DAYANANDA SAGAR ACADEMY OF TECHNOLOGY & MANAGEMENT

Scheme and Syllabus VII to VIII Semester

CURRICULUM

Outcome Based Education

(Academic Year 2026-2027)

Department of Information Science and

Engineering

7th & 8th Semester B.E

(**2023-2027 Batch**)

ABOUT THE INSTITUTE

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

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

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

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

VISION OF THE INSTITUTE

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

MISSION OF THE INSTITUTE

- To serve its region, state, the nation and globally by preparing students to make meaningful contributions in an increasing complex global society 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

The Information Science and Engineering provides an intellectual framework enabling ideas from Hardware, Software, Computation and the Information Sciences to integrate into and transform disciplines to provide solutions to real-time problems. This programme is specifically designed to meet the requirements of industry, with its graduates expected to become important players in the future of Information Technology. The curriculum is designed to provide both technical and practical knowledge in the field of Information Science & Engineering and their applications along with major specializations based on which students can branch out. Fundamental engineering subjects combined with basic programming languages that provide a basic understanding of engineering concepts are taught, along with courses in advanced computing techniques, machine learning, data science, artificial intelligence, and other cutting-edge topics to equip the graduates with the required skills to manage all domains within the Information Science and Engineering scope.

VISION OF THE DEPARTMENT

Impart magnificent learning atmosphere establishing innovative practices among the students aiming to strengthen their software application knowledge and technical skills.

MISSION OF THE DEPARTMENT

M1: To deliver quality technical training on software application domain.

M2: To nurture team work in order to transform individual as responsible leader and entrepreneur for future trends.

M3: To inculcate research practices in teaching thus ensuring research blend among students.

M4: To ensure more doctorates in the department, aiming at professional strength.

M5: To inculcate the core information science engineering practices with hardware blend by providing advanced laboratories.

M6: To establish innovative labs, start-ups and patent culture.

PROGRAM EDUCATION OBJECTIVES (PEO'S):

PEO1: Graduates shall have successful careers as information science engineers in software application domain and will be able to lead and manage teams across the globe.

PEO2: Graduates shall be professional in engineering practice and shall demonstrate good problem solving, communication skills and contribute to address societal issues.

PEO3: Graduates shall be pursuing distinctive education, entrepreneurship and research in an excellent environment which helps in the process of life-long learning.

PROGRAM OUTCOMES (PO's)

Engineering Graduates will be able to:

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

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: Apply appropriate programming knowledge in software development, operations and maintenance of real-time applications.
PSO2: Meet the industry requirements in adapting to cutting-edge technologies.
PSO3: Develop business and entrepreneurial ideas to support society requirements.

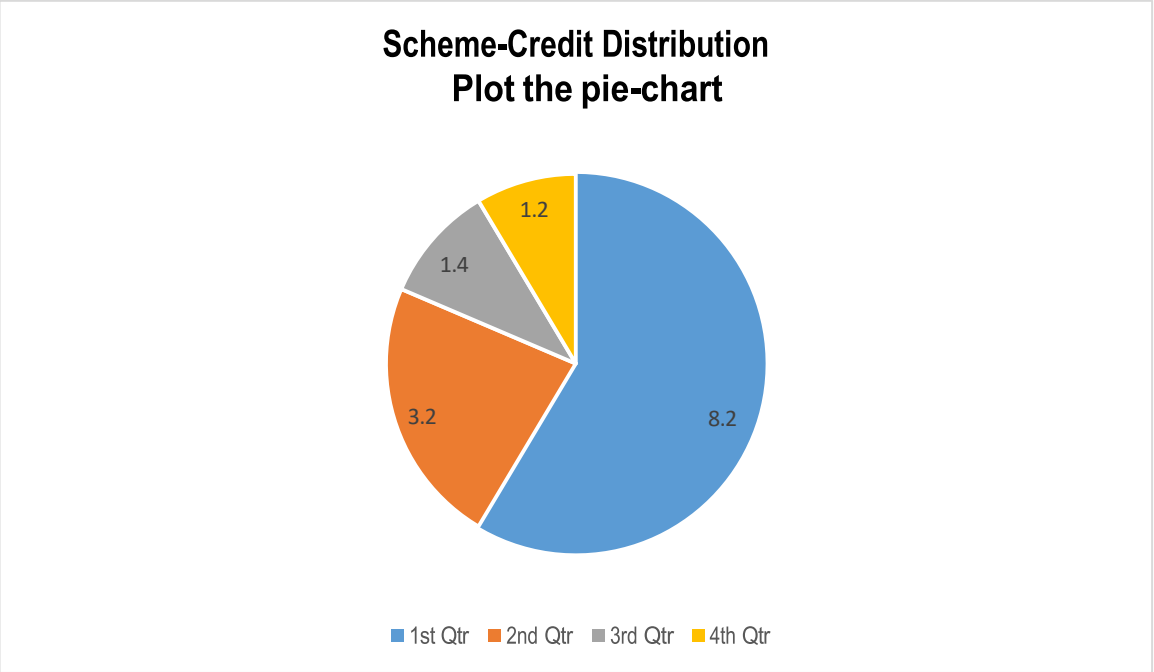
PROPOSED UG CREDIT STRUCTURE IN ALIGNMENT WITH VTU

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**

Scheme Distribution

Department of Information Science & Engineering

Course Component	Credits	% of Credits
Integrated Professional Core Course-1 (IPCC)	4	20%
Professional Core Course	3	15%
Professional Elective Course-1(PEC-1)	3	15%
Professional Elective Course-1 (PEC-2)	3	15%
Open Elective Course (OEC)	3	15%
Capstone Project (PROJ)	4	20%
Project (PR)	0	0
Total	**20**	**100**



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

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

Scheme of Teaching and Examinations – 2026-27
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from 2026-27)

7th SEMESTER: Computer Science & Engineering (CSE)

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S						
1	BIS701	Deep Learning & NLP	IPCC	ISE	ISE	3	-	2	-	5	**4**	3	50	50	100
	BIS702	Cloud Computing & Big Data Analytics	PCC	ISE	ISE	3	-	-	-	3	**3**	3	50	50	100
2	BIS703x	Professional Elective Course-1	PEC-3	ISE	ISE	3	-	-	-	3	**3**	3	50	50	100
4	Bxx704	Open Elective Course	OEC	-	-	3	-	-	-	3	**3**	3	50	50	100
5	BIS705	Capstone Project – Phase-2	PROJ	ISE	ISE	-	-	2	6	8	**7**	3	50	50	100
6	BIK706	Indian Knowledge System	NCMC	ISE	ISE	-	-	2	-	2	-	-	100	-	100
7		AICTE Activity Points	Details of 80 AICTE Activity Points Earned												
				Total		**12**	**-**	**6**	**6**	**27**	**20**	**15**	**350**	**250**	**600**

Professional Elective Course-3: Digital Twin, LLM & Agentic AI, Human Computer Interface (HCI), Data Engineering & MLOps

8th SEMESTER: Computer Science & Engineering (CSE)															
Sl.No.	**Course Code**	**Course Title**	**Course Category**	**BOS**	**TD**	**Teaching Hours/Week**					**Credits**	**Examination**			
						Lecture	**Tutorial**	**Practical**	**Project**	**Total**		**SEE Duration (Hrs.)**	**CIE Marks**	**SEE Marks**	**Total Marks**
						L	**T**	**P**	**S**						
1	BIS801x	Capstone Project – Phase-2 (Publication and Patents)	PROJ.								**4**	3	50	50	100
2		Internship (15 Weeks or 90 working Days)	INT	ISE	ISE	Two contact hours/week for interaction between faculty and students					**10**	3	50	50	100
3		AICTE Activity Points	**Details of 100 AICTE Activity Points Earned**												
Total											14		100	100	200

IPCC: Integrated Professional Core Course,

PEC: Professional Elective Course

OEC: Open Elective Course

PROJ: Project Work,

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:

		7th Semester
1.	List of Existing Elective Courses	• Computer Vision • Introduction to Cybersecurity • Edge Computing • Blockchain Essentials
2.	List of New Existing Elective Courses	• Natural Language Processing (NLP) • Digital Twin • LLM & Agentic AI • Human-Computer Interface (HCI) • Data Engineering & MLOps
3.	List of New Industry Aligned Courses	• LLM& Agentic AI • Digital Twin • Human-Computer Interface (HCI) • Data Engineering & MLOps

Percentage of Change in the Syllabus

7th Semester						
Sl.No.	Course Code	Course Name	Topics Added	Topics removed	Revised in %	Justification
1.	BIS701	Big Data Analytics (BDA)	Case studies	NIL	20	Analyzing and solving the case studies are important to understand the practical application of tools in real-world scenarios.

7th SEMESTER

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 50 Marks
			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

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**7th**				
Course Title	**:**	**Deep Learning and Natural Language Processing**				
Course Code	**:**	**BIS702X**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Integrated**				
Category	**:**	**IPCC**				
Stream	**:**	**Information Science and Engineering**		**CIE**	**:**	**50 Marks**
Credits (L:T:P:S)	**:**	**3:0:2:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**50 Hrs**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives: Students will be able to

Sl.No.	Course Objectives
1	Understand the basic concepts of deep learning
2	Know the basic working model of Convolutional Neural Networks and RNN in decision making
3	Illustrate the strength and weaknesses of many popular deep learning approaches
4	Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems
5	Build and deploy NLP applications using deep learning models such as LSTM and attention mechanisms for real-world use cases

Teaching-Learning Process

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

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation/Demonstration to explain functioning of various concepts
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

DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Human and Machine Language:** Deep Learning for Natural Language Processing: Deep Learning Networks Learn Representations Automatically, Natural Language Processing, A Brief History of Deep Learning for NLP, Computational Representations of Language: One-Hot Representations of Words, Word Vectors, Word-Vector Arithmetic, word2viz, Localist Versus Distributed Representations, Elements of Natural Human Language. **Textbook 2: Chapter 2**	**8**
Pedagogy	**Poster Presentation:** Students can visually represent the evolution of vision models (from Neocognitron to AlexNet) or the history of NLP. **Demonstration:** Utilize the **TensorFlow Playground** mentioned in the syllabus to exhibit how neural networks learn representations automatically.	
2	**Natural Language Processing:** Preprocessing Natural Language Data: Tokenization, Converting All Characters to Lowercase, Removing Stop Words and Punctuation, Stemming, Handling *n*-grams, Preprocessing the Full Corpus, Creating Word Embeddings with word2vec: The Essential Theory Behind word2vec, Evaluating Word Vectors, running word2vec, Plotting Word Vectors **Textbook 2: Chapter 8**	**8**
Pedagogy	**Problem Solving:** Encourage cognitive thinking by having students manually preprocess text (tokenization, stopword removal, stemming, n-grams) and then relate it to how words are converted into vectors using Word2Vec, helping them connect preprocessing with representation **Think-Pair-Share:** Discuss the trade-offs between preprocessing techniques (stemming vs. lemmatization, use of n-grams)	
3	**Convolution neural networks:** The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Convolutional Networks and the History of Deep Learning. **Textbook 1: Chapter 9 (9.1 to 9.8, 9.11)**	**8**
Pedagogy	**Demonstration:** Use visual animations to show how convolution operations, kernels, and pooling transform different data types, and illustrate how efficient convolution algorithms improve performance. **Collaborative Learning:** Assign group tasks to design CNN architectures for structured outputs (e.g., image classification vs. segmentation) and relate them to key milestones in the history of deep learning.	
4	**Regularization for Deep Learning:** Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi- Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations,	**8**

	Textbook 1: Chapter 7 (7.1 to 7.10)	
Pedagogy	**Problem Solving:** Have students compare model performance with and without regularization techniques (e.g., L1/L2 penalties, early stopping) to understand overfitting control. **Think-Pair-Share:** Discuss trade-offs between methods like dataset augmentation, noise robustness, and multi-task learning to deepen conceptual understanding	
5	**Interactive Applications of Deep Learning: :** The Area under the ROC Curve: The Confusion Matrix, Calculating the ROC, AUC Metric, Natural Language Classification with Familiar Networks: Loading the IMDb Film Reviews, Examining the IMDb Data, Standardizing the Length of the Reviews, Dense Network, Convolutional Networks, Networks Designed for Sequential Data: Recurrent Neural Networks, Long Short-Term Memory Units, Bidirectional LSTMs, Stacked Recurrent Models, Seq2seq and Attention, Transfer Learning in NLP. **Textbook 2: Chapter 8**	**8**
Pedagogy	**Case Study - IMDb Film Reviews:** Analyze the IMDb dataset using various networks (Dense, CNN, LSTM) to compare performance metrics like the **AUC Metric** and Confusion Matrix.	

Pedagogical Initiatives (Not limited to):

- **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another
- **Collaborative Learning**
- **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

Laboratory Infrastructure Requirements

1. Hardware Requirements

Processor: Intel i5 / AMD Ryzen 5 or higher

RAM: Minimum 8 GB (Recommended: 16 GB)

Storage: 256 GB SSD (for dataset handling)

GPU (Recommended for DL models):

NVIDIA GPU (GTX 1650 / RTX series) with CUDA support

Internet connectivity (for datasets and model downloads)

2. Software Requirements

OS: Ubuntu 20.04 / Windows 10+

Programming Language: Python 3.8+

Frameworks:

TensorFlow / Keras

PyTorch

Libraries:

NumPy, Pandas, Matplotlib, Seaborn

Scikit-learn

NLTK, SpaCy, Gensim

Tools:

Jupyter Notebook / Google Colab

Anaconda Distribution

Part A: List of Experiments/ Lab Programs

Sl. No.	Experiments/Programs	COs
1A	Implement a neural network model on the MNIST dataset to study the effect of regularization techniques by incorporating L2 regularization and dropout layers, train the model with and without regularization, and perform a comparative analysis of model performance using accuracy and loss metrics to demonstrate improvement in generalization and reduction of overfitting.	CO2
1B	Construct a complete Natural Language Processing (NLP) preprocessing pipeline by performing tokenization, case normalization, stop-word removal, stemming, and lemmatization on a given text corpus, and analyze the effect of preprocessing steps on text representation and downstream learning tasks.	CO4
2A	Develop a convolutional neural network model and conduct a comparative experimental study using different optimization algorithms such as Stochastic Gradient Descent (SGD), Adam, and RMSProp, analyze convergence behavior by plotting loss versus epochs, and interpret the impact of adaptive learning strategies on training efficiency and model performance.	CO2
2B	Train a Word2Vec model using a suitable text corpus to generate distributed word representations, perform word vector arithmetic to explore semantic relationships, and visualize word embeddings using dimensionality reduction techniques such as t-SNE to interpret contextual similarities among words.	CO4
3A	Design and implement a Convolutional Neural Network (CNN) architecture for image classification using the CIFAR-10 dataset, incorporate convolution and pooling operations, train the model, evaluate classification accuracy, and visualize feature maps to understand hierarchical feature extraction in deep learning models.	CO3
3B	Develop a sentiment analysis model using Long Short-Term Memory (LSTM) networks on the IMDb dataset, preprocess textual data, convert it into embeddings, train the model for binary classification, and evaluate performance using accuracy, confusion matrix, and other classification metrics.	CO5

4A	Implement a Recurrent Neural Network (RNN) model for sequence prediction tasks such as time-series forecasting or text sequence modeling, train the model on sequential data, analyze prediction performance, and interpret the ability of RNNs to capture temporal dependencies in sequential inputs.	CO3
4B	Implement a Convolutional Neural Network (CNN) for text classification by transforming textual data into embedding representations, train the model on a labelled dataset, evaluate classification performance, and compare the effectiveness of CNN-based approaches with recurrent architectures such as LSTM.	CO5
5A	Develop an encoder-decoder sequence-to-sequence model using Long Short-Term Memory (LSTM) networks for basic sequence translation tasks, train the model on paired input-output sequences, evaluate the generated outputs, and demonstrate the capability of deep learning architectures in handling variable-length sequence transformation problems.	CO5
5B	Design and implement an attention-based sequence-to-sequence model for natural language processing tasks such as text translation or summarization, integrate an attention mechanism into the encoder-decoder architecture, train the model, and analyze the improvement in performance compared to traditional sequence models without attention.	CO5

Part-B Mini Project	
The mini project should reflect real-world application of Deep learning technologies. Evaluation will be based on execution, report quality, and viva performance.	**CO4**

CIE for Practical

Part A-1: Practical (Total: 10 Marks)

To assess basic conceptual understanding and practical execution of deep learning and NLP tools.

CCA-1 Components

Component	Type	Description	Marks
Part A	Practical	Execution of **any one lab program** from the below tools (2 marks)	10
Part B	Mini Project	The mini project should reflect real-world applications of Deep Learning and NLP (e.g., sentiment analysis, chatbot systems, text summarization, or word embedding-based recommendation systems). Evaluation will be based on model design, preprocessing pipeline, performance metrics, report quality, and viva performance. Students are encouraged to use frameworks such as TensorFlow or PyTorch and apply proper preprocessing techniques and evaluation strategies	15
	Total		25

Part B: Mini Project + Report (Total: 15 Marks)

To enable students to apply **Deep Learning and NLP concepts** to real-world use cases by implementing a mini project and preparing a report.

The mini project should reflect real-world applications such as text classification, sentiment analysis, chatbot systems, or word embedding-based solutions using frameworks like TensorFlow or PyTorch.

Evaluation will be based on model implementation, preprocessing pipeline, performance metrics, report quality, and viva performance.

CCA-2 Components

Component	Description	Marks
Mini Project Work	Implementation of a real-world Deep Learning/NLP use case (e.g., sentiment analysis, text classification, chatbot, or word embeddings) using frameworks like TensorFlow / PyTorch	8
Project Report	Format: Abstract, Problem Statement, Model Architecture Diagram, Dataset & Preprocessing, Technologies Used, Results & Metrics, Screenshots, Conclusion	5
Viva / Presentation	5-minute explanation of model design, preprocessing, and results + Q&A session	2
Total		**15**

Mini Project Guidelines

Rule/Guideline	Description
Team Formation	Team of **2-3 students** only
Tool Restriction	Use at least one Deep Learning framework (e.g., TensorFlow, PyTorch, or NLP libraries like spaCy / NLTK)
Use Case	Should demonstrate a clear Deep Learning/NLP application (e.g., sentiment analysis, text classification, chatbot, machine translation, or word embeddings
Report Submission	Should follow department-specified template including preprocessing, model architecture, training, and evaluation
Viva Assessment	Should be conducted in lab by a panel/faculty team with focus on model understanding and results
Plagiarism Policy	Report similarity should be **less than 20%** (Turnitin/Urkund)

Textbooks	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016. https://www.deeplearningbook.org/lecture_slides.html
2	John Krohn, Grant Beyleveld, Aglae Bassens, Deep Learning Illustrated, A Visual, Interactive Guide to Artificial Intelligence, Pearson, 2022
References	
1	Speech and Language Processing / Daniel Jurafsky and James H. Martin / Pearson / 3rd Edition, 2026
2	Neural Networks and Deep Learning / Michael Nielsen / Determination Press / 1st Edition, 2015
3	Dive into Deep Learning / Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola / Cambridge University Press / 2021

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 fundamental concepts of Deep Learning for Natural Language Processing**,** including computational representations of language such as one-hot encoding, word vectors, and distributed representations.	**Understand**	**L2**
CO2	**Apply** various regularization techniques and optimization algorithms (e.g., early stopping, adaptive learning rates, parameter initialization) to improve the performance of deep learning models.	**Apply**	**L3**
CO3	**Analyze** and utilize Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) for solving problems involving image and sequence data modeling.	**Analyze**	**L4**
CO4	**Implement** Natural Language Processing pipelines, including preprocessing techniques (tokenization, stemming, embeddings) and sequence modeling approaches such as encoder-decoder architectures and word2vec.	**Evaluate**	**L5**
CO5	**Design** and develop end-to-end deep learning-based NLP solutions (e.g., sentiment analysis, text classification, or sequence-to-sequence models) using appropriate architectures such as LSTM, Bi-LSTM, and attention mechanisms..	**Create**	**L6**

Suggested AI Tools Used, not limit to:
• Google Colab – For coding with free GPU support • PyTorch – Flexible deep learning model development • TensorFlow – Industry-standard DL framework • spaCy – Fast and efficient NLP preprocessing • Hugging Face Transformers – Pretrained models for real-world NLP tasks

Weblink /Online References	
1	https://www.youtube.com/watch?v=VyWAvY2CF9c
2	https://www.youtube.com/watch?v=7sB052Pz0sQ
3	https://www.youtube.com/watch?v=Mubj_fqiAv8
4	https://www.coursera.org/learn/neural-networks-deep-learning
5	https://onlinecourses.nptel.ac.in/noc20_cs62/preview

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	3													

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

Course Outcomes	Program Outcomes	Program Specific Outcomes
CO1	PO1	-
CO2	PO1, PO2	-
CO3	PO2, PO3, PO4	-
CO4	PO2, PO3	-
CO5	PO3, PO5, PO8, PO9, PO10, PO11, PO12	PSO1, PSO2,PSO3

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	**5**	**-**	**-**	**-**	**-**
Understand	**5**	**5**	**10**	**-**	**10**
Apply	**20**	**25**	**20**	**-**	**10**
Analyse	**10**	**10**	**20**	**15**	**10**
Evaluate	**10**	**10**		**15**	**10**
Create	**-**	**-**	**-**	**20**	**10**

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	**5**	**5**	**-**	**3**	**-**	**2**	**15**	**15%**
CO2	**5**	**5**	**5**	**10**	**10**	**10**	**45**	**45%**
CO3	**2**	**3**	**2**	**3**	**5**	**5**	**20**	**20%**
CO4	**-**	**5**	**3**	**2**	**5**	**5**	**20**	**20%**
CO5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Total	**12**	**18**	**10**	**18**	**20**	**22**	**100%**	**100%**

SEE- Semester End Examination (50 Marks)

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

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	5	2	-	-	5	5	10	10%
CO2	5	5	5	10	10	5	40	40%
CO3	-	5	3	-	5	-	10	10%
CO4	-	4	6	5	5	-	20	20%
CO5	2	-	2	2	2	2	10	10%
Total	12	16	16	17	27	12	100	10%

PROFESSIONAL CORE COURSE (PCC)

PCC Course - Professional Core Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0
Total Hours	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 week of the semester and review 2 after the 12th week of the semester, with project demonstration and submission of the report
Total score for CCA is **10 Marks**
Total Marks scored for the 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**	
CIE	**Theory**	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	(50+50) / 2	**25**	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory					**50**	20	Total Marks of IAT and CCA is 50
SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
CIE + SEE				100	----	----	40	

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**7th**				
Course Title	:	**Cloud Computing & Big Data Analytics**				
Course Code	:	**BIS701**				
Course Type (Theory/ Practical/ Integrated)	:	**Program Core/ Theory**				
Category	:	**PCC**				
Stream	:	**Information Science and Engineering**		**CIE**	:	**50 Marks**
Credits (L: T:P:PJ)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs**		**SEE Duration**	:	**3 Hours**

Course Learning Objectives: Students will be taught

1	To understand Big Data fundamentals, including characteristics, evolution, and architecture.
2	To implement distributed storage and processing using the Hadoop ecosystem (HDFS, YARN, MapReduce),Hive, and Pig.
3	To develop solution and assess the working by deploying on cloud.
4	To solve problems using big data analytics techniques using tools like Spark for extracting insights from data.
5	

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	Cloud Computing Models and Services, Creation of Virtual Machines and Docker Containers, Cloud Architectures and Resources Management. **Text Book-2 : Chapter 2: 2.1 to 2.3**	6
Pedagogy	**Blended Learning**	
2	Case Studies of IaaS, PaaS and SaaS Clouds(AWS cloud), Mobile Clouds and Inter-Cloud Mashup Services **Text Book-2 : Chapter 2: 2.4 to 2.5**	6
Pedagogy	**Tool Usage**	
3	Introduction, Big Data, Scalability and Parallel Processing, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Applications and Case Studies **Text Book-1: Chapter 1: 1.1-1.7**	8
Pedagogy	**Poster Presentation**	
4	Hadoop and its Ecosystem, Hadoop Distributed File System (HDFS), MapReduce Framework and Programming Model, Hadoop YARN (Resource Management), Hadoop Ecosystem Tools. **Text Book-2: Chapter 2:2.1-2.6**	10
Pedagogy	**Case study**	
5	Introduction , MapReduce: Core Concepts & Execution, Composing MapReduce for Algorithms, HiveQL (Query Language),Pig (Apache Pig) **Text Book-1: Chapter 4: 4.1 to 4.6**	10
Pedagogy	**Think Pair and Share**	
	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	

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the fundamental concepts of Big Data and cloud architecture, and applications.	**Understand**	**L2**
CO2	**Apply** the working principles of Hadoop ecosystem components such as HDFS, YARN, MapReduce,PAAS,SAAS in cloud architecture to obtain an efficient solution.	**Apply**	**L3**
CO3	**Analyze** various problems in real world cases with the usage of big data tools and cloud implementation.	**Analyze**	**L4**
CO4	**Evaluate** and solve different cases studies for real-world applications.	**Evaluate**	**L5**
CO5	**Develop** integrated big data solutions combining Hadoop, Spark, Hive, Pig, and cloud services for real-world applications.	**Create**	**L6**

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning, Rajkamal and Preeti Saxena, McGraw Hill Publication, 2019
2	Big-Data Analytics for Cloud, IoTand Cognitive Computing,Kai Hwang, Min Chen,wiley 2017
Reference Books	
1	Designing Data-Intensive Applications ,Martin Kleppmann,2017
2	Hadoop: The Definitive Guide,Tom White, O'reilly Media, 2015
3	Big Data Fundamentals: Co ncepts, Drivers & Techniques, Thomas Erl, Wajid Khattak, and Paul Buhler, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4	Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, John D. Kelleher, Brian Mac Namee, Aoife D'Arcy,MIT Press , 2nd Edition, 2020

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

List of AI Tools To Be Used: (Not limited to):
Code Generation & Debugging Tools: These help you **write MapReduce, Spark, Pig, Hive scripts quickly**. GitHub Copilot; Google Gemini; Amazon Code Whisperer, Apache Superset, Oozie.

Useful for **case studies** like recommendation system, sentiment analysis, weather analysis: Apache Spark MLlib, NLTK, Tableau, Text Blob, VADER
Big Data AI Platforms: These help manage and analyse **large-scale Hadoop/Spark data:** Databricks; Google Cloud, Aws,Azure with AI Platform.

Weblinks and Video Lectures (e-Resources)	
1	https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
2	https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
3	https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&index=4
4	https://www.youtube.com/watch?v=GG-VRm6XnNk https://www.youtube.com/watch?v=JglO2Nv_92A

Assessment Pattern (both CIE and SEE)

4 Credit Course – IPCC								
Assessment Method	**Component**	**Type of Assessment**	**Assessment Type used**	**Max. Marks**	**Evaluation Details**	**Reduced Marks**	**Min. Marks**	**Total**
CIE	Theory	AAT	Pedagogical Initiatives	10	Any two assessment Methods as per VTU Clause 22OB4.2 of regulations (If assessment is Project Based Learning, then one assessment method may be adopted).	10	4	10
		Test-1	Theory	25	Average of two Internal Assessment Tests each of 25 Marks, scale down the Marks to 15 Marks	15	6	15
		Test-2	Theory	25				
					Total CIE Theory		**10**	**25**
	Lab	Conduction of Experiments	Performance with Record & Observation Book	15	Conduction of Experiments and Preparation of Laboratory Records	15	6	25
		CIE Practical test	Evaluation & Viva-Voce	10	One test after conduction of all Experiments	10	4	
					Total CIE Practical		**10**	**25**
SEE				**100**	SEE Exam is Theory Exam, conducted for 100 Marks, scored marks are scaled down to 50 marks	**50**	**18**	**50**
						CIE+SEE	**40**	**100**
	The Minimum Marks to be secured in CIE to appear for SEE shall be 10 (40% of Maximum marks – 25) in the Theory Component and 10 (40% of Maximum Marks -25) in the Practical Component. The Laboratory Component of the IPCC shall be for CIE only. However, in SEE the questions from the Laboratory Component shall be included in the respective Modules only.							

3 & 2 Credit Course

Assessment Method	**Component**	**Type of Assessment**	**Assessment Type used**	**Max. Marks**	**Evaluation Details**	**Reduced Marks**	**Min. Marks**	**Total**

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

1 Credit Course

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

CIE- Continuous Internal Evaluation (50 Marks)

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

Create	10	10	15	15	

Note :CCA 2- Shall be considered as Projects using Bigdata tools and Deployment in cloud

Mini Project Rubrics

Evaluation Component	**Criteria Description**	**Marks**
Problem Definition & Objectives	Clarity of problem, well-defined goals, relevance	5
Methodology / Design	Logical approach, architecture, workflow clarity	10
Implementation /Tool usage	Functionality, completeness, technical execution	15
Testing & Results Analysis	Testing methods, validation, interpretation of results	10
Documentation / Report	Structure, clarity, formatting, completeness	5
Presentation & Viva	Communication skills, explanation, ability to answer questions	5
Total		**50**

CIE Course Assessment Plan

CO's	**Marks Distribution**						**Total Marks (Scaled down to 50)**	**Weightage**
	Test-1			**Test-2**				
	Module-1	**Module-2**	**Module 2 to 2.5**	**Module-2.5 to 3**	**Module-4**	**Module-5**		
CO1	**5**	**5**		**5**			**15**	**15%**
CO2	**5**				**5**	**5**	**15**	**15%**
CO3		**5**	**5**	**5**	**5**	**5**	**25**	**25%**
CO4		**5**	**10**	**10**	**10**	**10**	**45**	**45%**
CO5		**5**	**5**	**5**			**15**	**15%**
Total	**10**	**20**	**20**	**10**	**20**	**20**	**100**	

SEE- Semester End Examination (50 Marks)

Bloom's Category	**SEE Marks (100 scaled down to 50) (90% Theory+10% Practical Questions)**
Remember	10
Understand	10
Apply	30
Analyse	20
Evaluate	15
Create	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	**5**	**5**		**5**			**15**	**15%**
CO2	**5**				**5**	**5**	**15**	**15%**
CO3		**5**	**5**	**5**	**5**	**5**	**25**	**25%**

CO4		5	10	10	10	10	45	45%
CO5		5	5	5			15	15%
Total	10	20	20	10	20	20	100	

PROFESSIONAL ELECTIVE COURSE (PEC)

PEC Course - Professional Elective Course

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

3 Credit Course – Professional Elective Course (PEC)

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

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 Elective Course (PEC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				**50**	----	----	**20**	
	Theory	Internal Assessment Test (IAT) - II	Module – 1 to 2.5	50	(50+50) / 2	**25**	10	Average of Two Internal test each of 50 Marks scale down the marks to
		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	**:**	**VII**				
Course Title	**:**	**Digital Twin**				
Course Code	**:**	**BIS703x**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PEC**				
Stream	**:**	**Information Science and Engineering**		**CIE**	**:**	**50**
Teaching hours/ week (L: T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50**
Total Hours	**:**	**40 Hours**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No.	Course Objectives
1	Understand the basic concepts of digital twin
2	Know the basic of Digital Twin architecture and to conceptualize any Digital Twin
3	To build skill in modelling-based system engineering, focusing on discrete event systems
4	Apply secure design practices while addressing privacy challenges in digital twin environments.

Teaching-Learning Process

Pedagogical Initiatives:

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

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation/Demonstration to explain functioning of various concepts
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction:** Digital Twin Essentials, The Big Picture of Digital Twins, History of the Digital Twin, Origin of the Digital Twin concept, Digital Twin and Product Life cycle Relationship, Types of Digital Twin: Discrete Vs Composite, Product versus facility, Types of Digital Twin: Simulation versus operational, Analytics versus physics-based, Characteristics of a Digital Twin, Digital Twin Architecture, Industrial Digital Twin applications, Examples of mock, functional, and executable twins.	**8**

Pedagogy	**Poster Presentation**	
2	**Digital Twin Essentials:** Data Driven Modelling, Physics Driven Modelling, Hybrid (Data-Physics) Modelling, Examples of Physics Driven Modelling: DT of a Propeller of a Drone, DT of a ceiling fan, Bio-Mechanical DT of human body; Examples of Data Driven Modelling: DT for RUL of a Battery, DT for traffic Mobility in Bangalore, DT of RUL of GUT; Hybrid Modelling: Heart Digital Twin, DT for Solar Array, DT for CAR using OBD., Case Study: Manufacturing, Case Study: Healthcare, Case Study: Buildings, Case Study: Transportation & Logistics.	**8**
Pedagogy	**Think-Pair-Share**	
3	**Foundations and Techniques in 3D View Synthesis:** Manual 3D modelling and mesh editing, Point cloud to mesh conversion, Poisson surface reconstruction, Ball-pivoting algorithm, Alpha shapes and Delaunay triangulation, Camera models and calibration, Epipolar geometry and depth estimation, Structure from Motion (SfM), Multi-View Stereo (MVS), Depth Image-Based Rendering (DIBR)	**8**
Pedagogy	**Collaborative Learning**	
4	**System Modelling and Simulation:** Introduction to Simulation, System and System Environment, Discrete Event System Simulation, General Principles, The Event Scheduling/Time Advance Algorithm, Input Modelling, Estimation of Absolute Performance, Verification, Calibration and Validation.	**8**
Pedagogy	**Demonstration**	
5	**Digital twins Applications: Cybersecurity:** Security Framework, Digital twins threat modelling, Common attacks on digital twins; **Deep learning** in digital twin technology - GANS and VAEs; Data-driven digital twins; Digital twin from multi-fidelity data; Bayesian methods in digital twin technology.	**8**
Pedagogy	**Case Study**	
	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	Building Industrial Digital Twins, Shyam Varan Nath & Pietervan Schalkwyk, Packt Publishing Ltd., 1st Edition, 2021.
2	Discrete-Event System Simulation, Jerry Banks, John S.CarsonII, Barry L. Nelson, David M. Nicol: 5th Edition, Pearson Education, 2010

Reference Books	
1	Digital Twin for Healthcare: Design, Challenges, and Solutions, El Saddik, Abdulmotaleb, Elsevier, 2022.
2	Digital Twin: Fundamentals and Applications, Soheil Sabri , Kostas Alexandridis , Newton Lee, Springer, 2024.

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand** the fundamental concepts of Digital Twins.	Understand	L2
CO2	**Apply** various modelling approaches with relevant examples and 3D view synthesis techniques & system modelling concepts.	Apply	L3
CO3	**Analyse** real-world Digital Twin applications across various domains	Analyze	L4
CO4	**Evaluate** advanced aspects of Digital Twins, including cybersecurity threats, deep learning techniques (GANs, VAEs), and data-driven methodologies for	Evaluate	L5

List of AI Tools To Be Used: (Not limited to)
TensorFlow-Data-driven modelling and predictive analytics **AnyLogic**-System modelling and discrete-event simulation **Blender**-3D modelling and visualization of digital twins **Azure Digital Twins**-Digital twin development and deployment

Weblinks and Video Lectures (e-Resources)	
1	https://dituniversity.digimat.in/nptel/courses/video/110101436/L52.html?utm_source=chatgpt.com
2	https://digimat.in/nptel/courses/video/110101436/L54.html?utm_source=chatgpt.com
3	https://www.geeksforgeeks.org/introduction-to-digital-twin/?utm_source=chatgpt.com
4	https://digitaltwin.video/?utm_source=chatgpt.com

CIE- Continuous Internal Evaluation (50 Marks)

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

CIE Course Assessment Plan

	Marks Distribution			
	Test-1	Test-2		Weightage

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

SEE- Semester End Examination (50 Marks)

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

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	5	2	-	-	5	5	17	17%
CO2	5	5	5	10	10	5	40	40%
CO3	-	5	3	-	5	-	13	13%
CO4	-	4	6	5	5	10	30	30%
Total	10	16	14	15	25	10	100	100%

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**VII Sem**				
Course Title	**:**	**LLM & Agentic AI**				
Course Code	**:**	**BIS703X**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	:	**PEC**				
Stream	**:**	**ISE**		**CIE**	**:**	**50**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No.	Course Objectives
1	To Understand the basic concepts of Natural Language Processing, Large Language Models and Agentic AI
2	To Describe the architecture, training methodologies, and evaluation techniques of Transformer-based Large Language Models.
3	To Apply prompt engineering techniques and model optimization methods to effectively utilize Large Language Models in real-world applications.
4	To Analyze retrieval mechanisms, embedding techniques, and Retrieval-Augmented Generation (RAG) architectures for knowledge-enhanced AI systems.

Teaching-Learning Process

Pedagogical Initiatives:

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to Large Language Models**: Introduction, words and Tokens: words, Morphemes: Parts of Words, Unicode, Sub word Tokenization: Byte-Pair Encoding Regular Expressions, Rule-based tokenization, N-gram Language Models: N-Grams, Evaluating Language Models: Training and Test Sets, Evaluating Language Models: Perplexity. **Textbook 1: Chapter 1, Chapter2:2.1-2.4,2.6,2.8, Chapter 3:3.1-3.3**	8
Pedagogy	**Poster Presentation**	
2	**Large Language Models and Transformers:** Three architectures for language models, Conditional Generation of Text: The Intuition, Prompting, Generation and Sampling, Training Large Language Models, Evaluating Large Language Models, Attention, Transformer Blocks, The Language Modeling Head, More on Sampling, Training, Dealing with Scale. **Textbook 1: Chapter 7:7.1-7.6, Chapter 8:8.1,8.2,8.6-8.8**	8
Pedagogy	**Think Pair and Share**	
3	**Prompt Engineering and Model Compression Methods**: In-Context Learning (ICL), Zero-Shot Prompting, Few-Shot Prompting, Instruction-Following Prompts, Structured Output Prompts (JSON/XML), Chain-of-Thought (CoT)Prompting, Advanced Prompting Techniques, Quantization, Pruning, Knowledge Distillation. Speculative Decoding Methods: Core Principle, Methods Comparison, Medusa: Multi-Head Speculative Decoding, Eagle: Feature-Level Drafting, N-gram Speculative Decoding, Integration with vLLM. **Textbook 2: Chapter 1: 1.13-1.15**	8
Pedagogy	**Demonstration**	
4	**Introduction to Agentic AI**: Introduction, Retrieval-Augmented Generation: Motivation and Problem Statement, Core RAG Architecture, Retrieval Methods, Retrieval Methods, Chunking Strategies. **Textbook 2: Chapter 15, Chapter 16:16.1-16.4**	8
Pedagogy	**Problem Solving**	
5	**Agentic Memory Systems**: Motivation: Why Agents Need Memory, Taxonomy of Memory Types, Memory Architectures, Memory Operations, Memory for Multi-Turn Conversations, Memory for Multi-Agent Systems **Textbook 2: Chapter 17: 17.1-17.6**	8
Pedagogy	**Case Studies**	

	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	Speech and Language Processing, Daniel Jurafsky and James H. Martin, 3rd Edition, Prentice Hall / Stanford University, 2023.
2	The Hitchhiker's Guide to Agentic AI From Foundations to Systems Haggai Roitman 2026 Version1.3.
Reference Books	
1	Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 2016.
2	Transformers for Natural Language Processing, Denis Rothman, 2nd Edition, Packt Publishing, 2021.
3	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, 3rd Edition, O'Reilly Media, 2022.

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the fundamental concepts of Natural Language Processing, Large Language Models, tokenization, language models, and Transformer-based Large Language Models.	**Understand**	**L2**
CO2	Apply prompt engineering techniques and model compression methods to effectively interact with and optimize Large Language Models.	**Apply**	**L3**
CO3	Analyze embedding techniques, retrieval methods, and Retrieval - Augmented Generation (RAG) architectures for LLM-based applications.	**Analyse**	**L4**
CO4	Develop simple Agentic AI systems incorporating reasoning, planning, memory, and retrieval to solve real-world problems.	**Evaluate**	**L5**

Mapping of Course Outcomes to Program Outcomes:

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

List of AI tools used: (not limit to)
Hugging Face Transformers: -Working with pre-trained LLMs (BERT, GPT, LLaMA), fine-tuning models **Lang Chain: -**Developing LLM-based applications and agent workflows **OpenAI API: -**Accessing and integrating LLMs into applications **Google Gemini API / AI Studio: -** Building multimodal AI applications and experimenting with large language models. **Google Colab :-**Running experiments and prototyping models

	Weblinks and Video Lectures (e-Resources)
1	https://web.stanford.edu/~jurafsky/slp3/
2	https://developers.google.com/machine-learning/crash-course
3	https://platform.openai.com/docs
4	https://python.langchain.com/docs/
5	https://paperswithcode.com/task/language-modelling
6	https://www.youtube.com/watch?v=gIsm7_rGA5g
7	https://www.youtube.com/watch?v=wXzEBCI0Qhk

CIE- Continuous Internal Evaluation (50 Marks)

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

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	5	5	-	3	-	2	15	15%
CO2	5	5	5	10	10	10	45	45%
CO3	2	3	2	3	5	5	20	20%
CO4	-	5	3	2	5	5	20	20%
Total							100%	100%

SEE- Semester End Examination (50 Marks)

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

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	5	2	-	-	5	5	17	17%
CO2	5	5	6	10	10	5	41	41%
CO3	-	5	4	2	6	-	17	17%
CO4	2	4	6	5	6	2	25	25%
Total	12	16	16	27	27	12	100	100%

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**VII**				
Course Title	**:**	**Human Computer Interface (HCI)**				
Course Code	**:**	**BIS703x**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	:	**PEC**				
Stream	**:**	**ISE**		**CIE**	**:**	**50**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:0:0**		**SEE**	**:**	**50**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No.	Course Objectives
1	Understand the concept of menus, windows, interfaces
2	Identify characteristics and components of windows and the various controls for the windows
3	Understand and explore the need for new computing paradigms.
4	Design and solve various problems in windows design with colour, text, graphics

Teaching-Learning Process

Pedagogical Initiatives:

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction:** Introduction, Overview, The importance of Human – Computer Interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design. **Textbook 1: part 1, Chapter 1,2**	8
Pedagogy	**Poster Presentation**	
2	**User interface design process**: Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-, Business definition and Requirement Analysis, Direct-Indirect methods, Basic business functions, Design standards. Human consideration in screen design, Structures of menus, Functions of menus, Contents of menu, Formatting and Phrasing the menu, Selecting menu choice, Navigating menus, Graphical menus. **Textbook 1: Part 2, Step1,2,3**	8
Pedagogy	**Think Pair and Share**	
3	**Windows:** Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device-based controls. **Textbook 1: Part 2, Step4,5**	8
Pedagogy	**Demonstration**	
4	**Text for web pages:** Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests. Effective feedback-guidance & assistance, Internationalization, accessibility, Icons, Image, Multimedia-colouring. **Textbook 1: Part 2, Step8,9,10**	8
Pedagogy	**Problem Solving**	
5	**HCI in the software process:** The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale: Design rules, Principles to support usability, Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles, Multi-modal interaction. **Textbook 2: Ch 6,7,8**	8
Pedagogy	**Case Studies**	

	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 Essential Guide to User Interface Design, Wilbent. O. Galitz, John Wiley& Sons, 2007.
2	Human-Computer Interaction, Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Pearson Education, 2005.
Reference Books	
1	Designing The User Interface: Strategies for Effective Human-Computer Interaction, 5e, Ben Sheiderman, Pearson Education, 2014.
2	The Essential of User Interface Design, Alvin Albuero De Luna, Arcler Education Incorporated, 2021

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand** the fundamental concepts of Human Computer Interface.	**Understand**	**L2**
CO2	**Apply** characteristics and components of windows and the various controls for the windows.	**Apply**	**L3**
CO3	**Analyse and Design** the User Interface, design, menu creation, windows creation and connection between menus and windows	**Analyse**	**L4**
CO4	**Evaluate** solutions for various problems in windows design with colour, text and graphics.	**Evaluate**	**L5**

Mapping of Course Outcomes to Program Outcomes:

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

Suggested AI Tools to be used: (Not limited to)
Figma AI-AI-assisted user interface design, prototyping, wireframing and usability design **Uizard**-Converts ideas/sketches into UI prototypes using AI for rapid interface design **Google Teachable Machine**-Demonstrating multimodal interaction, gesture and human-computer interaction concepts **Maze AI-**AI-supported usability testing, prototype evaluation and user behavior analysis

Weblinks and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc26_cs70/preview
2	https://www.edx.org/certificates/professional-certificate/gtx-human-computer-interaction
3	https://www.coursera.org/learn/human-computer-interactions-odc?msockid=398bfe2a94836a8d227ae8f295e16bd5
4	https://online.stanford.edu/programs/human-computer-interaction-graduate-certificate
5	https://onlinecourses.nptel.ac.in/noc26_ar15/preview
6	https://youtu.be/-BCmlDXGQws
7	https://www.udemy.com/course/human-computer-interactions/?utm_campaign=BG-Search_DSA_Beta_Prof_la.EN_cc.India&utm_source=bing&utm_medium=paid-search&portfolio=Bing-

CIE- Continuous Internal Evaluation (50 Marks)

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

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	5	5	-	3	-	2	15	15%

CO2	5	5	5	10	10	10	45	45%
CO3	2	3	2	3	5	5	20	20%
CO4	-	5	3	2	5	5	20	20%
Total							100%	100%

SEE- Semester End Examination (50 Marks)

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

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	5	5	-	-			10	10%
CO2	5	5	5	10	10	5	40	40%
CO3	2	6	5	2	5	-	20	20%
CO4	-		5	5	10	10	30	30%
Total	12	16	15	17	25	15	100	100%

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**VII**				
Course Title	**:**	**Data Engineering & MLOps**				
Course Code	**:**	**BIS703x**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Theory**				
Category	**:**	**PEC**				
Stream	**:**	**ISE**		**CIE**	**:**	**50**
Teaching hours/ week (L: T:P:S)	**:**	**3:0: 0:0**		**SEE**	**:**	**50**
Total Hours	**:**	**40**		**SEE Duration**	**:**	**3**
Credits	**:**	**3**				

Course Learning Objectives: Students will be able to:

Sl. No.	Course Objectives
1	Understand principles of data engineering and architecture.
2	Apply MLOps techniques in model development, deployment, and monitoring.
3	Analyze scalable data engineering solutions and pipelines.
4	Evaluate governance, security, reproducibility and Responsible AI.
5	Design production-ready end-to-end data engineering and MLOps solutions.

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 -2026-27

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to Data Engineering:** What is Data Engineering?, The Data Engineering Lifecycle, What is Data Architecture?, Principles of Good Data Architecture, Examples and Types of Data Architecture, Who's involved with designing a Data Architecture? **Textbook 1:** Chapters- 1, 2, 3	8
Pedagogy	**Think–Pair–Share, Short quizzes using Kahoot**	
2	**Choosing Technologies Across the Data Engineering Lifecycle:** Team Size and Capabilities, Speed to Market, Interoperability, Cost Optimization and Business Value, Today Versus the Future, Location, Build versus Buy, Monolithic versus Modular, Serverless versus Server, Data Generation in Source Systems, The Future of Data Engineering. **Textbook 1:** Chapters- 4, 5, 11	8
Pedagogy	**Group discussions and Demonstration**	
3	**Introduction to MLOps:** Defining MLOps and Its Challenges; MLOps to Mitigate Risk; MLOps for Scale; People of MLOps. **Key MLOps Features:** Model Development; Establishing Business Objectives; Data Sources and Exploratory Data Analysis, Feature Engineering and Selection; Training and Evaluation; Reproducibility; Responsible AI; Productionalization and Deployment; Model Deployment Types and Contents; Model Deployment Requirements; Monitoring. **Developing Models:** What is Machine Learning Model?; Data Exploration; Feature Engineering and Selection; Experimentation; Evaluating and Comparing Models; Version Management and Reproducibility. **Textbook 2:** Chapters- 1, 2, 3, 4	8
Pedagogy	**Peer review and Dataset exploration**	
4	**Preparation for Production:** Runtime Environments; Model Risk Evaluation; Quality Assurance for Machine Learning, Key Testing Considerations, Machine Learning Security, Model Risk Mitigation. **Deploying to Production:** CI/CD Pipelines; Building ML Artifacts; Deployment Strategies; Containerization; Scaling Deployments; Requirements and Challenges. **Monitoring and Feedback Loops:** How Often Should Models Be Retrained?; Understanding Model Degradation; Drift Detection in Practice ; The Feedback Loop.	8

	Textbook 2: Chapters- 5 ,6, 7	
Pedagogy	**Poster Presentation**	
5	**Model Governance:** Who decides what governance organization needs?; Matching governance with Risk Level ; Current regulations driving MLOps Governance; Key elements of Responsible AI; Template of MLOps Governance. **MLOps: Real-World Examples: Case Study 1-** Consumer Credit Risk Management; **Case Study 2-** Marketing Recommendation Engines, **Case Study 3-** Consumption Forecast. **MLOps Tools:** AI Platforms on Kubernetes - Kubeflow, MLOps Frameworks – Teraflow. **Textbook 2:** Chapters- 8, 9	**8**
Pedagogy	**Capstone case study**	
	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	Fundamentals of Data Engineering, Joe Reis, Matt Housley, O'Reilly, First Edition, 2022.
2	Introducing MLOps, Mark Treveil, Dataiku Team, O'Reilly, First Edition, 2020.
Reference Books	
1	MLOps: Operationalizing Data Science, David Sweenor, Steven Hillion, Dan Rope, Dev Kannabiran, Thomas Hill, Michael O'Connell, O'Reilly Media, Inc., 1st Edition, 2020.
2	Practical MLOps, Noah Gift and Alfredo Deza, O'Reilly Media, 1st Edition, 2021.

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand** basic principles of data engineering along with architecture.	**Understand**	**L2**

CO2	**Make Use of** various technologies for Data engineering.	**Apply**	**L3**
CO3	**Analyze** the challenges in developing for Machine Learning model deployment.	**Analyze**	**L4**
CO4	**Choose** modern technology to structure ML Model development to deployment for solving practical problems along with its governance.	**Evaluate**	**L5**

Mapping of Course Outcomes to Program Outcomes:

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

List of AI Tools to Be Used: (Not limited to)
Jupyter Notebook-Data exploration, Model Development. **Apache** – Large-Scale data processing and pipeline scheduling. **Docker**-Containerization of ML applications. **Kubernetes**-Container orchestration and scalable deployment **TensorFlow Extended (TFX)-**Production ML pipelines **Google Vertex AI**- Model training, deployment and monitoring

Weblinks and Video Lectures (e-Resources)	
1	https://martinfowler.com/articles/microservices.html
2	https://www.ibm.com/think/topics/data-engineering
3	https://aws.amazon.com/what-is/mlops/
4	https://www.coursera.org/learn/fundamentals-of-data-engineering-for-mlops

CIE- Continuous Internal Evaluation (50 Marks)

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

Remember	5	-	-	-
Understand	10	5	5	10
Apply	20	25	25	10
Analyse	10	10	10	15
Evaluate	5	10	10	15
	50	50	50	50

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	5	5	-	3	-	2	15	15%
CO2	5	5	5	10	10	10	45	45%
CO3	2	3	2	3	5	5	20	20%
CO4	-	5	3	2	5	5	20	20%
Total							100%	100%

SEE- Semester End Examination (50 Marks)

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

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	5	2	-	-	5	5	17	17%
CO2	5	5	6	10	10	5	41	41%
CO3	-	5	4	2	6	-	17	17%
CO4	2	4	6	5	6	2	25	25%
Total	12	16	16	27	27	12	100	100%

OPEN ELECTIVE COURSE

(OEC)

OEC – Open Elective Course

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator / Advisor / Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10. Project Phase – I: Students have to discuss with the mentor / guide and with their help he / she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Teaching Hours/Week (L: T:P: S)	3:0:0:0
Total Hours of Pedagogy	40 hours – Theory
Credits:	03
Modules	5
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Open Elective Course (OEC)

Open Elective Courses (OEC): A open elective course (OEC) is a course offered by departments other than a student's parent department. These interdepartmental /interdisciplinary courses allow students to explore disciplines beyond their core area of study. These courses are intended to promote interdisciplinary learning, broad-based education, thereby enhancing a student's overall knowledge, creativity, and employability. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor/Proctor.

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).

Open Elective Course (OEC) – 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 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	**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	

CAPSTONE PROJECT
(Phase-2)

CAPSTONE PROJECT (Phase-1 & 2):

Capstone Project – Guidelines & Implementation Framework (UG Engineering Programs)

---

1. Introduction

The Capstone Project is a comprehensive, year-long project carried out in **two phases during the 6th and 7th semesters** of the undergraduate engineering/technology program. It integrates knowledge and skills acquired from multiple courses and disciplines to address a **complex, real-world problem**.

This project provides students with an opportunity to apply:

- Scientific principles
- Engineering methodologies
- Technological tools

to **conceive, design, implement, and evaluate an engineering solution**.

The Capstone Project serves as a **culminating academic experience** enabling students to demonstrate attainment of program outcomes including:

- Problem-solving ability
- Teamwork
- Communication skills
- Practical application of engineering principles

Students may undertake the project:

- Individually, OR
- In a group **not exceeding four students**

The group may include:

- Students from the same discipline
- Students drawn from different disciplines

2. Types of Capstone Projects

Capstone projects undertaken during the one-year duration may fall into one or more of the following categories:

a) Research-Oriented Projects

- Focus on investigating new concepts, theories, or technologies.
- Aim to generate new knowledge or contribute to academic research.

b) Experimental / Analytical Projects

- Based on laboratory or field experiments to validate a hypothesis or study a phenomenon.
- Include detailed data collection, analysis, and interpretation.

c) Simulation / Modelling Projects

- Use computational tools to model, simulate, and predict system behaviour.
- Reduce the need for physical prototyping in the initial stages.

d) Industrial / Industry-Sponsored Projects

- Carried out in collaboration with an industry partner.
- Address real-world engineering problems faced by the organization.

e) Interdisciplinary / Multidisciplinary Projects

- Combine knowledge and techniques from multiple engineering domains.
- May also involve other fields such as:

- Management
- Medicine
- Environmental sciences

f) Entrepreneurial / Innovation Projects

- Focus on product or service innovation with potential for commercialization.
- Include:
  - Market analysis
  - Cost estimation
  - Business planning

3. Objectives of the Capstone Project

The objectives of the Project Work are:

1. To encourage independent learning and an innovative attitude among students.
2. To develop interactive attitude, communication skills, organization, time management, and presentation skills.
3. To impart flexibility and adaptability.
4. To inspire teamwork.
5. To expand intellectual capacity, credibility, judgment, and intuition.
6. To ensure adherence to punctuality and meeting deadlines.
7. To instill responsibility towards oneself and others.
8. To train students to present project work confidently in seminars, enhance communication skills, and participate in discussions to exchange ideas.

4. Capstone Project – Phase I Evaluation

Capstone Project Phase-I shall have **Continuous Internal Evaluation (CIE) only**.

4.1 Evaluation Committee – Single Discipline Project

The Departmental Project Review Committee shall consist of:

- One Senior Professor
- Project Guide
- One additional faculty member appointed by the Principal

4.2 Evaluation Committee – Interdisciplinary Project

The Project Review Committee shall consist of:

- One Senior Professor
- Department Project Guide
- Interdepartmental Project Guide(s)
- One faculty member from a related department

All members shall be appointed by the Principal.

4.3 Evaluation Criteria

Phase-I evaluation shall be based on:

- Rubrics designed to measure **NBA Graduate Attributes**

Successful completion of Phase-I allows the student to proceed to **Phase-II**.

5. Capstone Project – Phase II Evaluation

5.1 Continuous Internal Evaluation (CIE)

CIE for Phase-II shall be conducted similarly to Phase-I using the designated committee.

5.2 Semester End Examination (SEE)

The SEE shall be conducted by:

- **University-appointed examiners**

Assessment shall be based on:

- Rubrics designed to measure **NBA Graduate Attributes**

6. Continuous Internal Evaluation (CIE) Procedure

6.1 Single Discipline Project

The CIE marks shall be awarded by a committee consisting of:

- Head of the concerned Department
- Two senior faculty members of the Department
- One of the two faculty members shall be the Project Guide

6.2 Distribution of CIE Marks

The CIE marks for the project work shall be based on:

Component	Weightage
Project Report	50%
Project Presentation Skill	25%
Question & Answer Session	25%

Non-Credit Mandatory Courses (NCMC): are aimed at enhancing students' knowledge, skills, and awareness beyond the core curriculum. Successful completion of the NCMC is compulsory for fulfilling the requirements of the academic program. It shall not be considered for the computation of SGPA, CGPA and vertical progression. Each student shall register for the prescribed NCMC(s) in the prescribed semester. A student who fails to qualify in the prescribed NCMC shall not be eligible for the conferment of the degree.

AICTE Activity Points

Apart from technical knowledge and skills, to be successful as professionals, students should have excellent soft skills, leadership qualities and team spirit. They should have entrepreneurial capabilities and societal commitment. To match these requirements, AICTE has created a unique mechanism of awarding minimum 100 Activity Points for regular students and 75 Activity Points for Lateral Entry students over and above the academic grades.

The activities can be spread over the entire duration of the programme and will be reflected in the Student's VIII Semester Grade Card. It shall not be considered for computation of SGPA/CGPA and for vertical progression. The total duration of the activities for the entire programme is 320 hours for regular students and 240 hours for lateral entry students.

Break-up of CCE marks for activity points:

Evaluation by the Proctor/Coordinator 50 marks

Evaluation by the Dept. Committee

(i) Report 20 marks

(ii) Presentation 20 marks

(iii) Outcome 10 marks

Total 100 marks

1. No SEE for AICTE Activity Points.

2. Students will be awarded either NP or P grade based on marks obtained.

Students will be awarded 'Degree' only on earning P grade in the Activity Points.

8th SEMESTER

Projects

1. Community Project: A community is a social unit or group of people sharing socially-significant characteristics, such as place, set of norms, culture, religion, values, customs or identity. A community project involves addressing issues or needs within such a community or a network of entities working toward a common purpose. These projects may cover a wide range of areas, including welfare, sustainability, technology integration, and social development. Examples include establishing and maintaining an orphanage, implementing solar power generation and its maintenance, or developing environmental improvement solutions, etc. A community project is an experiential learning activity that encourages students to identify, analyse, and address real-life problems of the community using engineering knowledge. It aims to promote social responsibility and civic engagement, interdisciplinary thinking and collaboration and practical application of theoretical concepts, thereby enabling students to contribute meaningfully to community welfare and sustainable development. Students can take up project individually or in a group not exceeding 4 students.

The evaluation shall be done as per the following; CIE: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work shall be based on the rubrics. SEE: SEE will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the rubrics.

2. Environmental Science Project:

The Environmental Science Project is an applied learning component designed to develop students' awareness, understanding, and responsibility toward the environment. It provides an opportunity to study real-world environmental issues and apply scientific and engineering principles to design feasible and sustainable solutions. The topics under environment include, but not limited to, climate change, biodiversity, air and water pollution, land use, excess use of natural resources, earthquakes, rise in the earth's temperature, power generation, soil erosion, environment issues related programmme, etc. The project involves problem identification, field surveys, case studies, data collection, environmental audits, analysis, and proposal of remedial or preventive measures aimed at improving biodiversity, air quality, and thermal comfort, etc. Students can take up project individually or in a group not exceeding 4 students. Students can opt for Interdisciplinary Project based on their interest.

The evaluation shall be done as per the following; CIE: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the rubrics. SEE: SEE will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the rubrics.

3. Hackathon Based Project (Academic):

The term hackathon is derived from the combination of hack (referring to clever problem-solving, not illegal activity) and marathon, which denotes an arduous (i.e., difficult) intellectual task requiring sustained effort, endurance, and mental resilience. The meaning of a hackathon varies depending on the specific context and intent. In an academic context, a hackathon can be considered to involve several concepts, ranging from resourceful, unconventional approaches to problem-solving. Though a hackathon is an event, typically lasting for a few days to address a specific challenge, for academic purposes, it is conducted as a noncompetitive semester-long activity. The evaluation is done as and when the project is completed, by a panel of industry experts. The hackathons not only help participants develop skills like problem-solving, critical thinking, creativity, teamwork, communication and time management, but also foster indigenous technology development, promote innovation and entrepreneurship, and contribute to non-formal learning and skill enhancement. Students can take up a hackathon project individually or in a group of not exceeding 4 students.

The respective BoS will announce the problem statements in the beginning of the 5th semester. The topic selected can be discipline specific, interdepartmental, industrial, social (refers to immediate human relations, interactions, and individual behaviour within a community), societal (describes larger, general issues, institutions, and structures that define society as a whole), environmental, health, financial, or innovative in nature, leading to development of a working prototype, application, or product. Hackathon projects are aligned with the principles of Outcome-Based Education (OBE) and support the objectives of innovation, skill development, and experiential learning in engineering education. Projects shall be evaluated by industry experts, based on creativity, problem-solving approach, teamwork, and possible implementation, as far as possible, as and when the project is completed. The evaluation shall be done as per the following; CIE: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the rubrics. SEE: SEE will be conducted by the industry experts appointed by the Head of the Institute/University. The SEE marks awarded for the project work shall be based on the rubrics.

4. Capstone Project :

The Capstone project is a comprehensive, year-long project carried out in two phases during 6th and 7th semesters of the undergraduate engineering/technology program. It integrates knowledge and skills acquired from multiple courses and disciplines to address a complex, real-world problem. This project provides students with an opportunity to apply scientific principles, engineering methodologies, and technological tools to conceive, design, implement and evaluate an engineering solution. It serves as a culminating academic experience to demonstrate program outcomes, including problem-solving ability, teamwork, communication skills, and practical application of engineering principles. Students can take up project individually or in a group not exceeding 4 students. The group may have students from the same discipline and drawn from different disciplines.

Types of Capstone Projects: Capstone projects undertaken for one year may fall into one or more of the following categories:

a) Research-Oriented Projects : • Focus on investigating new concepts, theories, or technologies. • Aim to generate new knowledge or contribute to academic research.

b) Experimental/Analytical Projects • Based on laboratory or field experiments to validate a hypothesis or study a phenomenon. • Including detailed data collection, analysis, and interpretation.

c) Simulation/Modelling Projects

• Use computational tools to model, simulate, and predict system behaviour.

• Reduce the need for physical prototyping in the initial stages.

d) Industrial/Industry-Sponsored Projects

• Carried out in collaboration with an industry partner.

• Address real-world engineering problems faced by the organization.

e) Interdisciplinary/Multidisciplinary Projects

• Combine knowledge and techniques from multiple engineering domains or other fields such as management, medicine, or environmental sciences.

f) Entrepreneurial/Innovation Projects

• Focus on product or service innovation with potential for commercialization.

• Include aspects of market analysis, cost estimation, and business planning.

Phase I Evaluation: Capstone Project Phase-I shall have only Continuous Internal Evaluation (CIE). In case disciplinary capstone project, the CIE shall be conducted by the Departmental Project Review Committee, which consists of a Senior Professor, the Project Guide, and one additional faculty member appointed by the principal for projects within the parent discipline. For Interdisciplinary Projects, the Project Review Committee will consist of one Senior Professor, the department and interdepartmental Project Guides

and one faculty member from a department related to the interdisciplinary project. The committee members are appointed by the principal of the college.

Phase-I evaluation shall be based on rubrics designed to measure graduate attributes defined by NBA. Successful completion of Phase-I allows the student to proceed to Phase-II.

Phase II Evaluation: CIE of Phase shall be evaluated as indicated with phase -I evaluation. The SEE shall be conducted by university-appointed examiners. The assessment shall be based on rubrics designed to measure graduate attributes defined by NBA.

Note: One Publication indexed in Scopus or Web of Science is Mandatory from Students Projects

Internship

Internship refers to the position of a student as trainee or a temporary (or unconfirmed) employee, who works in an organization, with or without pay, in order to gain work experience or satisfy requirements for a qualification. It is a structured, supervised professional experience in an industry, research organization, or community setting. Students taking up internship may be with or without stipend. Internships play a vital role in bridging the gap between theoretical education and professional practice. In general, engineering internships serve as a crucial component of professional education by providing experiential learning, industry readiness, and holistic skill development, ultimately producing competent engineers or entrepreneurs. Apart from these, it develops professional ethics, work culture awareness and communication skills. Some of the common types of internships are as follows:

i. Industry Internship: Carried out in the engineering industry, companies, manufacturing units, startups, business, IT industry. The topic involved may be technical, managerial, production-related tasks, live projects, or innovative activities.
ii. Research Internship: Carried out at universities, research labs, or R and D departments or organisations. The internship may involve literature review, data analysis, and experimental work leading to publications, prototypes, technical reports or innovations. The research internship may induce students to plan for higher studies or academic careers.
iii. Academic or Teaching Internship: Carried out at educational institutions. The students assist in academic activities, laboratory sessions or content development, and prepare or present report, presentation and student evaluation. The internship encourages interest in academia and pedagogy, develops new skills, helps to gain a competitive edge on the job market or for post-baccalaureate studies.
iv. Community or Societal Internship: Carried out with government schemes, or rural development projects, Non-Governmental Organisations (NGOs). The internship focused on social and community development activities promotes social responsibility, sustainable development awareness, encourages civic responsibility and ethical engagement.
v. Entrepreneurship Internship: Undertaken in association with start-ups, or entrepreneurship cells or launching own idea in Preincubations/Incubation centres. The internship offers exposure to business planning, prototype product development, and promotes innovation, risk-taking, and entrepreneurial mindset.
vi. Virtual or Remote or Online Internship: Undertaken using online tools and digital collaboration platforms. Such internships are common in content writing, data science, marketing, and software development. It offers flexible learning environments and access to global opportunities, and allows participation in real projects without being physically present, from anywhere and anytime.
vii. Government Internship: Ministries, public sector units, or civic bodies offer such internships in policy research, administrative tasks, or public service projects. This internship is for students interested in governance or public administration.
viii. Post-Placement Internship: Refers to the internship offered to students after they receive a confirmed job offer (placement) from a company, but before formally joining as full-time employees. This internship (on-site, virtual, or hybrid) ensures that students are groomed to be professionally ready, technically competent, and culturally aligned with the organization even before official induction.
ix. Skill Enhancement Internship: Carried out at reputed organisations in offline or online mode. The aim of the internship is to expose to real-world tools, technologies, and professional environments to improve a student's employability by offering hands-on experience, application of theoretical concepts, and skill development aligned with current industry and technical trends. Skill Enhancement Internships, depending on focus area and scope, can be carried out at various organisations such as, Academic and Research Institutions, Industry and Corporate Settings, Government and Public Sector, NGOs and Social Enterprises. For Skill Enhancement Internship topics refer to https://online.vtu.ac.in/category/courses/Skill-Enhancement-Course.

Note on Internship for the Attention of Students and Colleges

• Placement training conducted at the college level, whether by third-party agencies, training institutes, or internal faculty, shall not be considered as internship for either a 15 week or a 30-week period.

The official engagement period of 15-week or 30-week for students selected/recruited by the company/ organization only at their premises under the supervision of the company, shall only be considered as an internship.

• The period of training and working of students who have been recruited as employees by organisations at the beginning of the 4th year of the programme, shall also be treated as an internship.

• Students and colleges/institutions shall follow all the guidelines and procedures of the organization and the University's Internship Guidelines, and complete the internship within a period that matches with the VTU Calendar and examination timetable.

• The assigned institution faculty mentor/ coordinator/guide should monitor the student's progress, and document offer letters, training reports, attendance, and evaluations for awarding academic credits.

• All students undergoing an internship, should adhere to all the guidelines, reporting protocols, and evaluation procedures prescribed by the University.

• Students must submit the certificate of completion of an internship with the period of internship clearly mentioned, from the respective company/organization.

• Colleges must submit details of students opting for internship during the odd and even semesters, along with a copy of the company selection letter, to the VTU when notified by the University.

Attention: In addition to the internship support provided by the college, students have the option to select internships through the AICTE and VTU Internship Portals. To ensure uniformity, quality, and transparency in the internship process, VTU has developed a dedicated web portal that serves as a single platform where colleges can also register companies offering internships. Every student is required to register on the portal before the commencement of their internship, and their progress will be monitored through the same platform. As per VTU norms, the CIE shall be conducted based on the students' performance during the training program, assessed through rubrics from the company supervisor. The SEE evaluation shall be conducted by the college as per the examination timetable published by the VTU.

AICTE Activity Points

Apart from technical knowledge and skills, to be successful as professionals, students should have excellent soft skills, leadership qualities and team spirit. They should have entrepreneurial capabilities and societal commitment. To match these requirements, AICTE has created a unique mechanism of awarding minimum 100 Activity Points for regular students and 75 Activity Points for Lateral Entry students over and above the academic grades.

The activities can be spread over the entire duration of the programme and will be reflected in the Student's VIII Semester Grade Card. It shall not be considered for computation of SGPA/CGPA and for vertical progression. The total duration of the activities for the entire programme is 320 hours for regular students and 240 hours for lateral entry students.

Break-up of CCE marks for activity points:

Evaluation by the Proctor/Coordinator 50 marks

Evaluation by the Dept. Committee

(i) Report 20 marks

(ii) Presentation 20 marks

(iii) Outcome 10 marks **Total 100 Marks**

1. No SEE for AICTE Activity Points.

2. Students will be awarded either NP or P grade based on marks obtained.

Students will be awarded 'Degree' only on earning P grade in the Activity Points.