Laboratory Records	15	6	25
		CIE Practical test	Evaluation & Viva-Voce	10	One test after conduction of all Experiments	10	4	
						Total CIE Practical	**10**	**25**
SEE				**100**	SEE Exam is Theory Exam, conducted for 100 Marks, scored marks are scaled down to 50 marks	**50**	**18**	**50**
						CIE+SEE	**40**	**100**
	The Minimum Marks to be secured in CIE to appear for SEE shall be 10 (40% of Maximum marks – 25) in the Theory Component and 10 (40% of Maximum Marks -25) in the Practical Component. The Laboratory Component of the IPCC shall be for CIE only. However, in SEE the questions from the Laboratory Component shall be included in the respective Modules only.							

3 & 2 Credit Course

Assessment Method	Component	Type of Assessment	Assessment Type used	Max. Marks	Evaluation Details	Reduced Marks	Min. Marks	Total
CIE	Theory	AAT	Pedagogical Initiatives	25	Any two assessment Methods as per VTU Clause 22OB4.2 of regulations (If assessment is Project Based Learning, then one assessment method may be adopted).	25	10	25
		Test-1	Theory	25	Average of two Internal Assessment Tests each of 25 Marks	25	10	25
		Test-2	Theory	25				
	Total CIE Theory						**20**	**50**
SEE				**100**	SEE Exam is Theory Exam, conducted for 100 Marks, scored marks are scaled down to 50 marks	**50**	**18**	**50**
CIE+SEE							**40**	**100**
	Note: A few of the Courses of 3 Credit are Integrated Course Type, for such courses the method suggested for 4 Credit IPCC shall be followed.							

1 Credit Course

Assessment Method	Component	Type of Assessment	Assessment Type used	Max. Marks	Evaluation Details	Reduced Marks	Min. Marks	Total
		AAT		25	Any two assessment Methods as per VTU Clause 22OB4.2 of	25	10	25

CIE	Theory		Pedagogical Initiatives		regulations (If assessment is Project Based Learning, then one assessment method may be adopted).			
		Test-1	Theory	25	Average of two Internal Assessment Tests each of 25 Marks	25	10	25
		Test-2	Theory	25				
	Total CIE Theory						**20**	**50**
SEE				**50**	MCQ type question papers of 50 Questions with each question of 1 mark, Examination duration is 1 Hour	**50**	**18**	**50**
CIE+SEE							**40**	**100**
	Note: A few of the Courses of 3 Credit are Integrated Course Type, for such courses the method suggested for 4 Credit IPCC shall be followed.							

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Theory**			**Practical**
	Continuous Assessment Tests		**Alternative Assessment Tool (AAT)**	**Test**
	Test-1	**Test-2**		
	25 Marks	**25 Marks**	**10 Marks**	**25 Marks**
Remember	**10**	**5**		**5**
Understand	**10**	**5**		**5**
Apply	**5**	**10**		**10**
Analyse		**5**		**5**
Evaluate			**5**	

Create			**5**	

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	5	5	5	5	5	35	35%
CO2	10	10	5	5	10	10	50	50%
CO3		5			5	5	15	15%
CO4								
CO5								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (100% Theory)
Remember + Understand	12%
Apply	22%
Analyse	44%
Evaluate	22%
Create	-
	-

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	20	10	10			40	40%
CO2		10	10	10	10	40	40%
CO3				10	10	20	20%
CO4							
CO5							
Total	20	20	20	20	20	100	

Course Contents and Lecture Schedule

Module No.	Topics	No. of Lectures
1	**Module1:Introduction to Big Data Analytics**	1
	Applications of Big Data Analytics	1
	Big Data, Scalability and Parallel Processing	1
	Designing Data Architecture, Data Sources	1
	Quality, Pre-Processing and Storing	1
	Data Storage and Analysis	1
	Big Data Analytics Applications	1
	Case Studies	1
2	**Module2: Introduction Hadoop and its Ecosystem**	1
	Hadoop Distributed File System	1
	MapReduce Framework and Programming Model	1
	Hadoop Yarn	1
	Hadoop Ecosystem Tools.	1
	Hadoop Distributed File System Basics : HDFS Design Features	1
	Components, HDFS User Commands.	1
	Essential Hadoop Tools: Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.	1
3	**Module3: Introduction to MongoDB and Cassandra Databases:** Introduction to MongoDB	1
	NoSQL Data Store,	1
	NoSQL Data Architecture Patterns,	1
	NoSQL to Manage Big Data	1

	Shared-Nothing Architecture for Big Data Tasks	**1**
	MongoDB	**1**
	Databases	**1**
	Cassandra Databases	**1**
4	**Module4:Map Reduce,Hive and Pig**	**1**
	Introduction, MapReduce Map Tasks	**1**
	Reduce Tasks and MapReduce Execution	**1**
	Reduce Tasks and MapReduce Execution	**1**
	Composing MapReduce forCalculations and Algorithms	**1**
	Hive,Pig.	**1**
	HiveQL	**1**
	Pig	**1**
5	**Module5:Spark and Big Data analytics**: Spark, Introduction to Data Analysis with Spark	**1**
	Introduction to Data Analysis with Spark	**1**
	Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining	**1**
	Finding Similar Items, Similarity of Sets ,Collaborative Filtering, Frequent Itemsets	**1**
	Association Rule Mining, Text, Web Content, **Link,** and Social Network Analytics: Introduction	**1**
	Text mining, Web Mining, Web Content and Web Usage Analytics	**1**
	Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs	**1**
	Total	**40 Hrs**

PROFESSIONAL ELECTIVE COURSE (PEC)

PEC Course - Professional Elective Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0
Total Hours of Pedagogy	40 hours
Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Professional Elective Course (PEC)

Assessment Details (both CIE and SEE)

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (20 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks. Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
  - The first test will be administered after 40-50% of the syllabus has been covered, and
  - The second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods

of assessment.

- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students must answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,
    - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
    - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **50 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Professional Elective Course (PEC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	----	----	**20**	
	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	(50+50) / 2	**25**	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory					**50**	20	Total Marks of IAT and CCA is 50

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
			CIE + SEE	100	----	----	40	

Semester	**:**	**6**				
Course Title	**:**	**Advanced Java**				
Course Code	**:**	**BCS604C**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PEC-2**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	**Understand** the fundamental concepts of collection framework and string operations supported in Java.
2	**Apply** Java programming principles to develop simple applications using collections and strings.
3	**Analyze** the concept of swings and servlets to build java applications.
4	**Design and Develop** Web applications using Java servlets and JSP with JDBC for database connectivity

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

COURSE CURRICULUM

Module No.	Topics	Hours
1	**The collections and Framework:** Collections Overview, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Arrays, The legacy Classes and Interfaces Text Book 1: Ch. 20	8
Pedagogy	**Problem-Solving Sessions**	
2	**String Handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, joining strings, Additional String Methods, StringBuffer , StringBuilder Text Book 1: Ch 18	8
Pedagogy	**Brainstorming Activity**	
3	**Introducing Swing:** The Origin of Swing, Swing Is Built on AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Painting in Swing. Exploring Swing : JLabel and ImageIcon,JTextField,The Swing Buttons-JButton, JToggleButton, Check Boxes, Radio Buttons Text Book 1: Ch 32 and Ch. 33	8
Pedagogy	**Live Coding Session**	
4	**Introducing servlets:** Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Jakarta. Servlet Package; Reading Servlet Parameter; The Jakarta. servlet. http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP); JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects. Text Book 1: Ch 36 Text Book 2: Ch 11	8
Pedagogy	**Live Coding Session**	
5	JDBC Objects: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.	8

	Text Book 2: Ch 06	
Pedagogy	**Hands-On Practice**	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Herbert Schildt: JAVA the Complete Reference. Twelfth Edition, Tata McGraw-Hill.
2	Jim Keogh, The Complete Reference J2EE, Tata McGraw-Hill 2007.
Reference Books	
1	Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2	Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.
3	Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand the different collections, string operations supported in Java**	**L2**	**U**
CO2	**Apply Java programming principles to perform basic operations on collections and strings.**	**L3**	**A**
CO3	**Analyze the functionality of swings and servlets to create basic applications**	**L4**	**An**
CO4	**Design and Develop web applications using Java servlets and JSP with JDBC for database connectivity**	**L5, L6**	**D**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2	3														1	
CO3		3												1	2	
CO4			2	2	1				1					1	2	

Weblinks and Video Lectures (e-Resources)	
1	Advanced Java Tutorial: https://www.youtube.com/watch?v=qGMxs-PbFPk
2	NPTEL Course: https://archive.nptel.ac.in/courses/106/105/106105191/

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	20	10		
Understand	20	10		
Apply	10	20	10	
Analyse		10	10	
Evaluate				10
Create				20

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	10			5	10	35	35%
CO2	10	10			5	10	35	35%
CO3			10	10	10		30	30%
CO4								
Total	20	20	10	10	20	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (100% Theory)
Remember	20%
Understand	20%
Apply	40%
Analyze	20%
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution						Total Marks	Weightage
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	20	10	5	5			40	40%
CO2	--	10	5	5	10	10	40	40%
CO3	--	--	--	--	10	10	20	20%
CO4	--	--	--	--	--	--	--	--
Total	20	20	10	10	20	20	100	100%

PROFESSIONAL ELECTIVE COURSE (PEC)

PEC Course - Professional Elective Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0
Total Hours of Pedagogy	40 hours
Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Professional Elective Course (PEC)

Assessment Details (both CIE and SEE)

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 40% of the maximum marks (20 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks.Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
  - The first test will be administered after 40-50% of the syllabus has been covered, and
  - The second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods

of assessment.

- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students must answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,
    - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
    - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Professional Elective Course (PEC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	----	----	**20**	
	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	(50+50) / 2	**25**	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory					**50**	20	Total Marks of IAT and CCA is50

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
			CIE + SEE	100	----	----	40	

Semester	:	**6**				
Course Title	:	**TIME SERIES ANALYSIS**				
Course Code	:	**BCS604D**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Category	:	**PEC**				
Stream	:	**CSE**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40**		**SEE Duration**	:	**3 Hours**
Credits	:	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Learn the importance of time series analysis on the data
2	Identify approaches to handle linear stationary and non stationary models
3	Analyse ways of model building and parameter estimation.
4	Recognize methods to handle multivariate time series data

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem & encourage the students to come up with creative & optimal-solutions
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

Module No.	Topics	Hours
1	Introduction, Five Important Practical Problems, Autocorrelation Function and Spectrum of Stationary Processes: Autocorrelation Properties of Stationary Models, Spectral Properties of Stationary Models, Linear Stationary Models: General Linear Process, Autoregressive Processes, Moving Average Processes, Mixed Autoregressive--Moving Average Processes. **Ch. 1.1, Ch. 2.1,2.2 Ch. 3.1,3.2,3.3,3.4**	**8**
Pedagogy	**Presentation, Quiz**	
2	Linear Nonstationary Models: Autoregressive Integrated Moving Average Processes, Three Explicit Forms for the ARIMA Model, Integrated Moving Average Processes. Forecasting : Minimum Mean Square Error Forecasts and Their Properties, Calculating Forecasts and Probability Limits, Examples of Forecast Functions and Their Updating, Use of State-Space Model Formulation for Exact Forecasting **Ch. 4.1,4.2,4.3, Ch. 5.1,5.2,5.3,5.4,5.5.**	**8**
Pedagogy	**Collaborative Learning, Presentation**	
3	Model Identification: Objectives of Identification, Identification Techniques, Initial Estimates for the Parameters, Model Multiplicity. Parameter Estimation: Study of the Likelihood and Sum-of-Squares Functions, Nonlinear Estimation, Some Estimation Results for Specific Models, Likelihood Function Based on the State-Space Model, Estimation Using Bayes' Theorem **Ch. 6.1,6.2,6.3,6.4 Ch. 7.1,7.2,7.3,7.4,7.5.**	**8**
Pedagogy	**Demonstration**	
4	Model Diagnostic Checking: Checking the Stochastic Model, Overfitting, Diagnostic Checks Applied to Residuals, Use of Residuals to Modify the Model, Analysis of Seasonal Time Series: Parsimonious Models for Seasonal Time Series, Some Aspects of More General Seasonal ARIMA Models, Structural Component Models and Deterministic Seasonal Components, Regression Models with Time Series Error Terms. **Ch. 8.1,8.2,8.3 Ch. 9.1,9.2,9.3,9.4,9.5**	**8**
Pedagogy	**Active Learning**	
5	Multivariate Time Series Analysis: Stationary Multivariate Time Series, Vector Autoregressive Models, Vector Moving Average Models, Vector Autoregressive--Moving Average Models, Forecasting for Vector Autoregressive--Moving Average Processes, StateSpace Form of the VARMA Model, Nonstationary and Cointegration **Ch. 14.1,14.2,14.3,14.4,14.5,14.6,14.8**	**8**
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinkingand enables creative problemsolving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily.	

	• **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, Greta M. Ljung, "Time Series Analysis – Forecasting and Control", Wiley Publications , 2016.
Reference Books	
1	Paul S.P. Cowpertwait and Andrew V. Metcalfe, Introductory Time Series with R, Springer Verlag, New York, 2009.
2	Rob J. Hyndman and George Athanasopoulos, Forecasting: Principles and Practice, One line, Open Access Textbooks

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the fundamental concept of Time series analysis for Autocorrelation Function and spectrum on linear stationary models	**L2**	**U**
CO2	Apply non-linear stationary models and perform forecasting	**L3**	**AP**
CO3	Analyze models and estimate the various parameters	**L4**	**AN**
CO4	Develop ways to perform model diagnostic checking and analyze the seasonal time series.	**L6**	**C**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-		-	-	-	-	-	-	-	-	3	-	-
CO3	3	-		-		-	-	-	-	-	-	-	-	3	-	-
CO4	-	2	-	-	2	-	-	-		-	-	-	-	-	2	-

Weblinks and Video Lectures (e-Resources)

1	● https://nptel.ac.in/courses/103106123
2	● https://www.youtube.com/watch?v=GE3JOFwTWVM
3	● https://www.youtube.com/watch?v=tepxdcepTbY
4	● https://www.youtube.com/watch?v=rDwczdWBlTA

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	20	10		
Understand	20	10	10	
Apply	10	20	10	
Analyse		10	10	
Evaluate				10
Create				10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	10	2.5	2.5	5	10	40	26.5%
CO2	10	10	2.5	2.5	5	10	40	26.5%
CO3	5	5	5	5	10	20	50	35%
CO4			2.5	2.5	5	10	20	14%
Total	25	25	12.5	12.5	25	50		

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10% + 2%
Understand	20% + 2%
Apply	40% + 4%
Analyse	20% + 2%
Evaluate	
Create	

SEE Course Plan

CO's	Marks Distribution						Total Marks	Weightage
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	20	10	5	5			40	40%
CO2	--	10	5	5	10	10	40	40%
CO3	--	--	--	--	10	10	20	20%
CO4	--	--	--	--	--	--	--	--
Total	20	20	10	10	20	20	100	100%

Semester	**:**	**6**				
Course Title	**:**	**Generative AI**				
Course Code	**:**	**BCSL607**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Practical**				
Category	**:**	**PCCL**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**0:2:2:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**24**		**SEE Duration**	**:**	**2 hrs**
Credits	**:**	**2**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	**Understand and analyse** word embeddings to explore semantic relationships using vector arithmetic and dimensionality reduction techniques.
2	**Apply domain-specific training** to build custom word embedding models and evaluate their effectiveness in capturing specialized semantics.
3	**Design and enhance prompts** for generative AI models using word similarity techniques to improve contextual richness and response quality.
4	**Utilize pre-trained models** for real-world applications such as sentiment analysis, summarization, style transfer, and question generation with semantic accuracy.

Teaching-Learning Process

Pedagogical Initiatives:

- **Use hands-on demonstrations** of pre-trained models (Word2Vec, GloVe, Hugging Face) to help students understand semantic similarity, sentiment, and summarization tasks.
- **Incorporate dimensionality reduction visualizations** (using PCA/t-SNE) to help students grasp the spatial relationships between word vectors.
- **Encourage group-based learning projects** such as creative story generation or prompt enrichment using similar words retrieved from embeddings.
- **Include HOTS questions** like “How does prompt enrichment improve output quality?” and “What does vector arithmetic reveal about semantic meaning?” to promote deep thinking.

- **Use real-world case studies** (e.g., sentiment analysis of customer reviews, style transfer for email writing) to link theory with practice.
- **Assign open-ended programming tasks** where students build simple NLP systems (e.g., NER + Question Generation) using Hugging Face or Langchain to foster innovation and independence.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Apply techniques to analyze word embeddings, perform vector arithmetic, and visualize using dimensionality reduction.	**L3**	**Application**
CO2	Apply prompt engineering to real-world tasks like information retrieval and text generation.	**L3**	**Creativity**
CO3	Utilize pre-trained Hugging Face models for sentiment analysis and summarization.	**L3**	**Application**
CO4	Analyze transformer-based architectures and evaluate their advantages and limitations	**L4**	**Analysis**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**										**2**	**2**			
CO2		**2**			**2**							**2**	**2**			
CO3			**2**											**2**		
CO4				**2**												

Weblinks and Video Lectures (e-Resources)	
1	**https://www.w3schools.com/gen_ai/index.php**
2	**https://youtu.be/eTPiL3DF27U**
3	**https://youtu.be/je6AlVeGOV0**
4	**https://youtu.be/RLVqsA8ns6k**
5	**https://youtu.be/0SAKM7wiC-A**
6	**https://youtu.be/28_9xMyrdjg**
7	**https://youtu.be/8iuiz-c-EBw**

8	https://youtu.be/7oQ8VtEKcgE
9.	genAI - YouTube

CIE- Continuous Internal Evaluation (50 Marks)

Evaluation		Allotted Marks		TOTAL CIE (50M)
Continuous Evaluation - 30 Marks	Record	10	Average Score of all experiments - 30 Marks	30
	Observation	10		
	Open Ended	10		
Lab IA- 20 Marks	Procedure write up	20	LAB IA-100 Marks	Reduced to 20
	Conduction and Results	60		
	Viva Voce	20		

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	10
Understand	10
Apply	20
Analyze	20
Evaluate	20
Create	20

List of Programs:

Warmup Programs:

- Load any pre-trained word embedding model (e.g., GloVe or Word2Vec). Print the vector representation of three words of your choice and display the embedding dimension
- Input three sentences (one positive, one negative, and one neutral), and display the sentiment label and confidence score for each.

Sl. No.	Experiments/Programs	COs
1	Explore pre-trained word vectors. Explore word relationships using vector arithmetic. Perform arithmetic operations and analyze results.	CO1
2	Use dimensionality reduction (e.g., PCA or t-SNE) to visualize word embeddings for Q 1. Select 10 words from a specific domain (e.g., sports, technology) and visualize their embeddings. Analyze clusters and relationships. Generate	CO1

	contextually rich outputs using embeddings. Write a program to generate 5 semantically similar words for a given input.	
3	Train a custom Word2Vec model on a small dataset. Train embeddings on a domain-specific corpus (e.g., legal, medical) and analyze how embeddings capture domain-specific semantics.	CO1
4	Use word embeddings to improve prompts for Generative AI model. Retrieve similar words using word embeddings. Use the similar words to enrich a GenAI prompt. Use the AI model to generate responses for the original and enriched prompts. Compare the outputs in terms of detail and relevance.	CO2
5	Use word embeddings to create meaningful sentences for creative tasks. Retrieve similar words for a seed word. Create a sentence or story using these words as a starting point. Write a program that: Takes a seed word. Generates similar words. Constructs a short paragraph using these words.	CO2
6	Use a pre-trained Hugging Face model to analyze sentiment in text. Assume a real-world application, Load the sentiment analysis pipeline. Analyze the sentiment by giving sentences to input.	CO3
7	Summarize long texts using a pre-trained summarization model using Hugging face model. Load the summarization pipeline. Take a passage as input and obtain the summarized text.	CO3
8	Install langchain, cohere (for key), langchain-community. Get the api key (By logging into Cohere and obtaining the cohere key). Load a text document from your google drive. Create a prompt template to display the output in a particular manner.	CO2
9	Use a pre-trained model to convert a sentence from one style to another (e.g., casual to formal or modern to Shakespearean). Take a sentence and a target style as input. Apply the model to perform the transformation. Compare the original and transformed sentence for tone, vocabulary, and grammar changes. Analyse how the model maintains the semantic meaning across styles	CO4
10	Design and implement a system that takes a paragraph as input, identifies key named entities using a pre-trained NER model, and generates questions using a pre-trained Question Generation model. Optionally, integrate the output with Langchain(open source to provide an interactive display format.	CO4
Open ended Programs		

1	Use a pre-trained embedding model to find and display 5 semantically similar words. Analyse the meaning and context of each similar word.	CO1
2	Take different sentences as input and display their sentiment (positive/negative/neutral). Interpret results and explain sentiment behaviour for each input.	CO3
3	Retrieve 5 related words using embeddings and use them to write a short paragraph. Display the generated story and highlight how the seed and similar words are used.	CO2

CIE for (Ability Enhancement Course (Practical)):
CIE marks for the practical course are 50 Marks.
The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks)
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks).
- The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

SEE for (Ability Enhancement Course(Practical))

- SEE marks for the practical course are 50 Marks
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure a result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course typ rubrics shall be decided by the examiners)

- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours

Note: L- Theory Lecture, T- Tutorial, P-Practical, S-Project, IPCC: Integrated Professional Core Course, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

1 Credit Course – Practical

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum Marks (20 Marks out of 50).

The minimum passing mark for the SEE is 40% of the maximum Marks (20 Marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (20 Marks out of 50) in the Semester-End Examination (SEE), and a minimum of 40% (40 Marks out of 100) in the total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course are 50 Marks.

- SEE shall be conducted jointly by the two examiners of the same institute; examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University. All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered by the examiners or based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here,
    - Writeup-20%,
    - Conduction procedure and result in -60%,
    - Viva-voce 20% of maximum marks.

  SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours.

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th**				
Course Title	:	**Devops**				
Course Code	:	**BCS608A**				
Course Type (Theory/ Practical/ Integrated)	:	**Practical**				
Category	:	**AEC**				
Stream	:	**CSE**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**0:0:2:0**		**SEE**	:	**50 Marks**
Total Hours	:	**24**		**SEE Duration**	:	**2 hrs**
Credits	:	**1**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce DevOps terminology, definition & concepts
2	To understand the different Version control tools like Git, Mercurial
3	To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
4	To understand Configuration management using Ansible
5	Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

List of Programs:

Sl. No.	Experiments/Programs	COs
1	**Introduction to Maven and Gradle:** Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup	CO1
2	**Working with Maven:** Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins	CO1
3	**Working with Gradle:** Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation	CO1
4	**Practical Exercise:** Build and Run a Java Application with Maven**,** Migrate the Same Application to Gradle	CO1
5	**Introduction to Jenkins:** What is Jenkins? Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use	CO2
6	**Continuous Integration with Jenkins:** Setting Up a CI Pipeline**,** Integrating Jenkins with Maven/Gradle**,** Running Automated Builds and Tests	CO2
7	**Configuration Management with Ansible:** Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook	CO3
8	**Jenkins-Ansible Integration Exercise:** Developing a Jenkins Continuous Integration Pipeline for Maven-based Projects, Automating Artifact Deployment via Ansible.	CO2,CO3
9	**Introduction to Azure DevOps Platform:** Exploring Azure DevOps Services and Creating Initial Projects on Azure DevOps	CO4
10	**Creating and Managing Build Pipelines with Azure DevOps:** Developing and Automating Build Pipelines, Integrating Version Control Systems (GitHub, Azure Repos), Executing Unit Tests, and Generating Build Reports.	CO2, CO4
	Open ended Programs	
1	**Integrating Multiple Version Control Systems:** Integrate Git and SVN with Jenkins CI/CD pipeline. Compare and analyze performance, usability, and manageability	CO1, CO2
2	**Advanced Build Optimization:** Experiment with different optimization strategies in Maven and Gradle. Evaluate build performance, dependency resolution efficiency, and memory consumption.	CO1
3	**Automated Deployment using Ansible and Docker:** Create a complex multi-container Docker application. Automate container orchestration and deployment through Ansible playbooks.	CO2,CO3
4	**Multi-Cloud CI/CD Implementation:** Set up a CI/CD pipeline simultaneously on Azure DevOps and GitHub Actions. Analyze deployment flexibility, speed, cost-effectiveness, and ease of integration.	CO2,CO4

Course Outcomes :

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Demonstrate different actions performed through Version control tools like Git.	L2	An
CO2	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using	L3	AP
CO3	Experiment with configuration management using Ansible.	L5	E
CO4	Demonstrate Cloud-based DevOps tools using Azure DevOps	L6	C

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3				3							2				
CO2	3	2			3				2			2				
CO3			3		3							3				
CO4		3		2	3					2		3				

Weblinks 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
5	https://www.geeksforgeeks.org/devops-tutorial/

CIE- Continuous Internal Evaluation (50 Marks)

Python LAB Evaluation		Allotted Marks		TOTAL CIE (50M)
Continuous Evaluation - 30 Marks	Record	10	Average Score of all experiments - 30 Marks	30
	Observation	10		
	Open Ended	10		
Lab IA- 20 Marks	Procedure write up	20	LAB IA-100 Marks	Reduced to 20
	Conduction and Results	60		
	Viva Voce	20		

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	4
Understand	3
Apply	18
Analyse	4
Evaluate	3
Create	18

Semester	**:**	**6**				
Course Title	**:**	**TOSCA – Automated Software testing**				
Course Code	**:**	**BCS608B**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Practical**				
Category	**:**	**AEC**				
Stream	**:**	**CSE**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**0:0:2:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**24**		**SEE Duration**	**:**	**2 hrs.**
Credits	**:**	**1**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the features, components, and benefits of the Tosca platform.
2	Build the Test case design, Test execution and Test data management
3	Build and Interpret the Test automation
4	Develop the Test scenario.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analysing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain of Tosca's architecture, key features and fundamentals of the Tosca automation tool.	L2	Apply
CO2	Develop test scenarios that can be run automatically	L3	Analyze
CO3	Construct test cases and modules in the Tosca automation tool.	L3, L4	Evaluates
CO4	Design Test Suits and run tests in different browsers.	L5, L6	Create

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		2													
CO3				2											
CO4			2		2	2									

Weblinks and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=QDV_TI0_JyU
2	https://www.youtube.com/watch?v=v2gyFqMLPf8

CIE- Continuous Internal Evaluation (50 Marks)

Evaluation		Allotted Marks		TOTAL CIE (50M)
Continuous Evaluation - 30 Marks	Record	10	Average Score of all experiments - 30 Marks	30
	Observation	10		
	Open Ended	10		
Lab IA- 20 Marks	Procedure write up	20	LAB IA-100 Marks	Reduced to 20
	Conduction and Results	60		
	Viva Voce	20		

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	**10**
Understand	**10**
Apply	**20**
Analyze	**20**
Evaluate	**20**
Create	**20**

List of Programs:

Sl. No.	Experiments/Programs	COs
1	Installation of Tosca: Installation and Setup, Tosca Commander, Tosca Executor, Tosca XScan (Tosca Wizard) and Test Repository	CO1
2	Functional acceptance testing: Tosca to perform functional acceptance tests for web applications (Hint: Web Application of your choice)	CO2
3	Scanning and creating a module: Create a basic test case and Object Identification methods – By properties, By Anchor, By image, By Index	CO2
4	Buffer Operations: Setting buffer, Deleting buffer, Partial buffer, Expression evaluator and Process Operations.	CO2
5	Window Operations: Send Keys, Window Operations using MATH operation to perform calculations, such as finding the minimum or rounding a value.	CO2
6	Record and Playback: Enable recording in the Execution Recorder settings, record your interactions with the application, Edit the recorded steps and Play back the recording.	CO2
7	Designing Testcases: Data creation in Test Case design and Conversion of Mapping and Templates.	CO2
8	Dynamic objects: (a) Creates dynamic lists when Module Attributes are added for the first time. (b) To convert a static list into a dynamic list, delete all static Module Attributes	CO2
9	Synchronization: Wait On, Default Settings, Static Wait, Timeout, TBox Wait and SfWaitForBusyIndicator	CO3
10	Reusable Test Step block: Create a Reusable TestStepBlock and Creating and Using Libraries.	CO3
11	Conditional statements: create conditional statements in Tosca to run test steps	CO3
12	Practical Exercise and Wrap-Up: Build Test suit with suitable application and complete end to end automation process, Discussion on Best Practices and Q&A	CO3

CIE for (Ability Enhancement Course (Practical)):
CIE marks for the practical course are 50 Marks.
The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.

- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks)
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks).
- The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

SEE for (Ability Enhancement Course (Practical))

- SEE marks for the practical course are 50 Marks
- SEE shall be conducted jointly by the two examiners of the same institute; examiners are appointed by the Head of the Institute.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure a result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course typ rubrics shall be decided by the examiners)

- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours

Note: L- Theory Lecture, T- Tutorial, P-Practical, S-Project, IPCC: Integrated Professional Core Course, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

1 Credit Course – Practical

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum Marks (20 Marks out of 50).

The minimum passing mark for the SEE is 40% of the maximum Marks (20 Marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (20 Marks out of 50) in the Semester-End Examination (SEE), and a minimum of 40% (40 Marks out of 100) in the total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course are 50 Marks.

- SEE shall be conducted jointly by the two examiners of the same institute; examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University. All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered by the examiners or based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here,
    - Writeup-20%,
    - Conduction procedure and result in -60%,
    - Viva-voce 20% of maximum marks.

  SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours.