DAYANANDA SAGAR ACADEMY OF TECHNOLOGY & MANAGEMENT

CURRICULUM

Scheme and Syllabus III to IV Semester

Outcome Based Education
(Academic Year 2024-2025)
Department of Computer Science and Engineering (Artificial Intelligence)
3rd & 4th 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 caliber 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 challenges.
- 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 and Engineering (Artificial Intelligence) is a CSE allied branch. Artificial intelligence (AI) is intelligence—perceiving, synthesizing, and inferring information demonstrated by machines, as opposed to intelligence displayed by animals and humans. Example tasks in which this is done include speech recognition, computer vision, translation between (natural) languages, as well as other mappings of inputs.

The course covers a wide range of topics, including programming languages, data structures, algorithms, computer architecture, software engineering, machine learning, natural language processing, computer vision, robotics, and more.

The curriculum is designed to provide students with a strong foundation in computer science and engineering, while also exploring the latest advancements in artificial intelligence. Students will learn to design and develop intelligent systems and algorithms in Center of Excellence set-up by Microsoft in the Department of AI. The Students can analyze, understand, interact, participate in lab sessions, group projects, and carryout individual research work in the department. Upon completion of the course, students can pursue careers as software engineers, AI developers, data scientists, machine learning engineers, or AI researchers, among other roles.

VISION OF THE DEPARTMENT

To create an enriching learning environment that imparts creative, learning and research skills to students in the domain of artificial intelligence.

MISSION OF THE DEPARTMENT

M1: To Impart Strong foundation of statistics for understanding Artificial Intelligence.

M2: To develop skilled and knowledgeable professionals in the field of Artificial Intelligence.

M3: To contribute towards advanced AI technologies that provide increased and better performance.

M4: To collaborate with renowned companies for multidisciplinary research and development.

M5: To guide the students in learning and creative for developing intelligent technology based solutions to societal problems.

PROGRAM EDUCATION OBJECTIVES (PEO'S):

PEO1: The Graduates of CSE (AI) acquire a comprehensive understanding of the fundamentals of Artificial Intelligence (AI) and its applications.

PEO2: To apply AI techniques and tools to solve real-world problems and create innovative solutions.

PEO3: To develop skills in data analysis, Cloud Computing, Full Stack development and Machine learning for AI implementation.

PEO4: To develop the ability to design, analyse, and evaluate the CSE (AI) systems.

PEO5: To foster creativity, innovative thinking, entrepreneurial Skills and a commitment to lifelong learning in the field of CSE (AI) to contribute towards DIGIWORLD.

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)

PSO 1: To Apply Analytical Skills for Problem Solving in Engineering, Business and Societal Applications using CSE (AI) Approaches safely and securely.

PSO 2: Ability to Enrich the Critical Thinking Skills and Decision making in Emerging Technologies such as Natural Language Processing, Machine Learning, Deep Learning, Data Analysis, Robotics and Computer Vision .

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(AI)	CSE(AI)	3	0	2	0	5	4
3	IPCC-2	CSE(AI)	CSE(AI)	3	0	2	0	5	4
4	PCC-1	CSE(AI)	CSE(AI)	3	0	0	0	3	3
5	PCC-2	CSE(AI)	CSE(AI)	3	0	0	0	3	3
6	PBL	CSE(AI)	CSE(AI)	0	0	2	2	4	2
7	AEC	CSE(AI)	CSE(AI)	0	0	2	0	2	1
8	SCR	CSE(AI)	CSE(AI)	0	0	2	0	2	1
9	NCMC	NSS / YOGA / PED							
10	AICTE Activity Points								
								Total	**21**

Percentage of Mapping– Theory & Practical - Scheme & Syllabus- 3rd Sem & 4th Sem

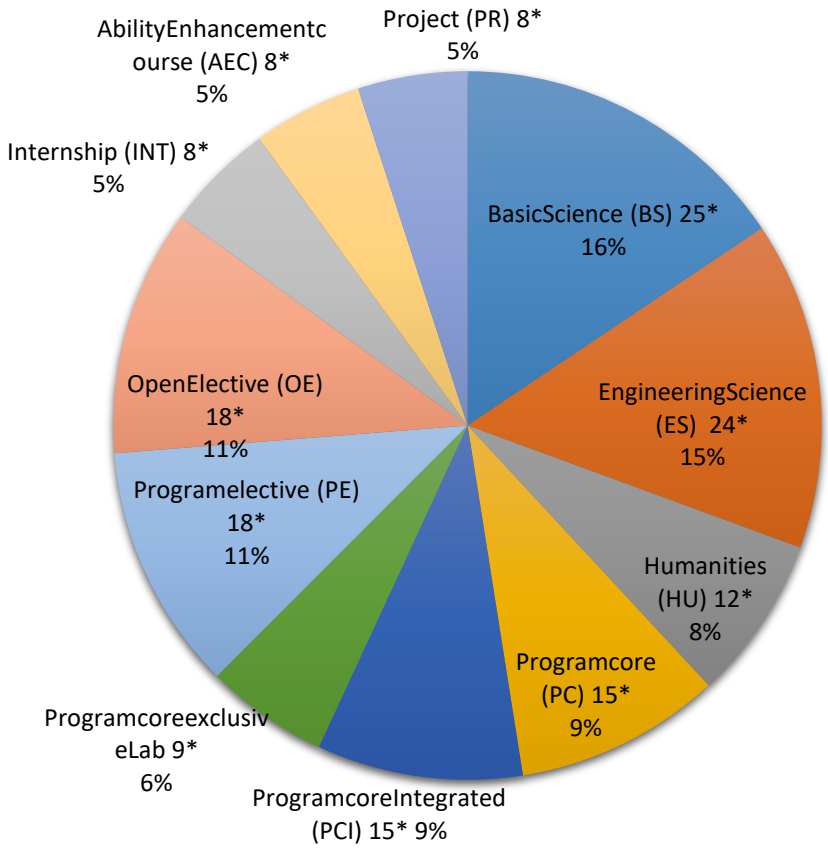
3rd Sem & 4th Sem

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%
	Total Percentage	53%	47%	13%	13%

Scheme Distribution

Department of Computer Science and Engineering (Artificial Intelligence)

Course Component	Credits	% of Credits
Basic Science (BS)	25*	15.6
Engineering Science (ES)	24*	15
Humanities (HU)	12*	7.5
Program core (PC)	15*	9.4
Program core Integrated (PCI)	15*	9.4
Program core exclusive Lab	9*	5.6
Program elective (PE)	18*	11.25
Open Elective (OE)	18*	11.25
Internship (INT)	8*	5
Ability Enhancement course (AEC)	8*	5
Project (PR)	8*	5
Total	**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							16
Engineering Sciences (ESC)	3	6	3	3					15
Humanities, Social Sciences and Management (HSMC)	1	2							03
Ability Enhancement Course (AEC)	2	1	1	1	1	1	1	1	09
Universal Human Values (UHV)	0	0	1	1					02
Professional Core Courses (PCC)	6	3	6	6	6	6	3		36
Integrated Professional core Course (IPCC)	0	0	8	8	6	6	3		31
Professional Elective Course (PEC)	0	0			6	6	6	6	24
Institutional Open Elective Courses (IOE)	0	0					3		03
Internship (INT)	0	0			1	1	2	3	07
Mini Project / Project Work (PW)	0	0	2	2	2	2	2	4	14
Non-credit Mandatory Courses (NCMC)	0	0							
Total Credits	20	20	21	21	22	22	20	14	160

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

3rd SEMESTER: Computer Science & Engineering (Artificial Intelligence) CSE(AI)

SI No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture L	Tutorial T	Practical P	Project S	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
1	BMATD301	Mathematics for AI	BSC	MAT	MAT	3	0	0	0	3	3	03	50	50	100
2	BCA302	Data Structures and Applications	IPCC1	CSE(AI)	CSE(AI)	3	0	2	0	5	4	03	50	50	100
3	BCA303	Artificial Intelligence	IPCC2	CSE(AI)	CSE(AI)	3	0	2	0	5	4	03	50	50	100
4	BCA304	Operating Systems	PCC1	CSE(AI)	CSE(AI)	3	0	0	0	3	3	03	50	50	100
5	BCA305	Computer Organization and Architecture	PCC2	CSE(AI)	CSE(AI)	3	0	0	0	3	3	03	50	50	100
6	BCA306	Object Oriented Programming with Java	PBL	CSE(AI)	CSE(AI)	0	0	2	2	4	2	03	50	50	100
7	BCA307	Data Analytics With R	AEC	CSE(AI)	CSE(AI)	0	0	2	0	2	1	03	50	50	100
8	BSCK308	Social Connect and Responsibility	SCR	CSE(AI)	CSE(AI)	0	0	2	0	2	1	-	100	-	-
Total						**15**	**0**	**10**	**2**	**27**	**21**	**21**	**450**	**350**	**700**

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, CIVIL)

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

4th SEMESTER: Computer Science & Engineering (Artificial Intelligence) CSE(AI)

SI 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	BMATD401	Algorithmic Game Theory	BSC	MAT	MAT	3	0	0	0	3	3	03	50	50	100
2	BCA402	Analysis and Design of Algorithm	IPCC1	CSE(AI)	CSE(AI)	3	0	2	0	5	4	03	50	50	100
3	BCA403	Microcontroller and Robotics	IPCC2	CSE(AI)	CSE(AI)	3	0	2	0	5	4	03	50	50	100
s 4	BCA404	Cloud Computing	PCC1	CSE(AI)	CSE(AI)	3	0	0	0	3	3	03	50	50	100
5	BCA405	Business Intelligence And Its Applications	PCC2	CSE(AI)	CSE(AI)	3	0	0	0	3	3	03	50	50	100
6	BCA406	Bioinformatics	PBL	CSE(AI)	CSE(AI)	0	0	2	2	4	2	03	50	50	100
7	BCA407	Scala	AEC	CSE(AI)	CSE(AI)	0	0	2	0	2	1	03	50	50	100
8	BUHV408	Universal Human Values Course	UHV	CSE(AI)	CSE(AI)	0	0	2	0	2	1	01	50	50	100
Total						**15**	**0**	**10**	**2**	**27**	**21**	**22**	**400**	**400**	**800**

IPCC: Integrated Professional Core Course,
PCC: Professional Core Course
PBL: Project Based Learning
AEC: Ability Enhancement Course,
NCMC: Non-Credit Mandatory Course
L: Lecture,
T: Tutorial,
P: Practical
S= SDA: Skill Development Activity,
CIE: Continuous Internal Evaluation,
SEE: Semester End Evaluation.

Integrated Professional Core Course (IPCC): Refers to Integrated Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

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

Newly introduced subjects in the syllabus

		3rd Semester	**4th Semester**
1.	List of Existing Elective Courses		
2.	List of New Existing Elective Courses		1. Cloud Computing 2. Business Intelligence and its Applications 3. Bioinformatics
3.	List of New Industry Aligned Courses	Data Analytics with R	Scala

Percentage of Change in the Syllabus

3rd Semester						
Sl. No	**Course Code**	**Course Name**	**Topics Added**	**Topics removed**	**Revised in %**	**Justification**
1	BMATD301	Mathematics for AI	NA	NA	10%	NA
2	BCA302	Data Structures and Applications	NA	NA	NA	NA
3	BCA303	Artificial Intelligence	NA	NA	10%	NA
4	BCA304	Operating Systems	NA	NA	NA	NA
5	BCA305	Computer Organization and Architecture	Computer Architecture	Digital Design	30 %	For removal of Digital Design: Most of the concept have been covered in the previous semester. Being CSE (AI) students, the knowledge of logic gates and logic design weakly connected. For introduction of computer architecture: Students must have an exposure to different processor architectures to understand how modern computer performs.
6	BCA306	Object Oriented Programming with java	NA	Type wrappers and autoboxing	NA	Focus on core concepts, Targeting beginners
7	BCA307	Data Analytics With R	NA	NA	NA	NA
8	BSCK308	Social Connect and Responsibility & NSS	NA	NA	NA	NA

4th Semester						
Sl. No	**Course Code**	**Course Name**	**Topics Added**	**Topics removed**	**Revised in %**	**Justification**
1	BMATD401	Algorithmic Game Theory	NA	NA	10%	NA
2	BCA402	Analysis and Design of Algorithm	NA	NA	NA	NA
3	BCA403	Microcontroller and Robotics	Robotics	Embedded Systems	40%	For removal of Embedded Systems: Embedded systems concepts are weakly connected with the Artificial Intelligence core topics and basics are covered in microcontroller itself. For introduction of Robotic: Robotics an AI go parallel. It is been introduced keeping in mind of multidisciplinary approach for better project in the higher semesters.
4	BCA404	Cloud Computing	Cloud Resource Management and Scheduling Cloud Storage Systems	Building Cloud Computing Environments, Amazon Web Services (AWS), Google App Engine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjra soft Aneka. Cloud Platforms in Industry Amazon web services	30%	For removal: Building cloud computing concepts is more suitable for advanced learners in higher semester and focus here is only to understand the foundation of cloud computing. Topics are added in such a way that learners get exposure to important aspects of cloud computing.
5	BCA405	Business Intelligence and Its Applications	NA	NA	10%	Development of applications were not there
6	BCA406	Bioinformatics	NA	NA	NA	NA
7	BCA407	Scala	NA	NA	NA	NA
8	BUHV408	Universal Human Values	NA	NA	NA	NA
		Course				

3rd SEMESTER

Semester	**:**	3rd				
Course Title	**:**	Linear Algebra, Discrete Mathematics and Game Theory				
Course Code	**:**	BMATD301				
Course Type (Theory/ Practical/ Integrated)	**:**	Theory				
Course Category	**:**	ASC				
Stream	**:**	CS-DS & CS-AI		**CIE**	**:**	50 Marks
Teaching hour/week (L:T:P:S)	**:**	2:2:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	40 Hrs		**SEE Duration**	**:**	3 Hours
Credits:	**:**	3				

Course Learning Objectives: Students will be taught

Sl.No	Course Objectives
1	Acquire basic knowledge of Mathematical concepts for understanding engineering problems
2	Use concepts of linear algebra, Discrete Mathematics and Game Theory in solving problems
3	Analyze problems using concepts of Linear algebra, Discrete Mathematics and Game Theory
4	Use MATLAB to obtain solutions of various mathematical problems

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.

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)

DSATM

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Linear Algebra** Elementary transformations on a matrix, echelon form & rank of a matrix, consistency of system of linear equations, Gauss elimination, Gauss – Seidel method to solve system of linear equations. eigen values and eigen vectors of a matrix, Rayleigh power method to determine the dominant eigen value of a matrix, diagonalization of matrices	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
2	**Fundamentals of logic** Basic connectives and truth tables, logical equivalence-laws of logic, predicates, quantifiers, logical equivalence involving quantifiers, logical implication-rules of inference, proofs of theorems.	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
3	**Relations and functions** Cartesian products and relations, properties, computer recognitions-zero-one matrices, partial orders, equivalence relations, partitions, Hasse diagrams. Functions: one-one and onto functions. composition of functions and invertible functions.	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
4	**Introduction to Strategic Games** Introduction to game theory, strategic games, the prisoner's dilemma, Bach or Stravinsky, matching pennies, Nash equilibrium, zero-sum games, min max strategy, best response functions, dominated action.	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
5	**Mixed Strategy and Extensive Games**	

	Strategic games in which players may randomize, mixed strategy Nash equilibrium, extensive games with perfect information, sub-game perfect equilibrium, finding sub-game perfect equilibria of finite horizon games, backward induction.	**8**
Pedagogy	**Chalk and board, group discussion, ppt, videos**	

List of Experiments or Programs

Sl.No	Experiments/Programs	COs
	NIL	

Text Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipso, Schaum's outline series, McGraw-Hill Education, 6th edition, 2017.
2	Discrete Mathematics and its Applications, Kenneth H Rosen, McGraw Hill publications, 7th edition.
3	An Introduction to Game Theory, Martin Osborne: , Oxford University Press, 7th impression, 2009

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Discrete and Combinatorial Mathematics, Ralph P. Grimaldi, Pearson Education, 5th Edition, 2004.
2	Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, Academic Press, 2nd edition, 2014.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the basic concepts of linear algebra, discrete mathematics and game theory	**Remember, Understand**	**L1, L2**
CO2	Apply techniques of linear algebra, discrete mathematics and game theory to solve engineering problems	**Apply**	**L3**
CO3	Analyze engineering problems using linear algebra, discrete mathematics and game theory	**Analyse**	**L4**
CO4	Develop mathematical solutions to various real time problems using MATLAB	**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
CO1													--	--
CO2	3												--	--
CO3		2											--	--
CO4			2		2				1	1			--	--

Weblinks and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/111/106/111106086/
2	https://archive.nptel.ac.in/courses/111/107/111107106/
3	https://youtu.be/h0bdo06qNVw?si=dBHPlak7D16z8fOX

Assessment Pattern (both CIE and SEE)

Applied Science Courses								
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**	
CIE	**Theory**	Internal Assessment Test (IAT) - I	Module – 1, 2 & 3(half	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down
		Internal Assessment Test (IAT) - II	Module - 3(half module), 4 & 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,
		CCA-2- Pedagogical Initiatives		50				

								then one assessment method may be adopted
	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	100	----	50	20	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.				

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

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

- First test after 7th week of the semester (syllabus completion of 50%)
- Second test after 14th week of semester (syllabus completion of 100%)

The average score of three test is taken and scaled down to **25 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 **25 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 **25 Marks**

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

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	50 Marks
Remember			30		
Understand	10	10	20		
Apply	30	30			
Analyse	10	10			
Evaluate				50	
Create					

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module-3	Module-3	Module-4	Module-5		
CO1	5	5	5		5	5	25	25%
CO2	10	10	5	5	10	10	50	50%
CO3	5	5		5	5	5	25	25%
CO4								
CO5								
CO6								
Total	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	5
Apply	35
Analyse	10
Evaluate	--
Create	--

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	5	--	--	--	--	5	10%
CO2	5	5	10	5	10	35	70%
CO3	--	5	--	5	--	10	20%
CO4	--	--	--	--	--	--	--
CO5	--	--	--	--	--	--	--
CO6	--	--	--	--	--	--	--
Total	10	10	10	10	10	50	100%

Course Contents and Lecture Schedule

Module No.	Topics	No. of Lectures
1	Elementary transformations on a matrix	1
1	Echelon form & rank of a matrix	1
1	Consistency of system of linear equations	1
1	Gauss elimination	1
1	Gauss – Seidel method to solve system of linear equations	1
1	Eigen values and eigen vectors of a matrix	1
1	Rayleigh power method to determine the dominant eigen value of a matrix	1
1	Diagonalization of matrices	1

2	Basic connectives	**1**
2	Truth tables	**1**
2	Logical equivalence-laws of logic	**1**
2	Predicates	**1**
2	Quantifiers,	**1**
2	Logical equivalence involving Quantifiers,	**1**
2	Logical implication-rules of inference,	**1**
2	Proofs of theorems.	**1**
3	Cartesian Products	**1**
3	Relations, Properties	**1**
3	Computer Recognitions-Zero-One Matrices,	**1**
3	Partial Orders	**1**
3	Equivalence relations	**1**
3	Partitions, Hasse Diagrams	**1**
3	Functions: one-one and onto Functions, Composition of functions	**1**
3	Invertible functions	**1**
4	Introduction to Strategic Games: What is game theory? Strategic games	**1**
4	The prisoner's dilemma	**1**
4	Bach or Stravinsky	**1**
4	Matching pennies	**1**
4	Nash equilibrium and Examples	**1**
4	Zero-Sum games	**1**
4	MinMax Strategy	**1**
4	Best response functions, Dominated action	**1**
5	Mixed Strategy and Extensive Games	**1**
5	Strategic games in which players may randomize	**1**
5	Mixed strategy Nash equilibrium	**1**
5	Extensive games with perfect information	**1**
5	Sub-game perfect equilibrium	**1**
5	Sub-game perfect equilibrium	**1**
5	Finding sub-game perfect equilibria of finite horizon games	**1**
5	Backward induction	**1**
	Total	**40 Hrs**

INTEGRATED PROFESSIONAL CORE COURSE (IPCC)

IPCC Course – Integrated Professional Core Course

Teaching Hours/Week (L: T:P: S)	3:0:2:0
Total Hours of Pedagogy	40 hours Theory + 20 Hours of Practical Classes
Credits:	04
Theory - Each Module	8 Hrs
Practical's	8-10 Programs / Experiments
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

- 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.

Integrated Professional Core Course (IPCC) - 4 Credit Course

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 35% of the maximum marks (18 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 (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 Continuous 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 has to 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 Ended 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.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Semester End Examination (SEE) for IPCC Theory

SEE will be conducted as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- 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**.
- 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 shall be of same course outcome, program outcome and Blooms RBT level. Emphasis to be given for higher order RBT levels.

- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored by the student shall be proportionally scaled down to 50 Marks.
- The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only.
- Questions mentioned in the SEE paper may include questions from the practical component.

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)/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,
    - 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).

4 Credits Courses – Integrated Professional Core Course (IPCC)

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	**----**	**----**	**20**	
CIE	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50)/2	15	6	Average of Two Internal test each of 50 Marks scale down the marks to 15 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	10	4	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					**25**	**10**	Scale down Marks of IAT and CCA to 25

CIE	Practical	Conduction of Experiments	Performance-Continuous Evaluation of each experiment	05	15	Average of all Experiments	15	4	Performance of the Experiment (On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. 20 marks are for conducting the experiment and calculations/observations/output)
			Record	05					
			Observation book	05					
		Practical Test	Write up	15	50	----	05	4	One Internal Practical Test after conduction of all Experiments for
			Execution	25					
			Viva-voce	10					
		Open Ended Experiment	Write up	05	20	----	05	2	One experiment for 20 marks. 20 marks reduced to 05 marks
			Execution	10					
			Viva-voce	05					
	Total CIE Practical						**25**	**10**	Scale down Marks of Experiments, Record, Observation, Practical Test and Open-Ended

								Experiment
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	

- 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

Semester	:	03				
Course Title	:	Data Structures and Applications				
Course Code	:	BCA302				
Course Type (Theory/ Practical/ Project/ Integrated)	:	Integrated				
Category	:	IPCC1				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	3:0:2:0		**SEE**	:	50
Total Hours	:	40 hours Theory + 20 Hours of Practical Classes		**SEE Duration**	:	03
Credits	:	04				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To explain fundamentals of data structures and their applications.
2	To illustrate representation of Different data structures such as Stack, Queues, Linked Lists, Trees and Graphs.
3	To Design and Develop Solutions to problems using Linear Data Structures.
4	To discuss applications of Nonlinear Data Structures in problem solving and advanced Data structure concepts such as Hashing and Optimal Binary Search Trees.
5	To design and develop different data structures problems.

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 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 data structures:** Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations Review of pointers and dynamic Memory Allocation, ARRAYS and **Structures:** Arrays, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, representation of **Multidimensional Arrays, Strings STACKS:** Stacks, Stacks Using Dynamic Arrays, Evaluation and conversion of Expressions **Text Book:** Chapter-1:1.2 Chapter-2: 2.1 to 2.7 Chapter-3: 3.1,3.2,3.6 Reference Book 1: 1.1 to 1.4	8Hours
Pedagogy	Problem solving	
2	**Queues:** Queues, Circular Queues, Using Dynamic Arrays, Multiple Stacks and queues. **Linked lists:** Singly Linked, Lists and Chains, Representing Chains in C, Linked Stacks and Queues. **Text Book:** Chapter-3: 3.3, 3.4, 3.7 Chapter-4: 4.1 to 4.4	8Hours
Pedagogy	Problem Solving	
3	**Linked lists:** Additional List Operations, Doubly Linked List. **Trees:** Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees. **Text Book:** Chapter-4: 4.5,4.7,4.8 Chapter-5: 5.1 to 5.3, 5.5	8Hours
Pedagogy	Hacker rank	
4	**Trees(Cont..):** Binary Search trees, Selection Trees, Forests, Representation of Disjoint sets, Counting Binary Trees, **Graphs:** The Graph Abstract Data Types, Elementary Graph Operations **Text Book:** Chapter-5: 5.7 to 5.11 Chapter-6: 6.1, 6.2	8Hours
Pedagogy	Presentation	
5	**Hashing:** Introduction, Static Hashing, Dynamic Hashing Priority queues: Single and double ended Priority Queues, Leftist Trees **Introduction to efficient binary search trees:** Optimal Binary Search Trees **Text Book:** Chapter 8: 8.1 to 8.3 Chapter 9: 9.1, 9.2 Chapter 10: 10.1	8Hours

	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	Develop a Program in C for the following: a) Declare a calendar as an array of 7 elements (A dynamically Created array) to represent7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day(A dynamically allocated String). Write functions create (), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.	CO2
2	Develop a Program in C for the following operations on Strings. a) Read a main String(STR),a Pattern String(PAT)and a Replace String(REP) b) Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.	CO1
3	Develop a menu driven Program in C for the following operations on STACK of Integers(Array Implementation of Stack with maximum size MAX) a) Push an Element onto Stack b) Pop an Element from Stack c) Demonstrate how Stack can be used to check Palindrome d) Demonstrate Overflow and Underflow situations on Stack e) Display the status of Stack f) Exit Support the program with appropriate functions for each of the above operations	CO2
4	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands	C02

5	Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters(Array Implementation of Queue with maximum size MAX) a) Insert an Element on to Circular QUEUE b) Delete an Element from Circular QUEUE c) Demonstrate Overflow and Underflow situations on Circular QUEUE d) Display the status of Circular QUEUE e) Exit Support the program with appropriate functions for each of the above operations	C02
6	DevelopamenudrivenPrograminCforthefollowingoperationsonSinglyLinkedList(SLL)of Student Data with the fields: *USN, Name, Programme, Sem, PhNo* a) Create a SLL of N Students Data by using *front insertion*. b) Display the status of SLL and count the number of nodes in it c) Perform Insertion/Deletion at End of SLL d)Perform Insertion/Deletion at Front of SLL(Demonstration of stack) Exit	C03
7	DevelopamenudrivenPrograminCforthefollowingoperationsonDoublyLinkedList(DLL)ofEmployeeData with the fields: *SSN, Name, Dept, Designation, Sal, PhNo* a) Create a DLL of N Employees Data by using *end insertion*. b) Display the status of DLL and count the number of nodes in it c) Perform Insertion and Deletion at End of DLL d) Perform Insertion and Deletion at Front of DLL e) Demonstrate how this DLL can be used as Double Ended Queue. Exit	CO3
8	Develop a menu driven Program in C for the following operations on Binary Search Tree(BST)of Integers . a) Create a BST of N Integers: 6, 9,5, 2,8, 15,24, 14,7,8,5, 2 b) Traverse the BST in Inorder, Preorder and Post Order Search the BST for a given element (KEY)and report the appropriate message Exit	C04
9	Develop a Program in C for the following operations on Graph(G) of Cities a) Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method	C04
10	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function H: K→L as H(K)=K mod m(remainder method),and implement hashing Technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.	C04

Open ended Programs		
1	Linked List Implementation	CO3
2	Travel Planner using Graphs	CO4
3	Develop a Program in C for the following operations on Singly Circular Linked List (SCLL)with header nodes a) RepresentandEvaluateaPolynomialP(x,y,z)=$6x^2y^2z-4yz^5+3x^3yz+2xy^5z-2xyz^3$ b) FindthesumoftwopolynomialsPOLY1(x,y,z)andPOLY2(x,y,z)andstoretheresultin POLYSUM(x, y, z) Support the program with appropriate functions for each of the above operations	CO3
4	Develop a Program in C for the following Stack Applications a) Evaluation of Suffix expression with single digit operands and operators: +,-,*,/,%,^ Solving Tower of Hanoi problem with in disks	CO2

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014
Reference Books	
1	Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
2	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, CengageLearning,2014.
3	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 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 fundamentals of data structures and their applications.	Understand	L2
CO2	Apply Arrays, Stacks and Queue data structures to solve	Apply	L3
CO3	Analyze the concept of linked list in problem solving.	Analyze	L4
CO4	Analyze solutions using trees and graphs to model the real-world problem advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search.	Analyze	L4

CO5	Develop C program for the different types of data structures and applications	Create	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
CO1															
CO2	3														
CO3		3							2						
CO4		3	2						2				1		
CO5	3	2			3					1			1		

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

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**	
Understand	15	15			
Apply	20	20	5	5	5
Analyze	15	15			5
Create					15

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	10				30	30%
CO2	10	10					20	20%
CO3				10			10	10%
CO4					20		20	20%
CO5						20	20	20%
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)
Understand	40
Apply	30
Analyse	30

SEE Course Plan

CO's	Marks Distribution						Total Marks	Weightage
	Module-1	Module-2	Module to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	10	10				30	30%
CO2	10	10					20	20%
CO3				10			10	10%
CO4					20		20	20%
CO5						20	20	20%
Total	20	20	10	10	20	20	100	100%

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	3rd Semester				
Course Title	:	Artificial Intelligence				
Course Code	:	BCA303				
Course Type Theory/Practical/Project Integrated)	:	Integrated				
Category	:	IPCC2				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	3:0:2:0		**SEE**	:	50
Total Hours	:	40 hours Theory + 8-10 Lab slots		**SEE Duration**	:	03
Credits	:	04				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Gain a historical perspective of AI and its foundations.
2	Become familiar with basic principles of AI toward problem solving
3	Get to know approaches of inference, perception, knowledge representation, and learning

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 with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve Teaching-Learning Process (TLP).

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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	8Hours
Pedagogy		
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	8Hours
Pedagogy		
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	8Hours
Pedagogy		
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	8Hours
Pedagogy		
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	8Hours
	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 and Demonstrate Breadth First Search Algorithm on Water Jug Problem	CO2
2	Implement and Demonstrate BFS Algorithm on Missionaries-Cannibals Problems using Python	CO2
3	Implement A* Search algorithm	CO2
4	Implement AO* Search algorithm	CO2
5	Solve 8-Queens Problem with suitable assumptions	CO5
6	Implementation of TSP using heuristic approach	CO3
7	Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining.	CO3
8	Write a Program to Implement Alpha-Beta Pruning using Python.	CO2
9	Implement Tic-Tac-Toe game using Python	CO5
10	Build a bot which provides all the information related to text in search box.	CO5
Open ended Programs		
1	Implement AI agents that can be designed to play games without explicit instructions on how to win.	CO5
2	Using GANs generate realistic images, enhance data set and create new artworks.	CO5
3	Using AI systems create art, music, and literature autonomously	CO5
4	Using AI in NLP and focusing on tasks like language generation and dialogue systems. Develop Language models like GPT	CO5
5	Using AI generate stories, poems, and scripts by analyzing patterns in existing literature and create new narratives.	CO5

Text Books	
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	Apply knowledge of agent architecture, searching and reasoning techniques for different applications.	Understand	L2
CO2	Compare various Searching and Inferencing Techniques.	Understand	L2
CO3	Develop knowledge base sentences using propositional logic and first order logic	Apply	L3
CO4	Describe the concepts of quantifying uncertainty	Analyze	L4
CO5	Use the concepts of Expert Systems to build applications.	Apply	L3

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	3			3										
CO3			3												
CO4				3											
CO5					3	3	2		2	1	2		2	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				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	
Understand	30	45			
Apply	20	05	30	30	
Analyse	-	-	15	15	
Evaluate	-	-	5	5	

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	10	5	5	10	10	50	50%
CO2	10	10					20	20%
CO3			5	5			10	10%
CO4					10		10	10%
CO5						10	10	10%
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)
Understand	40
Apply	30
Analyse	30

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	10	10	5	5	10	10	50	50%
CO2	10	10					20	20%
CO3			5	5			10	10%
CO4					10		10	10%
CO5						10	10	10%

Total	20	20	10	10	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 35% of the maximum marks (18 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 have to 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) - II	Module – 1 to 2.5	50	(50+50)/2	25	10	Average of Two Internal test each of 50 Marks scale
		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	

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	3rd Semester				
Course Title	:	Operating System				
Course Code	:	BCA304				
Course Type Theory/Practical/Project Integrated)	:	Theory				
Category	:	PCC1				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	3:0:2:0		**SEE**	:	50
Total Hours	:	40 hours Theory + 20 hours Practical		**SEE Duration**	:	03
Credits	:	04				

Course Learning Objectives: Students will be able to:

SI.No	Course Objectives
1	To Demonstrate the need for OS and different types of OS
2	To discuss suitable techniques for management of different resources
3	To demonstrate different APIs/Commands related to processor, Memory, storage and file system management.

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, implementing lab programs 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).

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Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
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COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. **Operating System Services:** User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot. Textbook 1: Chapter – 1 (1.1-1.12), 2 (2.2-2.11)	8Hours
Pedagogy		
2	**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. **Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling, Textbook 1: Chapter – 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1 -5.5)	8Hours
Pedagogy		
3	**Process Synchronization:** Synchronization The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; **Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Textbook 1: Chapter – 6 (6.1-6.6), 7 (7.1 -7.7)	8Hours
Pedagogy		
4	**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6)	8Hours
Pedagogy		

5	**File System, Implementation of File System:** File system File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; **Implementing File system:** File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **Secondary Storage Structure, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix. Textbook 1: Chapter – 10 (10.1-10.5) ,11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.4)	8Hours
	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	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2015
Reference Books	
1	D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
2	P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014
3	William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.
4	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2015

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 structure and functionality of operating system	Understand	L2
CO2	Apply appropriate CPU scheduling algorithms for the given problem.	Apply & Evaluate	L3 L5
CO3	Analyse the various techniques for process synchronization and deadlock handling.	Analyze	L4
CO4	Apply the various techniques for memory management	Apply	L3
CO5	Explain file and secondary storage management strategies.	Understand	L2
CO6	Describe the need for information protection mechanisms	Analyze	L4

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	2		2												
CO2		3	1										2		
CO3		3	2	2											
CO4	3														
CO5	3					2							2		

Weblinks and Video Lectures (e-Resources)	
1	https://youtu.be/mXw9ruZaxzQ
2	https://youtu.be/vBURTt97EkA
3	https://www.youtube.com/watch?v=783KABtuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f
4	https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Assessment (CCA)	Comprehensive
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Understand	30	05		
Apply	10	30	25	25
Analyze	10	15		
Create			25	25

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	5	10	10	50	50%
CO2	10	10					20	20%
CO3			5	5			10	10%
CO4					10		10	10%
CO5						10	10	10%
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)
Understand	30
Apply	30
Analyse	20
Evaluate	20

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	10	10	5	5	10	10	50	50%
CO2	10	10					20	20%
CO3			5	5			10	10%
CO4					10		10	10%
CO5						10	10	10%
Total	20	20	10	10	20	20	100	100%

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	3rd Semester				
Course Title	:	Computer Organization And Architecture				
Course Code	:	BCA305				
Course Type Theory/Practical/Project Integrated)	:	Theory				
Category	:	PCC2				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	3:0:2:0		**SEE**	:	50
Total Hours	:	40		**SEE Duration**	:	03
Credits	:	03				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To understand the organization and architecture of computer systems, operation and the concept of machine instructions and programs.
2	To demonstrate different ways of communicating with I/O devices.
3	To illustrate arithmetic and logical operations with different data types.
4	To understand basic memory system and how parallelism is implemented to boost the performance.
5	To understand high performance processor architecture and issues with multicore processor.

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, implementing lab programs 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).

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25
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(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Basic Structure of Computers:** Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes. Text book 1: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5	8Hours
Pedagogy	Demonstration	
2	**Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration. Text book 1: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4,4.5	8Hours
Pedagogy	Presentation	
3	**Basic Processing Unit:** Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. Pipelining: Basic concepts, Role of Cache memory, Pipeline Performance. Text book 1: 17.1, 7.2, 8.1	8Hours
Pedagogy	Problem Solving	
4	**Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions. Instruction level parallelism and Super Scalar Processors: Overview, Design Issues. Textbook 1: Chapter 5 – 5.1 to 5.2.3,5.3,5.4,5.5 (5.5.1, 5.5.2) Textbook 2: Chapter 16.1, 16.2	8Hours
Pedagogy	Think Pair Share	
5	**Parallel processing:** Multiple processor organization, Symmetric Multiprocessors, Cache Coherence and MESI protocol, Multithreading and Chip Multiprocessor, Nonuniform Memory Access, Multicore Computers: Hardware Performance issues, Software Performance issues, Multicore organization. Textbook 2: 17.1, 17.2, 17.3, 17.4,17.6, 18.1,18.2,18.3.	8Hours

	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	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill.
2	William Stallings, "Computer Organization and Architecture – Designing for Performance", Seventh Edition, Pearson Education, 2017.
Reference Books	
1	David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Elsevier, Third Edition, 2005
2	M. Morris Mano, Computer System Architecture, PHI, 3rd Edition
3	Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P. Singh with Anoop Gupta, Morgan Kaufmann, 1998.

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

CO	**Course Outcomes**	**RBT Level**	**RBT Level Indicator**
CO1	Understand different computer architectures and their applications.	Understand	L2
CO2	Apply the knowledge of machine instructions and its functions and concept of hierarchy for efficient memory design.	Apply	L3
CO3	Analyze fundamental concepts of instruction execution and Pipelining, functions of Parallel	Analyze	L4
CO4	Evaluate the performance of computer systems and suggest techniques to enhance the performance.	Evaluate	L5
CO5	Design of adders, ALU and Memory management unit and highlight the problems related to cache memory.	Create	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
CO1															
CO2	2								2	1			1		
CO3	3														
CO4	1	3							2	1			1		
CO5		2							2	1			1		

Weblinks and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc20_cs41/preview
2	https://www.coursera.org/learn/introduction-high-performance-computing#syllabus
3	https://cse11-iiith.vlabs.ac.in/
4	http://vlabs.iitkgp.ac.in/coa/#

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Assessment (CCA)	Comprehensive
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	5			
Understand	10	20	10	
Apply	25	10	20	20
Analyze	10	20	20	30

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		10		10	35	35%
CO2	10						10	10%
CO3			10	5	10		25	25%
CO4		20					20	20%
CO5						10	10	10%
Total	20	25	10	15	10	20	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	20
Understand	30
Apply	30
Analyze	20

SEE Course Plan

CO's	Marks Distribution						Total Marks	Weightage
	Module-1	Module-2	Module to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	10	10	4	6	10	10	50	50%
CO2	10	10	6	4			20	20%
CO3							10	10%
CO4					10		10	10%
CO5						10	10	10%
Total	20	20	10	10	20	20	100	100%

PROJECT BASED LEARNING (PBL)

PBL- Project Based Learning

Teaching Hours/Week (L: T:P: S)	0:0:2:2
Total Hours of Pedagogy	25 hours – Theory + Project
Credits:	02
Modules	5
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Project Evaluation

	CIE		**SEE**	
	Project Assessment	Weekly	Final Project Evaluation	
Project	Project Understanding	05 Marks	Write up	10 Marks
	Technical Competence	10 Marks	Presentation & Demonstration	50 Marks
	Innovation	10 Marks	Project report	25 Marks
	Problem Solving	15 Marks	Viva-Voce	15 Marks
	Project Demonstration	10 Marks	Total	100 Marks
Total		50 Marks	100 Marks Reduced to 50 Marks	

1. Introduction

Project Based Learning is a model for classroom activity that shifts away from the classroom practices of short, isolated, teacher-centered lessons and instead emphasizes learning activities that are long-term, interdisciplinary, and student-centered.

A systematic teaching method that engages students in learning essential knowledge and life-enhancing skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and tasks.

Project learning, also known as project-based learning, is a dynamic approach to teaching, in which students explore real-world problems and challenges, simultaneously developing cross-curriculum skills while working in small collaborative groups.

2. Characteristics of Project-Based Learning:

• Students making decisions within a framework
• A problem or challenge to be solved;
• Students designing the process for reaching a solution
• Students gathering and managing information
• Continuous Evaluation
Students regularly reflecting on the process
• A final product to be evaluated for quality
• An atmosphere that tolerates error and change

3. Purpose

- Introducing project-based learning on the curriculum.
- To help students to gain in-depth knowledge of the subject via project.
- During this process, students will be able to learn and understand the various stages of project development.

4. Objectives

- Introducing mini project based on the curriculum.
- Develop in depth knowledge of the topic and technology.
- Use critical thinking skills and make real world connections
- Demonstrate and understand through products.
- Industry and concept-oriented learning.

5. Why Incorporate PBL?

- Promotes collaboration and interaction
- Learners communicate meaningfully and for authentic purposes
- Allows students with a variety of learning styles to demonstrate their acquired knowledge

- Students learn language, content, and skills simultaneously
- Increases learner autonomy
- Provides opportunities for students to pursue their own interests and questions and make decisions about how they will find answers and solve problems.
- Improves education for all students Facilitates student integration of the content of different subjects
- Teaches children to use their own minds well and applies what they learn in school to life-long endeavors.
- Helps students to become technologically literate
- Establishes connections to life outside the classroom, addressing real-world concerns, and developing real-world skills
- Skills learned through PBL are those desired by today's employers.

6. Benefits of PBL

- Offers multiple ways for students to participate and to demonstrate their knowledge.
- Accommodates different kinds of intelligences.
- Shifts students away from doing only what they typically do in a classroom
- Environment.
- Encourages the mastery of technological tools, thus preparing them for the workforce.
- Serves as a medium for students who don't usually participate.
- Prompts students to collaborate while at the same time support self-directed learning.
- Offers a learning experience that draws on the thinking and shared efforts of several individuals.
- Helps students develop a variety of social skills relating to group work and negotiation.
- Promotes the internalization of concepts, values, and modes of thought, especially those related to cooperation and conflict resolution.
- Establishes a supportive and non-competitive climate for students.
- Provides a means for transferring the responsibility for learning from teachers to students.
- Calls upon students to explain or defend their position to others in their project groups, so that learning is more apt to be personalized and valued.

7. Process

- Project batches will be formed after the commencement of 3rd semester.
- The Students Batch Comprising of 4 members in a batch should be formed by the Project Based Learning co-ordinator.
- Each Semester consists of 16 Weeks of Project based Learning.

- The Level of the Projects to be identified.
- Level 1- 2nd Year – 3rd Semester & 4th Semester
- Level 2- 3rd year – 5th Semester & 6th Semester
- Level 3 – Final Year Project
- The Faculty handling the respective Theory Subject will be the PBL Coordinator and all the three Batches to be handled by the PBL Coordinator with additional faculty.
- The List of Project Batches to be identified by the faculty assigned in consultation with HOD.
- The batch can select any topic from the list circulated by the PBL Coordinator
- The details of students Interaction with the guide shall be maintained by the guide in the prescribed format.
- The Students Project should be continuously evaluated and PBL Coordinator should submit weekly report to the HOD.
- The Rubrics for the PBL should be followed.
- The Students batches shall give the presentation on understanding of the topic and plan for implementation.
- The Evaluation of the Projects is done in Two Phases

7.1 Two phases for Assessment

Phase 1:

1. Phase 1 is for 4 weeks

2. During this phase, the students shall discuss about the Objectives, Literature Survey and plan for project execution.

Phase 2:

1. Phase 2 is for 11 Weeks

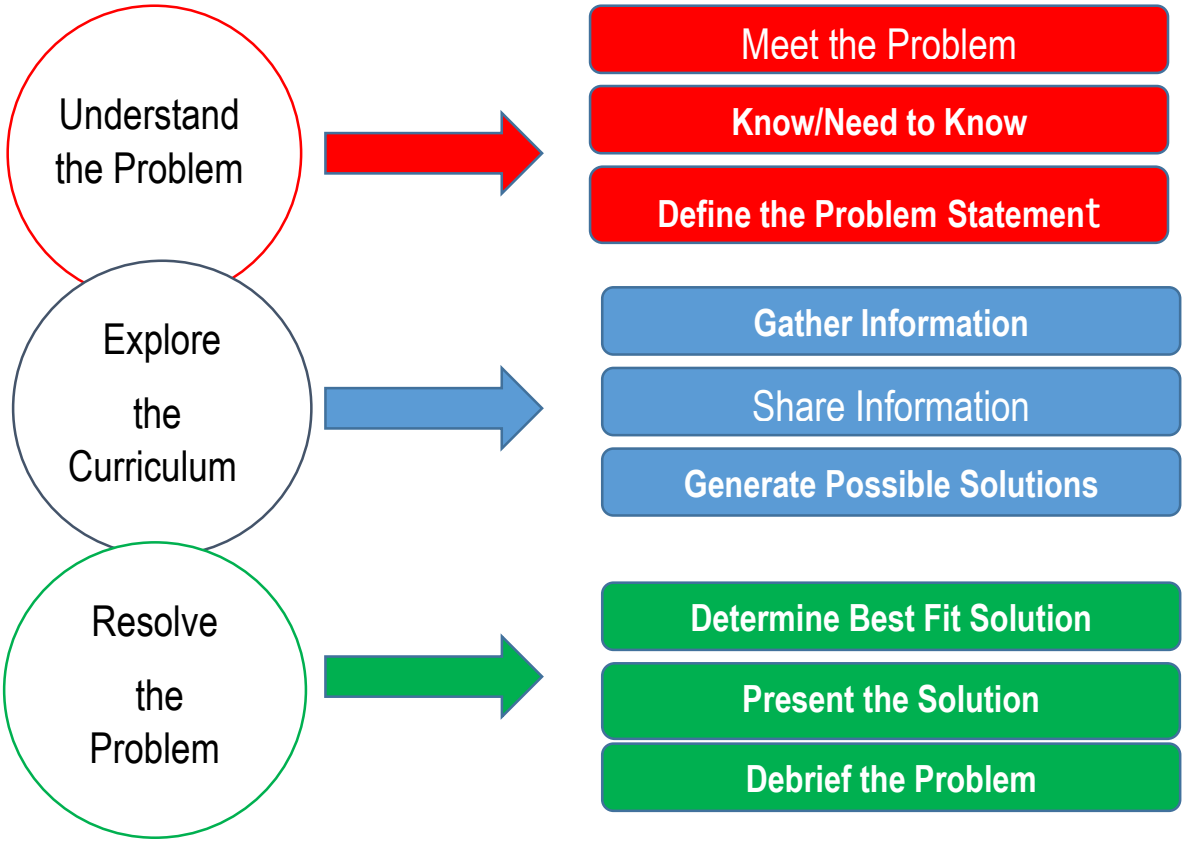
2. During this phase, the students shall carry out the project under regular supervision of the guide/subject expert, Implementation and give final presentation/demonstration with project documents.

The marks distribution for PBL Work:

Phase 1 – 25 Marks

Phase 2 – 25 Marks

8. PBL Teaching and Learning Template



9. Practice

- Every week 3 hour is exclusively dedicated to Project Based Learning.
- Assess their progress until they resolve the problem and summarise their learning.
- Provide opportunities for in-depth investigations of worthy topics.
- Allow learners to become more autonomous as they construct personally-meaningful artefacts that are representations of their learning.
- Motivate students by engaging them in their own learning. PBL affords students opportunities for development.
- Building communication, technical and management skills.

10. Obstacles/Gaps

- Lack of student's interest
- Lack of assessment
- Lack of Basic knowledge
- Lack of consistence attendance and monitoring.
- Lack of abundant time allotment and time management

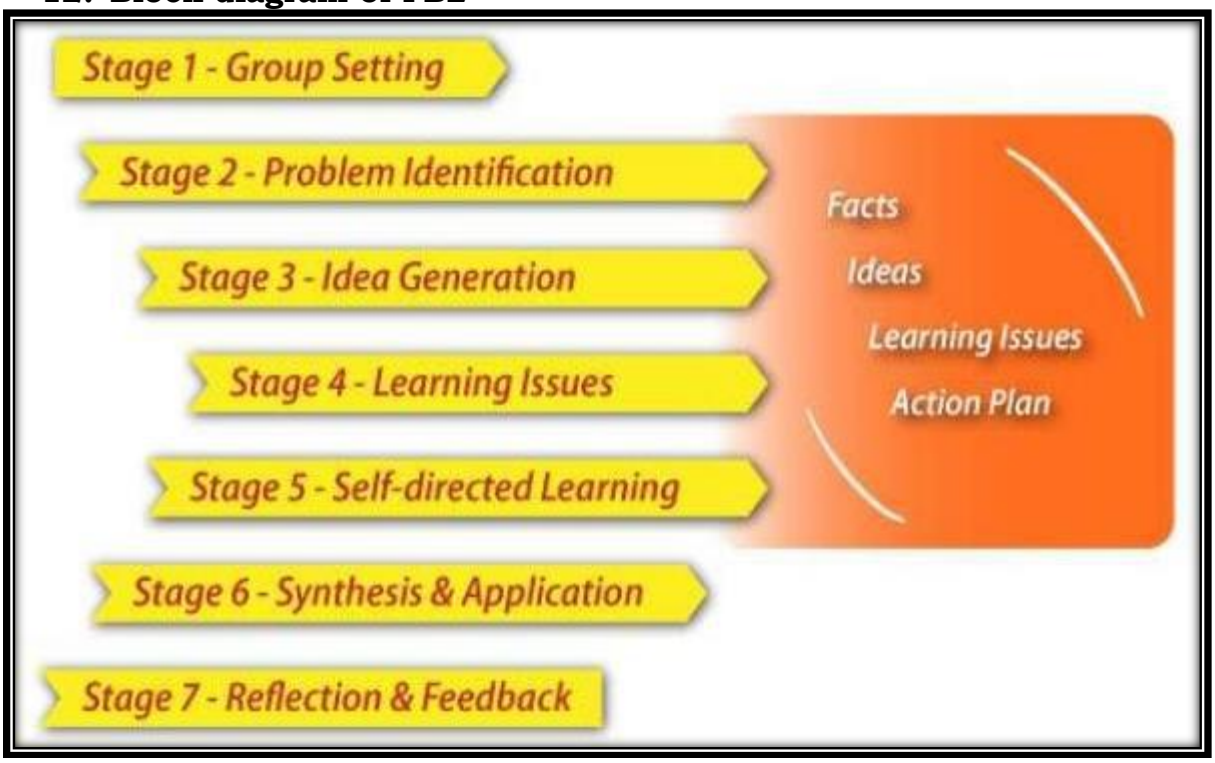
11. How to Overcome?

- Periodic process – stage wise assessment has to be done.
- Basic Knowledge- A complete guidelines and videos will be provided by the faculty who is handling the respective subject and allotted guide.

- Regular evaluation and periodic monitoring is done by 2 stages.

- For Successful execution and demonstration of end-to-end system, exclusive 3hr/week project time is allotted.

12. Block diagram of PBL



13. Impact Analysis

- It encourages students to draw on their own creativity on problem solving and they learn the bridge gap between theory and practice.
- Final products resulting from project-based learning can be shared with the department at large, thus fostering ownership and technically strong with the subject scenario.

14. PBL – Guidelines

The guidelines are for successful completion of the project and to facilitate effective and uniform conduction of projects by the students. It is expected that these guidelines will help in overall improvement in the quality of the project.

14.1 Main phases of the project

Sl.No	Topics	Duration
Phase-1		
1.	Understanding of the project and preparing a project plan	**3 Weeks**
2.	Literature review	**1 Week**
	Planning	**1 Week**
Phase-2		
4.	Analysis and Design	**3 Weeks**
5.	Implementation	**6 Weeks**
6.	Testing	**1 Week**
7.	Writing the project report	**1 Week**
	Total	**16 Weeks**

14.2 Final Presentation Structure

1. Title of the project & Batch Information
2. Agenda / Topics
3. Problem Statement / Project Definition
4. Background / Literature Review
5. Methodology
6. Analysis and Design
7. Implementation
8. Testing
9. Conclusion and Scope for Future Works

14.3 Project Based Learning Report Structure

1. Cover Page
2. Certificate
3. Declaration
4. Acknowledgement
5. Table of Contents
6. List of Tables
7. List of Figures
8. Introduction
9. Background / Literature Review
10. Methodology / Solution
11. Analysis and Design

12. Implementation
13. Results
14. Conclusion and Future Works
15. Bibliography / References
16. Appendices

15. Guidelines to prepare the Project report

- Project reports should be typed neatly only on one side of the paper with 1.5 or double line spacing on a A4 size bond paper (210 x 297 mm).
- The margins should be: Left – 1.25″, Right – 1″, Top and Bottom – 0.75″.
- The total number of reports to be prepared are

    - One copy to the department.
    - One copy to the concerned guide
    - One copy to the candidate.

- Before taking the final printout, the approval of the concerned guide is mandatory and suggested corrections, if any, must be incorporated in the Final Report.
- For making copies dry tone Xerox is suggested.
- An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.

16. Outcome of the project

- Students will gain the knowledge and understand
- To think creatively, work collaboratively.
- Solve complex problems using digital technology.
- Students learn and desire to engage continuous gain about knowledge such as design, analysis, development, implementation and testing.
- Strong written communication skills and the ability to write technical documents that include specification, design, and implementation of a mini project.

Project - Based Learning Rubric

Score Levels	Content	Conventions	Organization	Presentation
5	Is well thought out and supports the solution to the challenge or question Reflects application of critical thinking Has clear goal that is related to the topic Is pulled from a variety of sources	No spelling, grammatical, or punctuation errors High-level use of vocabulary and word choice	Information is clearly focused in an organized and thoughtful manner. Information is constructed in a logical pattern to support the solution.	Multimedia is used to clarify and illustrate the main points. Format enhances the content. Presentation captures audience attention. Presentation is organized and well laid out.
4	Is well thought out and supports the solution Has application of critical thinking that is apparent Has clear goal that is related to the topic Is pulled from several sources Is accurate	Few (1 to 3) spelling, grammatical, or punctuation errors Good use of vocabulary and word choice	Information supports the solution to the challenge or question.	Multimedia is used to illustrate the main points. Format is appropriate for the content. Presentation captures audience attention. Presentation is well organized.
3	Supports the solution Has application of critical thinking that is apparent Has no clear goal Is pulled from a limited number of sources	Minimal (3 to 5) spelling, grammatical, or punctuation errors Low-level use of vocabulary and word choice	Project has a focus but might stray from it at times. Information appears to have a pattern, but the pattern is not consistently carried	Multimedia loosely illustrates the main points. Format does not suit the content. Presentation does not capture audience

2	Provides inconsistent information for solution Has no apparent application of critical thinking Has no clear goal Is pulled from few sources Has significant factual errors, misconceptions, or misinterpretations	More than 5 spelling, grammatical, or punctuation errors Poor use of vocabulary and word choice	Content is unfocused and haphazard. Information does not support the solution to the challenge or question. Information has no apparent pattern.	Presentation appears sloppy and/or unfinished. Multimedia is overused or underused. Format does not enhance content. Presentation has no clear organization.

Subject Identified for Project Based Learning

Semester	03
Subject Identified for PBL	Object oriented programming with JAVA
Prerequisite	Programming knowledge (C or Python should be known)
Justification for the selected subject	Learning by Doing, Real-World Application, Improved Problem-Solving, Collaboration and Communication, Portfolio Building.
List of possible projects	**Beginner:** • Games: Tic-Tac-Toe, Number Guessing Game, Brick Breaker • Simulations: ATM Machine, Simple Banking Application • Text-Based Applications: Library Management System, Inventory Management System • Tools: Currency Converter, Word Counter **Intermediate:** • Games: Flappy Bird Clone, Text-Based Adventure Game • Management Systems: Student Management System, Hospital Management System • Educational Tools: Online Quiz System, Grading System **Advanced:** • Graphical User Interface (GUI) Applications: Drawing Application, Music Player • Web Applications: Online Store (basic functionality) **Network Applications:** Simple Chat Application

Signature of the Guide

Signature of HOD

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	03				
Course Title	:	Object Oriented Programming with Java				
Course Code	:	BCA306				
Course Type Theory/Practical/Project Integrated)	:	Project				
Category	:	PBL				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	0:0:2:2		**SEE**	:	50
Total Hours	:	25 hours – Theory + Project		**SEE Duration**	:	03
Credits	:	02				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To learn primitive constructs JAVA programming language.
2	To understand Object Oriented Programming Features of JAVA.
3	To gain knowledge on: packages, multithreaded programming and exceptions.

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 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
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COURSE CURRICULUM

Module No.	Topics	Hours
1	**An Overview of Java:** Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords). Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables. **Operators:** Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses. **Control Statements:** Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return).	5Hours
Pedagogy		
2	**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection. Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.	5Hours
Pedagogy		
3	**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods.	5Hours
Pedagogy		
4	**Packages:** Packages, Packages and Member Access, Importing Packages. **Exceptions:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's	5Hours

	Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.	
Pedagogy		
5	**Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. Enumerations, Enumerations (Enumeration Fundamentals, The values() and valueOf() Methods)	5Hours
	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	Java: The Complete Reference, Twelfth Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422
Reference Books	
1	Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.
2	Thinking in Java, Fourth Edition, by Bruce Eckel, Prentice Hall, 2006 (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

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

CO	**Course Outcomes**	**RBT Level**	**RBT Level Indicator**
CO1	Ability to comprehend the fundamental concepts of Object-Oriented Programming (OOP) and their application in Java.	Understand	L2
CO2	Ability to apply and design solutions to problems using OOP principles in Java.	Apply	L3
CO3	Ability to Apply well-structured and maintainable Java programs utilizing classes, objects, inheritance, polymorphism, and encapsulation.	Analyze	L4

CO4	Ability to Analyze the effectiveness and appropriateness of different OOP design choices for specific programming tasks.	Evaluate	L5
CO5	Ability to collaborate effectively to develop and debug complex Java applications using OOP best practices.	Create	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**
CO1															
CO2	2														
CO3	3														
CO4		2	1												
CO5					1				1	1	1		1		

Weblinks and Video Lectures (e-Resources)	
1	Java Tutorial: https://www.geeksforgeeks.org/java/
2	Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
3	Java Tutorial: https://www.w3schools.com/java/
4	Java Tutorial: https://www.javatpoint.com/java-tutorial

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**
Understand	20	10		
Apply	20	20	30	20
Analyse	10	20	20	10
Create				20

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 1 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	10	5	5	5	5	45	45%
CO2	10	5					15	15%
CO3			5	5	10		20	20%
CO4				5	5	10	20	20%
Total	25	15	10	15	20	15	100	100%

Project Based Learning – Batch

From, **Date:**

Name: & USN:

Name: & USN:

Name: & USN:

Name: & USN:

Semester:

Respected Sir/Madam,

Sub: Regarding PBL Batch

With respect to the above subject, we are the students mentioned above would like to form the batch for carrying out the mini project on……

Thanking you, Yours faithfully

Sl. No.	Name of the student	Signature
1.		
2.		
3.		
4.		

Signature of the Guide
Name of the Guide Designation

Department of …… Engineering

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 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 PBL Coordinator Signature of HOD

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Project Based Learning Outcomes

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

ABILITY ENHANCEMENT COURSE (AEC)

AEC Course – Ability Enhancement Course

Teaching Hours/Week (L: T:P: S)	0:0:2:0
Total Hours of Pedagogy	24 hours Practical
Credits:	01
Programs / Experiments	12
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Practical (Internal Examiners only)

Semester	:	03				
Course Title	:	Data Analytics with R				
Course Code	:	BCA307				
Course Type Theory/Practical/Project Integrated)	:	Practical Experiential Learning				
Category	:	AEC				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	0:0:2:0		**SEE**	:	50
Total Hours	:	30 hours of practical		**SEE Duration**	:	03
Credits	:	01				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To Gain the knowledge of R Programming Concepts
2	To Explain the concepts of Data Visualization
3	To Explain the concept of Statistics in R.
4	To Work with R charts and Graphs

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 with real-world scenarios and improve the understanding.
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Scheme of Teaching and Examinations for BE Programme -2024-25
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COURSE CURRICULUM

Module No.	Topics	Hours
1	Basics of R Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops, Basic Data Types in R, Vectors Chapter 1: 1.1 to 1.7 Chapter 2: 2.1,2.2	4
Pedagogy		
2	Basics of R Continued Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times Chapter 2: 2.3,2.4,2.5,2.6,2.7.2.8.1,2.8.2	5
Pedagogy		
3	Data Preparation Datasets, Importing and Exporting files, Accessing Databases, Data Cleaning and Transformation Chapter 3: 3.1,3.2,3.3,3.4	5
Pedagogy		
4	Graphics using R Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots, Histograms, Box Plots, Bar Plots, Other Graphical packages Chapter 4: 4.1 to 4.9	5
Pedagogy		
5	Statistical Analysis using R Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7	5
	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	R Programming: An Approach to Data Analytics, G. Sudhamathy and C. Jothi Venkateswaran, MJP Publishers, 2019
Reference Books	
1	An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16)
2	Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Describe the structures of R Programming.	Understand	L2
CO2	Apply the Graphical Packages of R for visualization.	Apply	L3
CO3	Analyze various Statistical methods for data	Analyze	L4
CO4	Illustrate the basics of Data Preparation with real world examples.	Create	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
CO1															
CO2	3														
CO3		3													
CO4			2		1				1	1	1		1		

Weblinks and Video Lectures (e-Resources)	
1	URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2	http://www.tutorialspoint.com/r/r_tutorial.pdf
3	https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
4	https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html
5	https://www.w3schools.com/r/r_stat_data_set.asp
6	https://rpubs.com/BillB/217355

CIE- Continuous Internal Evaluation (50) Marks

Bloom's Category	**Theory**			
	Continuous Assessment Tests (IAT)		**Continuous Assessment (CCA)**	**Comprehensive**
	IAT-1	**IAT-2**	**CCA-1**	**CCA-2**
	50 Marks	**50 Marks**	**50 Marks**	**50 Marks**
Understand	20			
Apply	40		10	10
Analyse	40		20	10
Create			20	30

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								
CO2								
CO3								
CO4								
CO5								
Total								

SEE- Semester End Examination (50 Marks)

Bloom's Category	**SEE Marks**
Understand	15
Apply	20
Analyse	15

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								
CO2								
CO3								
CO4								
CO5								
Total								

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 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. **I 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.

SOCIAL CONNECT
&
RESPONSIBILITY (SCR)

SCR- Social Connect & Responsibility

Teaching Hours/Week (L: T: P: S)	0:0:0:2
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning
Credits:	01
Programs / Experiments	12
CIE Marks	100
SEE Marks	------
Total Marks	100
Exam Hours	3
Examination nature (SEE)	No SEE only CIE For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept / Any Dept.

Dayananda Sagar Academy of Technology & Management

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Semester	**:**	03				
Course Title	**:**	Social Connect & Responsibility				
Course Code	**:**	BSCK308				
Course Type Theory/Practical/Project /Integrated)	**:**	Practical				
Category	**:**	SCR				
Stream	**:**	CSE(AI)		**CIE**	**:**	100
Teaching hours/ week (L:T:P:S)	**:**	0:0:3:1		**SEE**	**:**	-
Total Hours	**:**	40 hour Practical Session +15 hour Planning		**SEE Duration**	**:**	-
Credits	**:**	01				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Provide a formal platform for students to communicate and connect to the surrounding.
2	create a responsible connection with the society.
3	Understand the community in general in which they work.
4	Identify the needs and problems of the community and involve them in problem –solving.
5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

Teaching-Learning Process

General Instructions - Pedagogy :

- These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
- State the need for activities and its present relevance in the society and Provide real-life examples.
- Support and guide the students for self-planned activities.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical

skills

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

Contents :

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

Module No.	Topics	Hours
1	**Part I:** **Plantation and adoption of a tree:** Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.	9Hours
Pedagogy		
2	**Part II :** **Heritage walk and crafts corner:** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes.	9Hours
Pedagogy		
3	**Part III :** **Organic farming and waste management:** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.	9Hours
Pedagogy		
4	**Part IV:** **Water conservation:** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.	9Hours
Pedagogy		
5	**Part V :** **Food walk:** City's culinary practices, food lore, and indigenous materials of	9Hours

	the region used in cooking – Objectives, Visit, case study, report, outcomes.	
	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	
2	
Reference Books	
1	
2	

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Communicate and connect to the surrounding.	Understand	L2
CO2	Create a responsible connection with the society.	Understand	L2
CO3	Involve in the community in general in which they work.	Understand	L2
CO4	Notice the needs and problems of the community and involve them in problem –solving.	Understand	L2
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge	Understand	L2

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							3		2	2					
CO3									3	2					
CO4						3									
CO5										2		3			

Activities:
Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:
The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:
The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration :
A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per guidelines of scheme & syllabus.

Continuous Internal Evaluation (CIE):

- After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period.
- The report should be signed by the mentor.
- The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50.
- Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing
- Considering all above points allotting the marks as mentioned below

Excellent	: 80 to 100
Good	: 60 to 79
Satisfactory	: 40 to 59
Unsatisfactory and fail: <39	

Pedagogy – Guidelines:

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl.No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Plantation and adoption of a tree:	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
2.	Heritage walk and crafts corner:	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
3.	Organic farming and waste management:	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc....	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
4.	Water conservation: & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers / campus etc.....	Site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
5.	Food walk: Practices in societ	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Governme nt Schemes officers/ campus etc...	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty

1 Credit Course – Practical + Planning

Assessment Details (both CIE and SEE)

NO SEE – Semester End Exam – Completely Practical and activities based evaluation

Plan of Action (Execution of Activities)	
Sl.No	**Practice Session Description**
1.	Lecture session in field to start activities
2.	Students Presentation on Ideas
3.	Commencement of activity and its progress
4.	Execution of Activity
5.	Execution of Activity
6.	Execution of Activity
7.	Execution of Activity
8.	Case study-based Assessment, Individual performance
9.	Sector/ Team wise study and its consolidation
10.	Video based seminar for 10 minutes by each student At the end of semester with Report.
• Each student should do activities according to the scheme and syllabus. • At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion. • At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.	

Assessment Details for CIE (both CIE and SEE)

Weightage	CIE – 100%	Implementation strategies of the project (NSS work). The last report should be signed by NSS Officer, the HOD and principal. At last report should be evaluated by the NSS officer of the institute.
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study-based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report. Activities 1 to 5, 5*5 = 25	25 Marks	
Total marks for the course in each semester	100 Marks	
For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.		
Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.		

4th SEMESTER

Dayananda Sagar Academy of Technology & Management

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Semester	:	**4th**				
Course Title	:	**Statistics and Probability**				
Course Code	:	**BMATA401**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**ASC**				
Stream	:	**CSE, ISE, AIML, CSE-AI, CSE-DS & CYB. SEC.**		**CIE**	:	**50 Marks**
Teaching hour/week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs**		**SEE Duration**	:	**3 Hours**
Credits:	:	**3**				

Course Learning Objectives: Students will be taught

Sl.No	Course Objectives
1	Acquire basic knowledge of Mathematical concepts for understanding engineering problems
2	Use concepts of statistics and probability in solving problems
3	Analyze problems using concepts of statistics and probability
4	Use MATLAB to obtain solutions of various mathematical problems.

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	**Statistics** Introduction, curve fitting (Least squares method), fitting of a straight line, fitting of a second-degree parabola, fitting of exponential curves, correlation and correlation coefficient r, regression lines, rank correlation.	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
2	**Probability Distribution** Review of basic probability theory, random variables (discrete and continuous), probability mass and density functions, mathematical expectation, mean and variance, binomial, Poisson, normal, exponential distribution, Weibull and uniform distributions.	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
3	**Sampling Theory** Introduction, sampling distribution, standard error, testing of hypothesis, central limit theorem, levels of significance, z- test for large samples, confidence limits, Student's 't' distribution, Chi-square distribution as a test of goodness of fit, F-Distribution.	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
4	**ANOVA** The ANOVA technique, basic principle of ANOVA, one-way ANOVA, Two-way ANOVA, Latin-square Design	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	
5	**Time series and Markov chain** **Time series:** Introduction to times series data, Components of a time series, Decomposition of time series, method of semi averages, fitting a various mathematical curve and growth curves. **Markov chain**: Introduction to stochastic process, probability vectors, stochastic matrices, regular stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains.	8
Pedagogy	**Chalk and board, group discussion, ppt, videos**	

List of Experiments or Programs

Sl.No	Experiments/Programs	COs
	NIL	

Text Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1	Probability and Statistics, Murray R. Spiegel, John Schiller, R. Alu Srinivasan**,** Schaum's outline series, Mc Graw Hill Publication, 4th Edition, 2012.
2	Research Methodology Methods & Techniques, C R Kothari and Gaurav Garg, New Age International Limited, 3rd Edition, 2014
3	Probability & Statistics for Engineers & Scientists, Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye, Pearson Education, 9th edition, 2017.

Reference Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Higher Engineering Mathematics, B. S. Grewal, Khanna publishers, 44th Ed., 2021.
2	Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce & Peter Gedeck O'Reilly Media, Inc., 2nd edition 2020.
3	Fundamentals of Mathematical Statistics, S.C.Gupta and V.K.Kapoor, Chand Publishers,12th edition,2020.

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

CO	**Course Outcomes**	**RBT Level**	**Level Indicator**
CO1	Understand the basic concepts of statistics and probability	**Remember, Understand**	**L1, L2**
CO2	Apply techniques of statistics and probability to solve engineering problems	**Apply**	**L3**
CO3	Analyze engineering problems using statistics and probability	**Analyse**	**L4**
CO4	Develop mathematical solutions to various real time problems using MATLAB	**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
CO1													--	--
CO2	3												--	--
CO3		2											--	--
CO4			2		2				1	1			--	--

Weblinks and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2	https://avcce.digimat.in/nptel/courses/video/111107058/L05.html
3	https://archive.nptel.ac.in/courses/111/106/111106086/

Assessment Pattern (both CIE and SEE)

Applied Science Courses								
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**	
CIE	**Theory**	Internal Assessment Test (IAT) - I	Module – 1, 2 & 3(half module)	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 - 3(half module), 4 & 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	100	----	50	20	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.				

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

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

- First test after 7th week of the semester (syllabus completion of 50%)
- Second test after 14th week of semester (syllabus completion of 100%)

The average score of three test is taken and scaled down to **25 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 **25 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 **25 Marks**

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

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	50 Marks
Remember			30		
Understand	10	10	20		
Apply	30	30			
Analyse	10	10			
Evaluate				50	
Create					

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module-3	Module-3	Module-4	Module-5		
CO1	5	5	5		5	5	25	25%
CO2	10	10	5	5	10	10	50	50%
CO3	5	5		5	5	5	25	25%
CO4								
CO5								
CO6								
Total	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	5
Apply	35
Analyse	10

Evaluate	**--**
Create	**--**

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	5	--	--	--	--	5	10%
CO2	5	5	10	5	10	35	70%
CO3	--	5	--	5	--	10	20%
CO4	--	--	--	--	--	--	--
CO5	--	--	--	--	--	--	--
CO6	--	--	--	--	--	--	--
Total	10	10	10	10	10	50	100%

Course Contents and Lecture Schedule

Module No.	Topics	No. of Lectures
1	Introduction to Curve fitting	1
1	Curve fitting (Least squares method)	1
1	Fitting of a straight line	1
1	Fitting of a second-degree parabola	1
1	Fitting of curves of the form y=ab^x	1
1	Fitting of curves of the form y=ae^{bx}, y=ax^b	1
1	Correlation coefficient r, Regression lines	1
1	Rank Correlation	1
2	Introduction on basic probability theory	1
2	Discrete random variables and Continuous random variables	1
2	Probability mass and density functions	1
2	Mathematical expectation, Mean and variance	1
2	Binomial distribution, Poisson distribution	1
2	Normal distribution	1
2	Exponential distribution	1
2	Weibull and uniform distribution	1
3	Introduction to Sampling Theory, Sampling distribution	1
3	Standard error, testing of hypothesis	1
3	Central limit theorem	1
3	Levels of significance	1
3	Test of significance, Confidence limits	1
3	Student's 't' distribution, Problems	1
3	Chi-square distribution as a test of goodness of fit	1

3	F-Distribution, Problems	**1**
4	Introduction to ANOVA.	**1**
4	The ANOVA technique.	**1**
4	Explanation on ANOVA technique.	**1**
4	Basic principle of ANOVA.	**1**
4	Explanation on one-way ANOVA.	**1**
4	Problems on one-way ANOVA.	**1**
4	Two-way ANOVA and problems	**1**
4	Latin-square Design and problems	**1**
5	Introduction to time series data, Components of a time series	**1**
5	Decomposition of time series	**1**
5	Method of semi averages	**1**
5	Fitting a various mathematical curve and growth curves.	**1**
5	Introduction to stochastic process	**1**
5	Probability vectors	**1**
5	Stationary distribution of regular Markov chains	**1**
5	Markov chains	**1**
	Total	**40 Hrs**

INTEGRATED PROFESSIONAL CORE COURSE (IPCC)

IPCC Course – Integrated Professional Core Course

Teaching Hours/Week (L: T:P: S)	3:0:2:0
Total Hours of Pedagogy	40 hours Theory + 20 Hours of Practical Classes
Credits:	04
Theory - Each Module	8 Hrs
Practical's	8-10 Programs / Experiments
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

- 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.

Integrated Professional Core Course (IPCC) - 4 Credit Course

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 35% of the maximum marks (18 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 (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 Continuous 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 has to 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 Ended 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.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Semester End Examination (SEE) for IPCC Theory

SEE will be conducted as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- 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 shall be of same course outcome, program outcome and Blooms RBT level. Emphasis to be given for higher order RBT levels.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored by the student shall be proportionally scaled down to 50

Marks.

- The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only.
- Questions mentioned in the SEE paper may include questions from the practical component.

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)/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,
    - 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).

4 Credits Courses – Integrated Professional Core Course (IPCC)								
Assessment Method	**Component**	**Type of Assessments**	**Syllabus Coverage**	**Maximum Marks**	**Average**	**Reduced Marks**	**Minimum Passing Marks**	**Evaluation Details**
Total CIE Theory + Practical				**50**	----	----	**20**	
CIE	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50) / 2	15	6	Average of Two Internal test each of 50 Marks scale down the marks to
		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	10	4	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					**25**	**10**	Scale down Marks of IAT and CCA to 25

CIE	Practical	Conduction of Experiments	Performance- Continuous Evaluation of each experiment	05	15	Average of all Experiments	15	4	Performance of the Experiment (On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. 20 marks are for conducting the experiment and calculations/ observations/ output)
			Record	05					
			Observation Book	05					
		Practical Test	Write up	15	50	----	05	4	One Internal Practical Test after conduction of all
			Execution	25					
			Viva-voce	10					
		Open Ended Experiment	Write up	05	20	----	05	2	One experiment for 20 marks. 20 marks reduced
			Execution	10					
			Viva-voce	05					

	Total CIE Practical					**25**	**10**	Scale down Marks of Experiments, Record, Observation, Practical Test and Open-Ended Experiment
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**	

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

Dayananda Sagar Academy of Technology & Management

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Semester	:	04				
Course Title	:	Analysis & Design of Algorithms				
Course Code	:	BCA402				
Course Type Theory/Practical/Project Integrated)	:	Integrated				
Category	:	IPCC-1				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours week (L:T:P:S)	:	03:00:02:00		**SEE**	:	50
Total Hours	:	40 hours Theory + 20 Hours of Practical Classes		**SEE Duration**	:	03
Credits	:	04				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To learns the methods for analyzing algorithms and evaluating their performance.
2	To demonstrate the efficiency of algorithms using asymptotic notations.
3	To solve problems using various algorithm design methods, divide and conquer, decrease and conquer, transform and conquer, backtracking, and branch and bound.
4	To solve problems using various algorithm design methods, including dynamic programming and Greedy methods.
5	To learn the concepts of P and NP complexity classes and backtracking, and branch and bound.

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 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
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COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction:** What is an Algorithm?, Fundamentals of Algorithmic Problem Solving. **Fundamentals of the analysis of algorithm efficiency:** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. Brute force approaches: Selection Sort and Bubble Sort, Sequential Search an Brute Force String Matching. Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)	8Hours
Pedagogy	Program Solving	
2	**Brute force approaches (contd..):** Exhaustive Search (Travelling Salesman problem and Knapsack Problem). Decrease-and-conquer: Insertion Sort, Topological Sorting. Divide and conquer: Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication. Chapter 3(Section 3.4), Chapter 4 (Sections 4.1,4.2), Chapter 5 (Section 5.1,5.2,5.3, 5.4)	8Hours
Pedagogy	Program Solving	
3	**Transform-and-conquer:** Balanced Search Trees, Heaps and Heapsort. **Space-time tradeoffs:** Sorting by Counting Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm. Chapter 6 (Sections 6.3,6.4), Chapter 7 (Sections 7.1,7.2)	8Hours
Pedagogy	Hands-on	
4	**Dynamic programming:** Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. **The greedy method:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.	8Hours

Pedagogy	Presentation	
5	**Limitations of algorithmic power:** Decision Trees, P, NP, and NP-Complete Problems. **Coping with limitations of algorithmic power:** Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem). Chapter 11 (Section 11.2, 11.3), Chapter 12 (Sections 12.1,12.2,12.3)	8Hours
	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	Design and implement C Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.	C04
2	Design and implement C Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.	C04
3	a. Design and implement C Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement C Program to find the transitive closure using Warshal's algorithm.	C04
4	Design and implement C Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.	C04
5	Design and implement C Program to obtain the Topological ordering of vertices in a given digraph.	C02
6	Design and implement C Program to solve 0/1 Knapsack problem using Dynamic Programming method.	C04
7	Design and implement C Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.	C01

8	Design and implement C Program to sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.	C03
9	Design and implement C Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.	C03
10	Design and implement C Program for N Queen's problem using Backtracking.	C05
	Open ended Programs	
1	Minimum Spanning Tree for Communication Networks	C04
2	Dynamic Programming optimization	C04
3	Design and implement C Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method	CO4
4	Design and implement C Program to find a subset of a given set S = {sl , s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d.	CO5

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Introduction to the Design and Analysis of Algorithms, By Anany Levitin, 3rd Edition (Indian), 2017, Pearson.
Reference Books	
1	Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI

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 fundament of algorithmic problem solving	Understand	Un

CO2	Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity and decrease & conquer approaches to solve computational problems.	Apply	Ap
CO3	Apply Divide & conquer approaches to solve computational problems.use of transform & conquer and space off traders to solve problem.	Apply	Ap
CO4	Analyse Dynamic programming design approaches to solve the given real world or complex computational problems and use greedy	Analyse	An
CO5	Analyse various classes (P,NP and NP Complete) of problems and use backtracking, branch & bound and approximation methods.	Analyse	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
CO1															
CO2	3												1		
CO3	3				2								1		
CO4		3	2		2				2	1			1		
CO5		3								1			1		

Weblinks and Video Lectures (e-Resources)	
1	Design and Analysis of Algorithms: https://nptel.ac.in/courses/106/101/106101060/
2	https://onlinecourses.nptel.ac.in/noc19_cs47/preview
3	https://onlinecourses.nptel.ac.in/noc22_cs01/preview

CIE- Continuous Internal Evaluation (50 Marks)

	Theory		Practical
Bloom's	Continuous Assessment	Continuous Comprehensive	

Category	Tests (IAT)		Assessment (CCA)		Practical Test
	IAT-1	IAT-2	CCA-1	CCA-2	
	50 Marks	50 Marks	50 Marks	50 Marks	
Understand	15	15			
Apply	20	20	5	5	5
Analyze	15	15			5
Create					15

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	10				30	30%
CO2	10	10					20	20%
CO3				10			10	10%
CO4					20		20	20%
CO5						20	20	20%
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)
Understand	40
Apply	30
Analyse	30

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	10	10	10				30	30%
CO2	10	10					20	20%
CO3				10			10	10%
CO4					20		20	20%
CO5						20	20	20%
Total	20	20	10	10	20	20	100	100%

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	04				
Course Title	:	Microcontroller and Robotics				
Course Code	:	BCA403				
Course Type Theory/Practical/Project Integrated)	:	Integrated				
Category	:	IPCC-2				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/week (L:T:P:S)	:	03:00:02:00		**SEE**	:	50
Total Hours	:	40+20		**SEE Duration**	:	03
Credits	:	04				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR.
2	Use the various instructions to program the ARM controller
3	Familiarize with the Anatomy of robot and 3D homogeneous transformations
4	To study the different sensors and actuators used in robotics
5	Study the application of robot technology in wheeled mobile robots, medical robots, unmanned aerial vehicles, service robots, underwater robots.

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 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
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COURSE CURRICULUM

Module No.	Topics	Hours
1	Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions Textbook 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5	8Hours

Pedagogy	Quiz	
2	Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants. C Compilers and Optimization: Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing. Textbook 1: Chapter 3: Sections 3.1 to 3.6 (Excluding 3.5.2), Chapter 5	8Hours
Pedagogy	Demonstration	
3	Definitions- Robots, Robotics; Types of Robots - Manipulators, Mobile Robots -wheeled & Legged Robots, Aerial Robots; Anatomy of a robotic manipulator sensors- -links, joints, actuators, sensors, controller; open kinematic vs closed kinematic chain; degrees of freedom; Robot considerations for an application- number of axes, work volume, capacity & speed, stroke & reach, Repeatability, Precision and Accuracy, Operating environment,point to point control or continuous path control. 3D Homogeneous transformations: 3D homogeneous rotation Matrix, 3D Homogeneous translation Matrix, Composite rotation Matrix, Rotation Matrix about an Arbitrary Axis, Application of 3D homogeneous transformations in robotics, numerical Problems.	8Hours
Pedagogy	Think Pair Share	
4	Sensors for Robots Sensor classification- Proprioceptive and Exteroceptive sensors, active and passive sensors, characteristics of sensors, touch, force, range, proximity, vision sensors. External sensors-contact type, noncontact type; Vision - Elements of vision sensor, image acquisition, image processing; Selection of sensors. Actuators for Robots: classification-Electric, Hydraulic, Pneumatic actuators; their advantages and disadvantages; Electric actuators- Stepper motors, DC motors, DC servo motors and their drivers, AC motors, Linear actuators, selection of motors.	8Hours
Pedagogy	Demonstration	
5	Application of Robot: Industrial Robots, aerial robots-Fixed wing unmanned aerial vehicle, helicopters, Multi rotor UAV, Flapping wing/Bio inspired UAV, wheeled mobile robots, smarm robots, Legged robots, medical/healthcare robots-Surgical Robot, Exoskeleton robot.	8Hours
	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	Using Keil software, write a program to find the sum of the first 10 integer numbers	CO2
2	Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM.	CO2
3	Write a program to find the square of a number (1 to 10) using a look-up table.	CO2
4	Write a program to arrange a series of 32 bit numbers in ascending/descending order.	CO2
5	Write a program to find the largest or smallest number in an array of 32 numbers.	CO2
6	Experiments using Raspberry Pi: A) Proximity Sensors B) Range Sensors-Ultrasonic, IR and laser range sensor	CO5
7	Experiments on: A) Linear and rotary displacement sensors. B) Vision Sensors	CO5
8	Experiments on: A) Stepper motor controlled linear slide B) Servo motor controlled linear slide	CO5
9	Experiments on Quadcopter micro air vehicle	CO5
10	Experiments on Differential Wheel Mobile robot	CO5
Open ended Programs		
1	Experiments on Robot for demonstrating 3D Printing	CO5
2	Experiments on Robot for demonstrating Pick and Place operation	CO5
3	Experiments on 3D Homogeneous transformations using 3D Coordinate frame models	CO5

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008
2	"Robotics and Control" R. K. Mittal, I. J. Nagrath, Tata-McGraw-Hill Publications, 2007
3	"Robotics: Control, Sensing, Vision, Intelligence" Fu K. S., Gonzelez R. C., Lee C. S. G., McGraw Hill

	Book Co., 2008
Reference Books	
1	Raghunandan. G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
2	The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3	"Service Robots and Robotics: Design and Application", Marco Ceccarelli, Published by Engineering Science Reference, Year-2012, ISBN: 9781466602915
4	"Small Unmanned Fixed-Wing Aircraft Design", Andrew J. Keane, András Sóbester, James P. Scanlan, Wiley Publications Year-2017, ISBN:9781119406303
5	"Surgical Robotics: Systems Applications and Visions", Jacob Rosen, Blake Hannaford, Richard M. Satava, Springer Publication, Year-2011, ISBN:978-1-4419- 1126-1.
6	"Swarm Robotics: A Formal Approach", Heiko Hamann, Springer Publication, Year2018, ISBN: 978-3-319-89
7	"Underwater Robots Motion and Force Control of Vehicle-Manipulator Systems", Gianluca Antonelli, Springer Publication, Year-2006, ISBN: 978-3-642-06859-1.
8	"Wheeled Mobile Robotics: From Fundamentals Towards Autonomous Systems", Gregor Klancar , Andrej Zdesar, Saso Blazic, Igor Skrjanc, Publisher: ButterworthHeinemann, Year-2017, ISBN: 978-01280

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 basics of ARM microcontrollers, classify the different types of robots, and identify the different components of a robotic manipulator.	Understand	L2
CO2	Apply the knowledge gained from programming on ARM to different	Apply	L3
CO3	Apply 3D homogeneous transformations to robot motion.	Apply	L3
CO4	Analyze different sensors and actuators used to collect data and control robotics motion.	Analyze	L4
CO5	Design a simple robotics experiments using microcontrollers, sensors and actuators.	Create	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**
CO1															
CO2	3				2								1		
CO3	2	2												1	
CO4		2	2										1		
CO5					3				3	1		1	1	1	

Weblinks and Video Lectures (e-Resources)	
1	Introduction to Robotics https://ocw.mit.edu/courses/mechanical-engineering/2-12- introduction-to-robotics- fall-2005/syllabus/
2	Introduction to robotics https://nptel.ac.in/courses/107/106/107106090/
3	Robotics Specialization https://www.coursera.org/specializations/robotics

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	10				
Understand	10	10			
Apply	20	20	20	20	
Analyse	10	20	20	20	
Evaluate			10	10	10
Create					15

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	5	10	10	50	50%
CO2	10	10					20	20%
CO3			5	5			10	10%
CO4					10		10	10%
CO5						10	10	10%
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	20
Understand	30
Apply	30
Analyze	20

SEE Course Plan

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

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 35% of the maximum marks (18 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 have to 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) - II	Module – 1 to 2.5	50	(50+50) / 2	25	10	Average of Two Internal test each of 50 Marks scale
		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**	

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	04				
Course Title	:	Cloud Computing				
Course Code	:	BCA404				
Course Type Theory/Practical/Project/Integrated)	:	Theory				
Category	:	PCC1				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	3:0:0:0		**SEE**	:	50
Total Hours	:	40		**SEE Duration**	:	03
Credits	:	03				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Explain cloud computing concepts, models, benefits, disadvantages, and the role of open standards.
2	Illustrate the cloud architecture and differentiate between various cloud service models.
3	To equip students with a thorough understanding of cloud resource virtualization and the impact of virtualization on performance and security.
4	To explore concepts in cloud resource management and the evolution of storage technology and various cloud storage systems.
5	To provide students with a comprehensive understanding of cloud security, mitigating security risks in cloud application development with real time application.

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, implementing lab programs 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).

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	Defining Cloud Computing: Defining Cloud Computing, Cloud Types: The NIST model, The Cloud Cube Model, Deployment models, Service models. Examining the Characteristics of Cloud Computing, Paradigm shift: Benefits of cloud computing, Disadvantages of cloud computing Assessing the Role of Open Standards. Measuring the Cloud's Value: Early adopters and new applications The laws of cloudonomics Cloud computing obstacles Behavioral factors relating to cloud adoption Measuring cloud computing costs. Text Book 1: Chapter1, Chapter2	8Hours
Pedagogy		
2	Understanding Cloud Architecture: Exploring the Cloud Computing Stack, Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications. Understanding Services and Applications by Type: Defining Infrastructure as a Service (IaaS), Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), Defining Identity as a Service (IDaaS). Textbook 1: Chapter3, Chapter4	8Hours
Pedagogy		
3	Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems. Textbook2: Chapter 5.1 to 5.12, 5.16	8Hours
Pedagogy		
4	Cloud Resource Management and Scheduling: 1 Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource Allocation	8Hours

	Architecture. Cloud Storage Systems: The Evolution of Storage Technology, Storage Models, File Systems, and Databases, Distributed File Systems: The Precursors, General Parallel File System, Google File System, Apache Hadoop. Textbook2: Chapter 6, 6.1,6.2,6.3 , Chapter 8, 8.1 to 8.6	
Pedagogy		
5	Cloud Security: Cloud Application Development: 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, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems. Textbook2: Chapter 9, 9.1 to 9.11, 9.13	8Hours
	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	Barrie Sosinsky “Cloud Computing Bible” , Wiley India Edition , 2011
2	Cloud Computing: Theory and Practice, Dan C Marinescu Elsevier (MK), 2013.
Reference Books	
1	Computing Principles and Paradigms, Rajkumar Buyya, James Broberg Andrzej Goscinsk,i Willey, 2014.

2	Cloud Computing Implementation, Management and Security John W Rittinghouse, James F Ransome, CRC 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	Understand the concept of cloud computing, cloud architecture, resource virtualization, cloud resource management and scheduling and cloud security.	Understand	L2
CO2	Apply the concept cloud computing stack to describe the functionality and use cases.	Apply	L3
CO3	Apply the knowledge of cloud security to mitigate security risks in cloud application development.	Apply	L3
CO4	Analyze and compare different virtualization technologies and methods, evaluate the performance	Analyze	L4
CO5	Analyze resource management policies, control theory for task scheduling in a cloud environment.	Analyze	L4

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															
CO2	3												1		
CO3	2								2	1					
CO4		3							2	1			1		
CO5		2			2				2	1			1		

Weblinks and Video Lectures (e-Resources)	
1	https://nptel.ac.in/courses/106105167/
2	https://www.coursera.org/learn/cloud-computing-basics
3	https://www.tutorialspoint.com/cloud_computing/index.htm
4	https://www.digimat.in/nptel/courses/video/106105167/L01.html (V

CIE- Continuous Internal Evaluation (50 Marks)

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

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	5	10	10	50	50%
CO2	10	10					20	20%
CO3			5	5			10	10%
CO4					10		10	10%
CO5						10	10	10%
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	20
Understand	30
Apply	30
Analyze	20

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	10	10	4	6	10	10	50	50%
CO2	10	10	6	4			20	20%
CO3							10	10%
CO4					10		10	10%
CO5						10	10	10%
Total	20	20	10	10	20	20	100	100%

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	04				
Course Title	:	Business Intelligence And Its Applications				
Course Code	:	BCA405				
Course Type Theory/Practical/Project Integrated)	:	Theory				
Category	:	PCC2				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/week (L:T:P:S)	:	3:0:0:0		**SEE**	:	50
Total Hours	:	40		**SEE Duration**	:	03
Credits	:	03				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Explain the Decision Support systems and Business Intelligence framework.
2	Illustrate the significance of computerized Decision Support, and understand the mathematical modeling behind decision support.
3	Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.
4	Explore knowledge management; explain its activities, approaches and its implementation.
5	Describe the Expert systems , areas suitable for application of experts system

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, implementing lab programs 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).

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	**Decision Support and Business Intelligence:** Opening Vignette, Changing Business Environments and Computerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), A framework for Business Intelligence (BI), A Work System View of Decision Support. Text Book 1: Chapter 1	8Hours
Pedagogy		
2	**Computerized Decision Support:** Decision Making, Models, Phases of the Decision-Making Process, The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions Are Supported. **Modeling and Analysis:** Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking. Text Book 1: Chapter 2	8Hours
Pedagogy		
3	**Data Warehousing:** Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, Data Warehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes. Text Book 1: Chapter 5	8Hours
Pedagogy		
4	**Knowledge Management:** Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation. Text Book 1: Chapter 11	8Hours
Pedagogy		
5	**Expert Systems:** Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems, Benefits, Limitations, and	8Hours

	Critical Success Factors of Expert Systems. Text Book 1: Chapter 12	
	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	Business Intelligence, A managerial Perspective on Analytics. Sharda, R, Delen D, Turban E.Pearson. 2014
Reference Books	
1	Data Mining Techniques. For Marketing, Sales and Customer Relationship Management Berry M.&Linoff G. Wiley Publishing Inc 2004
2	Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly Media,Inc2013

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

CO	**Course Outcomes**	**RBT Level**	**RBT Level Indicator**
CO1	Apply the basics of data and business to understand Decision Support systems and Business Intelligence	Understand, Apply	L2,L3
CO2	Describe the significance of Computerized Decision Support, apply the basics of mathematics to Understand the mathematical modeling behind decision support.	Apply	L3
CO3	Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL)	Understand	L2
CO4	Analyze the importance of knowledge management and explain its activities, approaches and Its implementation	Analyze	L4

CO5	Describe the Expert systems and analyze its development, discuss areas suitable for application of experts system.	Understand, Analyze	L2,L4

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	3		2												
CO3		2													
CO4	3			2		2									
CO5		3	2	2	1	1									

Weblinks and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=3DTFmMNiGlg
2	https://www.youtube.com/watch?v=Hg8zBJ1DhLQ

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**
Understand	30	10		
Apply	10	10	25	25
Analyse	10	10		

Evaluate		10		
Create		10	25	25

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	5	10	10	50	50%
CO2	10	10					20	20%
CO3			5	5			10	10%
CO4					10		10	10%
CO5						10	10	10%
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)
Understand	30
Apply	30
Analyse	20
Evaluate	20

SEE Course Plan

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

Semester	:	04				
Course Title	:	Bioinformatics				
Course Code	:	BCA406				
Course Type Theory/Practical/Project Integrated)	:	Project Experiential Learning				
Category	:	PBL				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	0:0:2:2		**SEE**	:	50
Total Hours	:	25 hours theory + project		**SEE Duration**	:	03
Credits	:	02				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the basics of bioinformatics and identify different types of biological sequence.
2	Explain RNA and Protein folding
3	Analyze multiple sequence and find conserved regions.
4	Evaluate HMM and its algorithms for applications in bio informatics.

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 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	**Bioinformatics and Computational Biology**, Nature & Scope of Bioinformatics. Importance of databases- Biological databases-primary sequence databases, Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases, Types of databases, Data retrieval tools – Entrez	5Hours
Pedagogy		
2	**Sequence alignment – local/global**, pairwise sequence alignment, scoring methods. Needleman and Wunsch algorithm, global and local alignments. Multiple sequence **Alignment Scoring matrices:** basic concept of a scoring matrix, Matric es for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. Differences between distance & similarity matrix.	5Hours
Pedagogy		
3	**Introduction, Advantages**, **Phylogenetic Trees**, Tree topologies, Methods for phylogenetic analysis- Distance Matrix methods, Character based methods. HMM(Hidden Markov Model): Introduction to HMM, Forward algorithm, Viterbi algorithm, applications in Bioinformatics.	5Hours
Pedagogy		
4	**Nature-Inspired Algorithms:** Simulated Annealing, Differential Evolution, Ant and Bee Algorithms, Particle Swarm Optimization. **Genetic Algorithms:** Introduction, Genetic Algorithms, Role of Genetic Operators, Choice of Parameters	5Hours
Pedagogy		
5	**Protein and RNA structure Predictio**n: Predicting RNA secondary structure - Nussinov Algorithm, Energy minimization methods - Zuker Algorithm. Amino Acids, Polypeptide Composition, Protein Structures, Algorithm for protein folding, Structure prediction,	5Hours
	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	S C Rastogi, N Mendiratta and P Rastogi, " Bioinformatics: Methods and Applications", New Delhi, 2015.
2	D E Krane and M L Raymer, Fundamental Concepts of Bioinformatics, 2006.
3	Nature-Inspired Optimization Algorithms" by Xin- She Yang First edition 2014. British Library Cataloguing- in-Publication Data. Elsevier publications. ISBN 978-0-12-416743-8.
Reference Books	
1	Andreas D.Baxevanis, B F Francis Ouellette, "Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins", Third Edition,
2	Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT press, 2004.
3	Ant Colony Optimization" by Marco Dorigo and Thomas Stützle

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 bioinformatics, RNA and Protein folding.	Underst and	L2
CO2	Apply the different types of biological sequence.	Apply	L3
CO3	Analyze HMM and its algorithms and its applications in bio informatics.	Analyze	L4
CO4	Analyze multiple sequences and find conserved regions.	Analyze	L4
CO5	Ability to create bioinformatics concepts	Create	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
CO1															
CO2	2														
CO3		3													

CO4		2													
CO5					1				1	1	1		1		

Weblinks and Video Lectures (e-Resources)	
1	https://nptel.ac.in/courses/102106065 **CIE-**
2	https://onlinecourses.nptel.ac.in/noc21_bt06/preview
3	https://onlinecourses.swayam2.ac.in/cec21_bt04/preview

Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Theory**			
	Continuous Assessment Tests (IAT)		**Continuous Assessment (CCA)**	**Comprehensive**
	IAT-1	**IAT-2**	**CCA-1**	**CCA-2**
	50 Marks	**50 Marks**	**50 Marks**	**50 Marks**
Understand	20	10		
Apply	20	20	30	10
Analyze	10	20	20	10
Create				30

CIE Course Assessment 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	5	5	5	5	5	45	45%
CO2		5	5	5			15	15%
CO3		10	5	5	5		25	25%
CO4				5	5	5	15	15%
Total	20	20	15	20	15	20	100	100%

Project Based Learning - Batch

From, **Date:**

Name: & USN:

Name: & USN:

Name: & USN:

Name: & USN:

Semester:

Respected Sir/Madam,

Sub: Regarding PBL Batch

With respect to the above subject, we are the students mentioned above would like to form the batch for carrying out the mini project on……

Thanking you, Yours faithfully

Sl. No.	Name of the student	Signature
1.		
2.		
3.		
4.		

Signature of the Guide
Name of the Guide Designation
Department of …… Engineering

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 PBL Coordinator Signature of HOD

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

Affiliated to VTU
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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 PBL Coordinator Signature of HOD

Project Based Learning Outcomes

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

ABILITY ENHANCEMENT COURSE (AEC)

AEC Course – Ability Enhancement Course

Teaching Hours/Week (L: T:P: S)	0:0:2:0
Total Hours of Pedagogy	24 hours Practical
Credits:	01
Programs / Experiments	12
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Practical (Internal Examiners only)

Semester	:	04				
Course Title	:	Scala				
Course Code	:	BCA407				
Course Type Theory/Practical/Project / Integrated)	:	Practical				
Category	:	AEC				
Stream	:	CSE(AI)		**CIE**	:	50
Teaching hours/ week (L:T:P:S)	:	0:0:2:0		**SEE**	:	50
Total Hours	:	24 hours practical		**SEE Duration**	:	03
Credits	:	01				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Model data using algebraic data types, represented in Scala as families of sealed traits and case classes.
2	Use structural recursion and pattern matching to traverse and transform data.
3	Learn programming with the common data structures of Scala
4	Learn object-oriented programming in Scala

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 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	Scala Introduction: Scala Environment, Scala Shell, Scala ID, Implementing the Object Scala Building Blocks: Introduction, Apps and Applications, Basics of the Language Scala Classes: Introduction, Classes, Case Classes Scala Methods: Introduction, Method Definitions, Named Parameters	
2	Classes, Inheritance and Abstraction: Introduction, Inheritance Between Types, Inheritance Between Classes, Restricting a Subclass, Abstract Classes, The Super Keyword, Scala Type Hierarchy, Polymorphism Objects and Instances: Introduction, Singleton Objects, Companion Objects Value Classes: Introduction, Value Classes, Simple Value Type Example,	
3	Scala Constructs: Introduction, Numbers and Numeric Operators, Characters and Strings, Assignments, Variables, Messages and Message Selectors, Control and Iteration Traits: Introduction, Abstract Trait Members, Dynamic Binding of Traits, Sealed Traits, Marker Traits Arrays: Introduction, Arrays, Creating Square Arrays, Looping Through Arrays Tuples: Introduction, Tuple Characteristics, classes, Creating a Tuple,	
4	Functional Programming in Scala: Introduction, Scala as a Functional Language, Defning Scala Functions Scala Collections Framework: Introduction, Scala Collections Immutable Lists and Maps: Introduction, the Immutable List Collection	
5	Scala and JDBC Database Access: Introduction, Working with JDBC, The Database Driver, Registering Drivers, Setting Up MySQL, Setting Up the Database GUIs in Scala Swing: Introduction, Windows as Objects, Windows in Scala, Scala Swing, Scala Swing Packages, Swing Scala Worked Examples Scala& Java Interoperability: Introduction, a Simple Example, Inheritance, Issues, Functions	
	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

Sl. No.	Experiments/Programs	COs
1	a. Write a Scala program to compute the sum of the two given integer values. If the two values are the same, then return triples their sum. b. Write a Scala program to check two given integers, and return true if one of them is 22 or if their sum is 32.	CO1
2	a. Write a Scala program to remove the character in a given position of a given string. The given position will be in the range 0...string length -1 inclusive. b. Write a Scala program to create a new string taking the first 5 characters of a given string and return the string with the 5 characters added at both the front and back.	CO1
3	a. Write a Scala program to print the multiplication table of a given number using a for loop. b. Write a Scala program to find the largest element in an array using pattern matching	CO1
4	a. Write a Scala function to calculate the product of digits in a given number b. Write a Scala function to check if a given number is a perfect square	CO1
5	a. Write a Scala program that creates a subclass Student that extends the Person class. Add a property called grade and implement methods to get and set it. b. Write a Scala program that creates a class Triangle with properties side1, side2, and side3. Implement a method is Equilateral to check if the triangle is equilateral.	CO2
6	a. Write a Scala program that creates an enum class Color with values for different colors. Use the enum class to represent an object's color. b. Write a Scala program that creates a class ContactInfo with properties name, email, and address. Create a class Customer that includes a ContactInfo object.	CO2
7	a. Write a Scala program to create a set and find the difference and intersection between two sets. b. Write a Scala program to create a set and find the second largest element in the set.	CO3
8	a. Write a Scala program to create a list in different ways. Note: Use Lisp style, Java style, Range list, Uniform list, Tabulate list b. Write a Scala program to flatten a given List of Lists, nested list structure.	CO4
9	a. Write a Scala program to add each element n times to a given list of integers.	CO3

	b. Write a Scala program to split a given list into two lists.	
10	a. Write a Scala program to swap the elements of a tuple Further print no swapping required if elements are same. b. Write a Scala program to find non-unique elements in a tuple	CO3
Open ended Programs		
1	Playing with Functions	CO4
2	Working with Collections	CO1
3	Working with Traits and Abstract Classes	CO2
4	Introduction to Pattern Matching	CO3
5	Building a Simple Console Application	CO3

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 Scala syntax, object-oriented principles and learn advanced concepts – loops, expressions, inheritance, pattern matching	Understand	L2
CO2	Apply your understanding of functions to write modular and reusable code. Break down complex problems into smaller, well-defined functions.	Apply	L3
CO3	Analyze problems from a functional programming perspective, focusing on immutability and pure functions.	Analyze	L4
CO4	This level focuses on the ability to generate new ideas, products, or processes. It involves using your knowledge and understanding to come up with something original.	Create	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
CO1															
CO2	3														
CO3		3													
CO4					1				1	1	1		1		

Weblinks and Video Lectures (e-Resources)	
1	Programming Scala, Third Edition, O'Reilly Media.
2	Paul Chiusano, Rúnar Bjarnason, Functional Programming in Scala 1st Edition, Manning Publications
3	https://docs.scala-lang.org/tutorials/scala-for-java-programmers.html
4	https://www.javatpoint.com/scala-tutorial

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Theory**	
	Continuous Assessment Tests (IAT)	**Continuous Comprehensive Assessment (CCA)**
	IAT-1	**CCA-1**
	50 Marks	**50 Marks**
Understand	10	
Apply	20	10
Analyse	20	10
Create		30

CIE Course Assessment Plan

CO's	**Marks Distribution**		**Total Marks**	**Weightage**
	Test-1	**Test-2**		
CO1	10	10	20	20%
CO2	10	10	20	20%
CO3	10	10	20	20%
CO4	10	10	20	20%
CO5	10	10	20	20%
Total	50	50	100	100%

SEE- Semester End Examination (50 Marks)

Bloom's Category	**SEE Marks**
Understand	10

Apply	20
Analyse	20

SEE Course Plan

CO's	Marks Distribution		Total Marks	Weightage
	Test -1	Test -2		
CO1	10	10	20	20%
CO2	10	10	20	20%
CO3	10	10	20	20%
CO4	10	10	20	20%
CO5	10	10	20	20%
Total	50	50	100	100%

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 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.

I 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.

Universal Human Values (UHV)

UHV- Universal Human values

Teaching Hours/Week (L: T: P: S)	1:0:0:1
Total Hours of Pedagogy	15 hour Theory Session +15 hour Self study
Credits:	01
Programs / Experiments	12
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	1
Examination nature (SEE)	SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions).

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Semester	**:**	04				
Course Title	**:**	Universal Human values				
Course Code	**:**	BUHV408				
Course Type Theory/Practical/Project Integrated)	**:**	Theory				
Category	**:**	UHV				
Stream	**:**	CSE(AI)		**CIE**	**:**	50
Teaching hours/ week (L:T:P:S)	**:**	15 hour Theory Session +15 hour Self study		**SEE**	**:**	50
Total Hours	**:**	1:0:0:1		**SEE Duration**	**:**	01
Credits	**:**	01				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
4	This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Teaching-Learning Process

General Instructions - Pedagogy :

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

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.

3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.

Encourage the students for group work to improve their creative and analytical skills.

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

Module No.	Topics	Hours
1	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	3Hours
Pedagogy		
2	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	3Hours
Pedagogy		
3	**Harmony in the Family and Society:** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	3Hours
Pedagogy		
4	**Harmony in the Nature/Existence :** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	3Hours
Pedagogy		

5	**Implications of the Holistic Understanding – a Look at Professional Ethics :** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	**3Hours**
	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	The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
2	The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
Reference Books	
1.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3.	The Story of Stuff (Book).
4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5.	Small is Beautiful - E. F Schumacher.
6.	Slow is Beautiful - Cecile Andrews
7.	Economy of Permanence - J C Kumarappa
8.	Bharat Mein Angreji Raj – Pandit Sunderlal

9.	Rediscovering India - by Dharampal
10.	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11.	India Wins Freedom - Maulana Abdul Kalam Azad
12.	Vivekananda - Romain Rolland (English)
13.	Gandhi - Romain Rolland (English)
14.	Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15.	Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16.	A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17.	P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18.	A N Tripathy, 2003, Human Values, New Age International Publishers.
19.	SubhasPalekar,
20.	E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers ,Oxford University Press
21.	M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22.	B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23.	B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Weblinks and Video Lectures (e-Resources)	
1	Value Education websites,
2	https://www.uhv.org.in/uhv-ii,
3	http://uhv.ac.in,
4	http://www.uptu.ac.in
5	Story of Stuff,
6	http://www.storyofstuff.com
7	Al Gore, An Inconvenient Truth, Paramount Classics, USA
8	Charlie Chaplin, Modern Times, United Artists, USA

9	IIT Delhi, Modern Technology – the Untold Story
10	Gandhi A., Right Here Right Now, Cyclewala Productions
11	https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
12	https://fdp-si.aicte-india.org/8dayUHV_download.php
13	https://www.youtube.com/watch?v=8ovkLRYXIjE
14	https://www.youtube.com/watch?v=OgdNx0X923I
15	https://www.youtube.com/watch?v=nGRcbRpvGoU
16	https://www.youtube.com/watch?v=sDxGXOgYEKM

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 responsibility in life, handle problems with sustainable solutions, while keeping human relationships and human nature in mind.	Understand	L2
CO2	Develop better critical ability.	Apply	L3
CO3	Apply the knowledge gained to their own self in day-to-day settings to balnce the harmony in self, nature, family and society.	Apply	L3
CO4	Analyse what they have understood (human values, human relationship and human society) to achieve holistic development of professional ethics.	Apply	L3

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							3		2	2					
CO3									3	2					
CO4					3										
CO5										2		3			

Activities:
Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration :

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per guidelines of scheme & syllabus.

Continuous Internal Evaluation (CIE):

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 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she 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 Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 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 mentioned in the 22OB2.4, 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.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks

Internal Assessment Test question paper is designed to attain the

different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for **50 questions,** each of the 01 marks. **The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.