BE SCHEME & SYLLABUS

Fourth Year
(VII and VIII Semester)

With effect from 2022-23

Artificial Intelligence & Machine Learning

ST JOSEPH ENGINEERING COLLEGE

AN AUTONOMOUS INSTITUTION

Vamanjoor, Mangaluru - 575028

MOTTO

Service & Excellence

VISION

To be a global premier Institution of professional education and research.

MISSION

- Provide opportunities to deserving students of all communities, the Christian students in particular for quality professional education.
- Design and deliver curricula to meet the national and global changing needs through student-centric learning methodologies.
- Attract, nurture and retain the best faculty and technical manpower.
- Consolidate the state-of-art infrastructure and equipment for teaching and research activities.
- Promote all round personality development of the students through interaction with alumni, academia and industry.
- Strengthen the Educational Social Responsibilities (ESR) of the institution.

ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E. (ECE, EEE, ME and CIV) & PG (MBA and MCA)
NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS
(With effect from 2022-23)

Artificial Intelligence and Machine Learning

FOURTH YEAR

(VII and VIII Semester)

AUTONOMY AND ACCREDITATION

St Joseph Engineering College (SJEC) is an Autonomous Institute under Visvesvaraya Technological University (VTU), Belagavi, Karnataka State, and is recognized by the All-India Council for Technical Education (AICTE), New Delhi. SJEC is registered under the trust "Diocese of Mangalore, Social Action Department".

The SJEC has been conferred Fresh Autonomous Status from the Academic Year 2021-22. The college was granted autonomy by the University Grants Commission (UGC) under the UGC Scheme for Autonomous Colleges 2018 and conferred by VTU. The UGC Expert Team had visited the college on 28-29 November 2021 and rigorously assessed the college on multiple parameters. The fact that only a handful of engineering colleges in the state have attained Autonomous Status adds to the college's credibility that has been on a constant upswing. Autonomy will make it convenient for the college to design curricula by recognizing the needs of the industry, offering elective courses of choice and conducting the continuous assessment of its students.

At SJEC, the Outcome-Based Education (OBE) system has been implemented since 2011. Owing to OBE practised at the college, SJEC has already been accredited by the National Board of Accreditation (NBA). Four of the UG programs, namely Mechanical Engineering, Electronics and Communication Engineering, Electrical & Electronics Engineering and Civil Engineering and two of the PG programs, namely, MBA and MCA programs, have accreditation from the NBA.

Also, SJEC has been awarded the prestigious A+ grade by the National Assessment and Accreditation Council (NAAC) for five years. With a Cumulative Grade Point Average (CGPA) of 3.39 on a 4-point scale, SJEC has joined the elite list of colleges accredited with an A+ grade by NAAC in its first cycle. The fact that only a small percentage of the Higher Education Institutions in India have bagged A+ or higher grades by NAAC adds to the college's credibility that has been on a constant upswing.

The college is committed to offering quality education to all its students, and the accreditation by NAAC and NBA reassures this fact. True to its motto of "Service and Excellence", the college's hard work has resulted in getting this recognition, which has endorsed the academic framework and policies that the college has been practicing since its inception. The college has been leveraging a flexible choice-based academic model that gives students the freedom to undergo learning in respective disciplines and a transparent and continuous evaluation process that helps in their holistic development.

CONTENTS

ABOUT THE DEPARTMENT

Artificial Intelligence (AI) and Machine Learning (ML) are being looked as the drivers for the next industrial revolution happening in the world today. Artificial Intelligence has been utilized in various fields like Medicine, Language processing, Finance, Education, Transportation, Business, Law and more.

Artificial Intelligence is the branch of Computer Science that emphasizes the development of intelligent machines which think and work like humans. With the advancement in technology, we are already connected to AI in one way or the other – whether it is Siri, Watson or Alexa. More and more companies are investing resources in Machine Learning (ML), indicating a robust growth in AI products and apps in the near future.

AI and ML are integral parts of data science, where techniques from both such as regression, predictive analytics and more are applied for insight generation. Job Opportunities for AI & ML engineers such as - Business Intelligence Developer, Research Scientist, Full stack developer, Software architect, Data analyst, Data warehouse engineer and Product manager are highly demanding. Demand for AI and ML engineers is projected to be 1,25,00 in the next five years.

The four-year engineering course in AI and ML at SJEC offers subjects like Introduction to Sensors, ML with Python, Big Data Analytics, Natural Language Processing (NLP), Applied Statistics, Expert System, Fuzzy Logic, Virtual Reality, Robotics Process Automation (RPA), Internet of Things (IoT), Speech Processing, Computation Intelligence, Pervasive Computing, Knowledge and Data Engineering, ML and AI for Healthcare & Agriculture, Deep Learning, Game Theory, etc.

DEPARTMENT VISION

To impart value-based quality education with the motive of transforming mankind with excellence and competing areas of engineering, technology and management.

DEPARTMENT MISSION

1. Focus on the practical aspects of the curriculum to make learning a meaningful and interesting experience.
2. Encourage active collaboration with industries, communities, and fellow institutions within the country and abroad.
3. Infuse strong moral and ethical principles in students in order to make them conscientious citizens and excellent human beings.
4. Cultivate the competitive spirit required for success.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To provide students with a solid foundation and the ability to use engineering concepts, mathematics, physics, and humanities required to develop, analyse, design, and implement solutions to the problems in intelligent computing and business systems.
2. To develop in students, the knowledge of computer science and engineering to work in domains such as artificial intelligence, machine learning and data science.
3. To foster in students, the capacity of teamwork through efficient communication in multidisciplinary projects.
4. To prepare students for building successful careers in artificial intelligence, data science and business systems to meet the needs of society while incorporating professional ethics.
5. To inspire learners to pursue higher education in their desired fields and engage in research.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences and engineering sciences with consideration for sustainable development.

3. Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

4. Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

5. Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

6. The Engineer and the World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

7. Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

8. Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

9. Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

10. Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

11. Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Entrepreneurship and Freelancing**: Recognize the tenets of entrepreneurship, freelancing and the prerequisites for starting a business in the IT or related fields.

2. **Competitive Exams**: Participate skillfully in competitive examinations for certification, professional advancement, and admission to higher studies.

VII Semester (B.E. – Artificial Intelligence and Machine Learning)													
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total**	
						L	**T**	**P**					
1	IPCC	22AIM71	Computer Vision (Integrated)	AIML	AIML	3	-	2	03	50	50	100	4
2	IPCC	22AIM72	Deep Learning (Integrated)	AIML	AIML	3	-	2	03	50	50	100	4
3	PCC	22AIM73	Cloud Computing	AIML	AIML	3	-	-	03	50	50	100	3
4	PEC	22AIM74X	Professional Elective -III	AIML	AIML	3	-	-	03	50	50	100	3
5	PRJ	22AIM75	Major Project Phase II	AIML	AIML	-	-	6	03	50	50	100	6
					Total	**12**	**-**	**10**	**15**	**250**	**250**	**500**	**20**

22AIM74X : Professional Elective III			
22AIM741	Big Data Analytics	22AIM743	Nature Inspired Computing
22AIM742	Generative Artificial Intelligence	22AIM744	Augmented and Virtual Reality

VIII Semester (B.E. – Artificial Intelligence and Machine Learning)													
Sl. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total**	
						L	**T**	**P**					
1	PEC	22AIM81	Professional Elective IV (Online Course)	Any MOOC topic (Choices are given by respective Department) with minimum 12 weeks to be completed before the end of 8th semester.								100	3
2	OEC	22AIM82	Open Elective -II (Online Course)	Any MOOC topic (Choices are given by respective Department) with minimum 12 weeks to be completed before the end of 8th semester.								100	3
3	INT	22AIM83	Research / Industry Internship			-	-	-	03	50	50	100	10
Total						**-**	**-**	**-**	**03**	**50**	**50**	**300**	**16**

Note: a. Professional Elective IV: These are ONLINE courses suggested by the Board of Studies (Department).

b. Open Elective -II: These are ONLINE courses suggested by the Board of Studies (Department).

c. During 4th year of the program i.e., after VII semester, students shall take up the **Research Internship /Industrial Internship for 14-16 weeks**. Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

VII Semester

Computer Vision			
Course Code	**22AIM71**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Understand preprocessing and manipulation of digital images using operations such as filtering, geometric transformations, and frequency-domain techniques.
- Detect and match visual features such as key points, edges, contours, and vanishing lines to support tasks like correspondence and motion tracking.
- Explore key computer vision tasks including image recognition, segmentation, tracking, depth estimation and 3D reconstruction.
- Apply different levels of vision processing—low, mid, and high—to build computer vision models for real-world applications.

Module-1 Image Processing Concepts (8 hours)

Point operators, Linear Filtering, More Neighbourhood operators, Fourier Transforms, Pyramids and Wavelets, Geometric transformations
TB1: Ch 3

Module-2 Image Recognition (8 hours)

Instance Recognition, Image Classification, Object Detection, Semantic Segmentation, Video Understanding, Vision and Language
TB1: Ch 6

Module-3 Feature Detection and Matching (8 hours)

Points and Patches, Edges and Contours, Contour tracking, Lines and Vanishing points, Segmentation
TB1: Ch 7

Module-4 Depth Estimation (8 hours)

Epipolar Geometry, Sparse correspondence, Dense correspondence, Local methods, Global optimization, Deep neural networks, Monocular depth estimation
TB1: Ch 12

Module-5 3D Reconstruction (8 hours)

Shape from X, 3D Scanning, Surface representations, Point based representations, Volumetric representations, Model based reconstruction, Recovering Texture maps and albedos
TB1: Ch 13

PRACTICAL MODULE

1. Apply wavelet decomposition to extract key features from handwritten digits
2. Load a small set of labelled images from disk and train a simple CNN for classification
3. Use preloaded Haar cascades to detect objects like faces, eyes, or ears.
4. Detect and match features in two images. Use SIFT, ORB, or Harris corner detection on locally stored images.
5. Implement YOLO or Faster R-CNN to detect objects in a given image.
6. Implement an optical flow algorithm to track feature points in a video sequence.
7. Compute disparity maps with stereo images. Use pre-saved stereo image pairs to estimate depth with OpenCV's disparity functions.
8. Generate a 3D point cloud from depth data. Use depth maps or disparity images to reconstruct basic 3D structures.

OPEN ENDED EXPERIMENTS

1. Track pedestrian motion patterns in a marketplace, train station, or campus
2. Implement pose estimation to detect key actions (ex: ball kicks or jumps) in sports footage.
3. Implement hand gesture recognition system

Course Outcomes: At the end of the course the student will be able to:	
22AIM71.1	Describe fundamental concepts of computer vision, including image filtering, transformations, feature extraction, and deep learning models.
22AIM71.2	Summarize the different options available for image recognition, feature matching, depth perception and 3D reconstruction of images
22AIM71.3	Select and justify the most appropriate technique for image recognition, feature matching, depth perception and 3D reconstruction for the given requirement
22AIM71.4	Analyze and compare the results of different computer vision techniques, evaluate their strengths and limitations, and select the most appropriate method for a given application
22AIM71.5	Propose a computer vision pipeline that combines relevant techniques to solve real-world problems
22AIM71.6	Design and develop advanced computer vision applications by integrating techniques such as image processing, feature extraction, object recognition, depth estimation, and 3D reconstruction for solving real-world problems.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Computer Vision: Algorithms &Applications	Richard Szeliski	Springer	2nd Edition, 2022
Reference Books				
1	Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in Opencv and Tensorflow with Python	Shamshad Ansari	Apress	1st Edition, 2020
2	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall	4th Edition, 2018

Web links and Video Lectures (e-Resources):

- Modern computer vision | IIT Madras: https://www.youtube.com/playlist?list=PLyqSpQzTE6M8X3Veh5ijSQ2UGFFEZIpKf
- Deep Learning for Computer Vision: https://www.youtube.com/playlist?list=PLyqSpQzTE6M_PI-rIz4O1jEgffhJU9GgG
- A decade in Computer Vision - Richard Szeliski: https://www.youtube.com/watch?v=90oS7j8zVYw
- Visual Reconstruction and Image-Based Rendering - https://www.youtube.com/watch?v=Zh5WZoPcDMg
- Deep Learning for Computer Vision: https://www.youtube.com/watch?v=u6aEYuemt0M

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22AIM71.1	1	-	-	-	-	-	-	-	-	-	-	-	-
22AIM71.2	-	1	-	-	-	-	-	-	-	-	-	-	-
22AIM71.3	-	-	2	-	-	-	-	-	-	-	-	-	-
22AIM71.4	-	-	2	2	-	-	-	-	-	-	-	-	-
22AIM71.5	-	-	2	-	2	-	-	-	-	2	-	-	-
22AIM71.6	-	-	2	-	2	-	-	-	-	2	-	-	-

1: Low 2: Medium 3: High

Deep Learning			
Course Code	**22AIM72**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Understand major deep neural network frameworks and issues in basic neural networks.
- Solve real-world applications using Deep learning.
- Identify suitable deep learning approaches for given applications.
- Demonstrate the working of TensorFlow.
- Know the significance of Autoencoders.

Module-1 Introduction to Neural Networks and Deep Neural Networks (8 hours)

Introduction: The Neuron, Expressing Linear Perceptron as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Activation functions: Sigmoid, Tanh, ReLU, and SoftMax, Loss functions: Mean Squared Error, Mean Absolute Error, Cross Entropy, Categorical Cross Entropy

TB1: Ch 1

Module-2 Training feed-forward Neural Network (8 hours)

Deep Neural Networks – Forward and Back Propagation – Parameters – Hyperparameters. Gradient Descent, Gradient Descent with Sigmoidal Neurons, Stochastic and Minibatch Gradient Descent, RMSProp and Adam Optimization, Test Sets, Validation Sets and Overfitting, Preventing Overfitting in Deep Neural Networks, Implementation of Neural Network using TensorFlow, Exercise: Boston Housing Price Prediction with Feed Forward Neural Networks.

TB1: Ch 2

Module-3 Convolutional Neural Network (8 hours)

Foundations of Convolutional Neural Networks – CNN operations – Architecture – Simple Convolution Network – Deep Convolutional Models – VGGNet, ResNet, AlexNet, Inception Net and others. Exercise: Handwritten digit recognition using CNN.

TB1: Ch 5 TB2: Ch 8

Module-4 Models for Sequence analysis (8 hours)

Recurrent Neural Networks, The Challenges with Vanishing Gradients, Long Short-Term Memory (LSTM) Units, TensorFlow Primitives for RNN and LSTM Models, Implementing a Sentiment Analysis Model, Solving seq2seq Tasks with Recurrent Neural Networks. Exercise: Sentiment Analysis for Movie Reviews using RNN.

TB1: Ch 7

Module-5 Introduction to Auto Encoders and GAN (8 hours)

Autoencoders: Efficient Data Representation, Performing PCA, Stacked, Autoencoders, Denoising, Sparse Autoencoders, Variational and other Autoencoders. Generative Adversarial Networks. Exercise: Image generation using GAN.

TB1: Ch 6 TB2: Ch 10

PRACTICAL MODULE

1. Implement a multilayer perceptron (MLP) model using Keras with TensorFlow for house price prediction. (a) Perform Exploratory Data Analysis (b) Prepare dataset (c) Build MLP model (d) Evaluate Model performance (e) Predict for test data.
2. Build a Multiclass classifier using keras with TensorFlow. Use MNIST or any other suitable dataset. (a) Perform Data Pre-processing (b) Define Model and perform training (c)

Evaluate Results using confusion matrix.

3. Design and implement CNN models AlexNet and VGG-16 for Image Classification. (a) Select a suitable image classification dataset (medical imaging, agricultural, etc.). (b) Optimized with different hyper-parameters including learning rate, filter size, no. of layers, optimizers, dropouts, etc.
4. Design and implement CNN model ResNet-50 for Image Classification. (a) Define Model and perform training (b) Evaluate Results using two performance measure matrix. Select a suitable image classification dataset.
5. Apply transfer learning technique in deep neural network. Use two pre-trained models ResNet and DenseNet on suitable datasets.
6. Develop a program for Sentiment Analysis using LSTM.
7. Develop a program for denoising using autoencoder
8. Implement a GAN model for a fake image generation

OPEN ENDED EXPERIMENTS

1. Develop a deep learning model to segment flooded vs. non-flooded areas to estimate affected land from satellite/drone images after heavy rain.
2. Design a Grad-CAM model to show where the model "looked" for positive cases in the pneumonia classification model on chest X-ray images.

Course Outcomes: At the end of the course the student will be able to:	
22AIM72.1	Describe the basic concepts of Neural Networks and Deep Learning.
22AIM72.2	Make use of Tensor Flow to build model.
22AIM72.3	Identify Convolutional Neural Network for a given scenario
22AIM72.4	Select Deep Learning models for sequence analysis.
22AIM72.5	Apply the concept of Autoencoders and GAN.
22AIM72.6	Build Deep learning models for Real-world applications.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Deep Learning A Practitioner's Approach	Josh Patterson and Adam Gibson	O'Reilly	1st Edition, 2017
2	Neural Networks and Deep Learning	Charu C Aggarwal	Springer	2nd Edition, 2023
Reference Books				
1	Hands on Machine Learning with Scikit-Learn &TensorFlow	Aurelien Geron	O'Reilly	2nd Edition, 2019
2	Deep Learning	Lan Good fellow and Yoshua Bengio	MIT Press	2nd Edition, 2016

Web links and Video Lectures (e-Resources):

- Neural Networks and Deep Learning: https://www.coursera.org/learn/neural-networks-deep-learning
- Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization: https://www.coursera.org/learn/deep-neural-network
- How Deep Neural Networks Work: https://www.youtube.com/watch?v=dPWYUELwIdM
- How Deep Neural Networks Work: https://www.youtube.com/watch?v=ILsA4nyG7I0
- How to Implement Autoencoders in Python and Keras: https://www.youtube.com/watch?v=TtyoFTyJuEY

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22AIM72.1	2	-	-	-	-	-	-	-	-	-	-	-	-
22AIM72.2	-	1	1	-	2	-	-	-	-	-	-	-	1
22AIM72.3	1	1	2	-	1	-	-	-	-	-	-	-	1
22AIM72.4	-	1	2	-	1	-	-	-	-	-	-	-	1
22AIM72.5	-	1	2	-	1	-	-	-	-	-	-	-	-
22AIM72.6	-	2	2	1	2	2	-	2	-	-	-	-	1

1: Low 2: Medium 3: High

Cloud Computing			
Course Code	**22AIM73**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Introduce the rationale behind the cloud computing revolution and the business drivers.
- Understand various models, types and challenges of cloud computing.
- Understand the design of cloud native applications, the necessary tools and the design tradeoffs.
- Realize the importance of Cloud Virtualization, Abstraction`s, Enabling Technologies and cloud security.

Module-1 Distributed System Models and Enabling Technologies (8 hours)

Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds.
TB1: Ch 1: 1.1 - 1.4

Module-2 Virtual Machines and Virtualization of Clusters (8 hours)

Virtual Machines and Virtualization of Clusters: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management
TB1: Ch 3: 3.1 - 3.4

Module-3 Cloud Platform Architecture over Virtualized Datacenters (8 hours)

Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure
TB1: Ch 4: 4.1 - 4.4

Module-4 Cloud Security (8 hours)

Cloud Security: Security, The top concern for cloud users, Cloud Security Risks, Privacy Impact Assessment, Security of Database Services, Operating System security, Virtual Machine Security. **Cloud Security and Trust Management**: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.
TB2: Ch 11: 11.1- 11.3, 11.6 – 11.8
TB1: Ch 4: 4.6

Module-5 Cloud Programming and Software Environments (8 hours)

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft
TB1: Ch 6: 6.1 - 6.4

Course Outcomes: At the end of the course the student will be able to:	
22AIM73.1	Describe various cloud computing platforms and service providers.
22AIM73.2	Illustrate the significance of various types of virtualizations.
22AIM73.3	Identify the architecture, delivery models and industrial platforms for cloud computing based applications.
22AIM73.4	Analyze the role of security aspects in cloud computing.

22AIM73.5	Demonstrate cloud applications in various fields using suitable cloud platforms.
22AIM73.6	Investigate emerging trends and best practices in cloud computing.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1.	Distributed and Cloud Computing	Kai Hwang, Geoffrey C Fox, and Jack J Dongarra	Morgan Kaufmann, Elsevier	1st Edition, 2012
2.	Cloud Computing: Theory and Practice	Dan C Marinescu	Morgan Kaufmann, Elsevier	3rd Edition, 2023
Reference Books				
1	Cloud Computing Implementation, Management and Security	John W Rittinghouse, James F Ransome	CRC Press	Reprint, 2013
2	Computing Principles and Paradigms	Rajkumar Buyya , James Broberg, Andrzej Goscinsk,	John Wiley & Sons	Reprint, 2014

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=EN4fEbcFZ_E
- https://www.youtube.com/watch?v=RWgW-CgdIk0
- https://www.geeksforgeeks.org/virtualization-cloud-computing-types/
- https://www.tpointtech.com/cloud-service-provider-companies
- http://www.digimat.in/nptel/courses/video/106105167/L01.html

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22AIM73.1	1	2	-	-	-	-	-	-	-	-	-	-	-
22AIM73.2	2	1	-	-	1	-	2	-	-	2	-	-	-
22AIM73.3	-	2	2	-	2	-	2	-	-	3	-	2	-
22AIM73.4	-	-	1	-	1	2	-	-	-	2	-	-	-
22AIM73.5	-	-	-	-	2	-	2	-	-	2	-	-	-
22AIM73.6	-	2	3	-	-	-	-	-	-	-	-	-	3

1: Low 2: Medium 3: High

Big Data Analytics			
Course Code	**22AIM741**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Understand Big Data Analytics concepts, architecture, and applications.
- Analyse data processing using the Hadoop ecosystem and NoSQL databases.
- Apply Apache Spark for real-time analytics, ETL process, and Spark GraphX for Graph Analytics.
- Develop knowledge of Machine Learning Algorithms for big data analytics and Text and Web Mining for extracting insights.

Module-1 Big Data Analytics (8 hours)

Introduction to Big Data Analytics: Introduction, Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.
TB1: Ch 1

Module-2 Hadoop (8 hours)

Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, Hadoop Yarn, Hadoop Ecosystem Tools : Hadoop Ecosystem, Ambari, HBase, Hive, Pig, Mahout **MapReduce, Hive and Pig:** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, HiveQL: Hive DDL, Hive DML, Hive QL for querying the data, Aggregation, Join, Group by Clause
TB1: Ch 2, Ch 4

Module-3 NoSQL Big Data Management (8 hours)

Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks. MongoDB Database, Cassandra Databases.
TB1: Ch 3

Module-4 Spark and Graph Analytics (8 hours)

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark, Data ETL (Extract, Transform and Load) Process **Graph Analytics for Big Data and Spark GraphX Platform:** Representing a Graph as Triples, Graph Analytics, Choosing Graph Analytics, Use Cases of Graph Analytics, Graph Analytics Algorithms and Approaches
TB1: Ch 5, Ch 8

Module-5 Big Data Analytics using ML Algorithms and Social Network Analytics (8 hours)

Machine Learning Algorithms for Big Data Analytics: Estimating the Relationships, Outliers, Variances, Probability Distributions and Correlations, Regression Analysis: Simple Linear Regression, Multiple Regression, K-Nearest-Neighbour Regression Analysis, Finding Similar Items, Frequent Itemset Mining. **Text, Web Content and Social Network Analytics:** Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Social Networks as Graphs, SimRank, Counting Triangles & Graph Matches
TB1: Ch 6, Ch 9

Course Outcomes: At the end of the course the student will be able to:	
22AIM741.1	Explain Big Data Analytics concepts, architecture, and applications.
22AIM741.2	Describe the Hadoop ecosystem and its components for Big Data processing.
22AIM741.3	Apply NoSQL databases and explain their role in managing Big Data.
22AIM741.4	Apply Spark for data processing and Graph Analytics using Spark GraphX.

22AIM741.5	Evaluate Machine Learning Algorithms and Social Network Analytics for data analysis.
22AIM741.6	Analyze real-world problems and develop Big Data solutions.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning	Raj Kamal and Preeti Saxena	McGraw Hill Education (India) Private Limited	5th Reprint 2023
Reference Books				
1	Big data and Analytics	Seema Acharya and Subhashini Chellappan	Wiley India Publishers	2nd Edition, 2019
2	Hadoop: The Definitive Guide	Tom White	O'reilly Media	4th Edition, 2015
3	MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems	Adam Shook and Donald Mine	O'Reilly	2012
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

Web links and Video Lectures (e-Resources):

- https://youtu.be/bAyrObl7TYE?si=ndGgElNxRcVoNoqb
- https://youtu.be/Uv96qQ3uC6Y?si=Tq3gJn46V8rhb80f
- https://www.youtube.com/live/47Us3i_XetI?si=js4dwLRzxCvjokPR
- https://youtu.be/8eJJe4Slnik?si=Zu-LtlqiaiSlt0lR
- https://youtu.be/ExcRbA7fy_A?si=Mbsen6ERTc91fVAm
- https://youtu.be/Up6KLx3m2ww?si=oYCq41qYlJtJw2FL
- https://youtu.be/FHI4gX5EbYI?si=F0xOKZCvXAW_jOZ0

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22AIM741.1	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
22AIM741.2	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM741.3	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
22AIM741.4	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM741.5	**2**	**2**	**2**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
22AIM741.6	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

1: Low 2: Medium 3: High

Generative Artificial Intelligence			
Course Code	**22AIM742**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Apply AI and generative AI techniques to real-world tasks, such as data classification, regression, and generation.
- Analyze the differences and applications of various generative AI models, including GANs, RNNs, and LSTMs.
- Evaluate the ethical, societal, and business implications of generative AI, focusing on privacy, bias, and security concerns.
- Assess the challenges and opportunities of generative AI platforms in both open-source and closed-source environments.
- Propose effective strategies and solutions for integrating generative AI technologies into various industries while addressing associated risks and ethical concerns

Module-1 AI in A Nutshell (8 hours)

What is AI? - How AI Trains Complex Tasks, What Is Discriminative AI? – Classification, Regression, Clustering, Dimensionality Reduction, What Is Generative AI? – Data Generation, Data Transformation, Data Enrichment, Gen AI Impact.

TB1: Ch 1

Module-2 Generative Models (8 hours)

Why Generative Models, Development of Generative Models, GANs, How GANs Work, GAN Challenges, GANs for Image Generation, CLIP, DALL-E 2, Diffusion Models. Text Generation, RNN, LSTM, Seq2Seq, Tokenization for LLMs, Pretraining LLMs.

TB1: Ch 2

Module-3 Application Field (8 hours)

Foundational and Specialized AI Models, Gen AI Platforms, Open-Source Models, Closed Source Models, Open-Source vs Closed Source, Generating Revenue with Open-Source Models, Understanding Autonomous Agents.

TB1: Ch 3

Module-4 Growth of Gen AI (8 hours)

The S-Curve, Exponential Progress in Computing, Exponential Growth in Data, The Data Growth Drivers, Synthetic Data, Data Storage, Trends in Data, The AI-Driven Economy, Challenges to AI Progression. What's Next in AI, Multitasking Generative AI, Multimodal Generative AI, Multisensory Generative AI, Other Observable Trends in Generative AI.

TB1: Ch 4, Ch 6

Module-5 Ethical Concerns of AI (8 hours)

Intellectual Property and the Generative AI Platform, Bias and Fairness in AI-Generated Data, Misinformation and Misuse of Generative AI, Privacy, Safety, and Security, Generative AI's Impact on Jobs and Industry, The Dependency on AI, Environmental Concerns, Regulations and Policies in Generative AI

TB1: Ch 5

Course Outcomes: At the end of the course the student will be able to:	
22AIM742.1	Apply AI techniques to classify, regress, and cluster data, and evaluate the impact of discriminative and generative AI models in solving complex tasks.
22AIM742.2	Choose generative models like GANs, RNNs, and LSTMs, and apply them for real-world applications such as image and text generation.

22AIM742.3	Articulate the effectiveness of foundational and specialized AI models and critically evaluate the business and technical considerations between open-source and closed-source platforms.
22AIM742.4	Analyze the exponential growth of generative AI, including its data-driven advancements and the challenges presented by the increasing scale of data and computational resources.
22AIM742.5	Evaluate the ethical implications of generative AI, addressing concerns such as bias, fairness, privacy, and its societal impact, and propose strategies for responsible use.
22AIM742.6	Integrate the knowledge of generative AI to propose innovative solutions to real-world problems.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Generative AI	Martin Musiol	Wiley	1st Edition, 2024
Reference Books				
1	Generative AI for Everyone	Altaf Rehmani	Independently Published	Feb, 2024
2	Generative AI for Everyone: A Practical Guidebook	Preston McCauley	Independently Published	Jan, 2025

Web links and Video Lectures (e-Resources):

- Introduction to Generative AI : https://www.cloudskillsboost.google/course_templates/536
- Generative AI : https://www.coursera.org/learn/introduction-to-generative-ai
- Generative AI and Large Language Models: https://onlinecourses.swayam2.ac.in/imb24_mg116/preview
- Introduction to Generative AI: https://www.youtube.com/watch?v=cZaNf2rA30k
- Generative AI Explained in 5 Minutes: https://www.youtube.com/watch?v=NRmAXDWJVnU
- Gen AI Essential – Full Course : https://www.youtube.com/watch?v=nJ25yl34Uqw

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22AIM742.1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM742.2	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM742.3	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
22AIM742.4	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM742.5	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**
22AIM742.6	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Low 2: Medium 3: High

Nature Inspired Computing			
Course Code	**22AIM743**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives:

- Understand the key concepts and philosophy behind Natural Computing and its real-world relevance.
- Learn the fundamentals of fuzzy logic, classical sets, and fuzzy sets for handling uncertainty.
- Explore genetic algorithms and compare them with traditional optimization techniques.
- Study evolutionary computing principles inspired by biological evolution and their applications.
- Understand the structure and functioning of Artificial Immune Systems and their computational models.

Module-1 Introduction to Natural Computing (8 hours)

From nature to natural computing: Introduction, A small sample of Ideas, the philosophy of Natural Computing, when to use Natural Computing Approaches.
Conceptualization: Introduction, General Concepts.
TB2: Ch1, Ch 2

Module-2 Fuzzy Logic, Classic Sets & Fuzzy Sets (8 hours)

Fundamentals of Fuzzy Logic and Set Theory: Introduction to Fuzzy Logic, Classical Sets (Crisp Sets), Fuzzy Sets, Classical Relation, Fuzzy Relations, Noninteractive Fuzzy Sets
TB1: Ch 10, Ch 11

Module-3 Genetic Algorithm (8 hours)

Genetic Algorithms and Optimization Techniques: Introduction, Biological Background, Traditional Optimization & Search Techniques, Genetic Algorithm & Search Space, Genetic Algorithm vs Traditional Algorithms, Basic Terminologies in Genetic Algorithm, Simple GA
TB1: Ch 21

Module-4 Computing inspired by Nature (8 hours)

Evolutionary Computing: Introduction, Problem solving as a search task, Evolutionary Biology, Evolutionary Computing, the other main Evolutionary algorithms, from Evolutionary Biology to computing, Scope of Evolutionary Computing
TB2: Ch 3

Module-5 Immunocomputing (8 hours)

Immunocomputing: Introduction, the Immune System, Artificial Immune Systems, Bone Marrow Models, Negative Selection Algorithms, Clonal Selection and Affinity Maturation, Artificial Immune Networks, from Natural to Artificial Immune systems, Scope of Artificial Immune Systems
TB2: Ch 6

Course Outcomes: At the end of the course the student will be able to:	
22AIM743.1	Describe the fundamental ideas and philosophy of Natural Computing and its practical relevance.
22AIM743.2	Interpret fuzzy logic concepts including classical and fuzzy sets, and their applications in uncertain reasoning.
22AIM743.3	Apply genetic algorithm techniques to optimization problems using basic genetic operators.

22AIM743.4	Analyze evolutionary computing strategies by examining problem-solving approaches based on biological evolution.
22AIM743.5	Evaluate artificial immune system models in terms of their structure, function, and computational effectiveness.
22AIM743.6	Design a natural computing solution by integrating concepts from fuzzy logic, genetic algorithms, evolutionary strategies, and immune computing.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Principles of Soft Computing	Shivanandam, Deepa S. N	Wiley India Pvt. Ltd	3rd Edition, 2018
2	Fundamentals of Natural Computing- Basic Concepts, Algorithms, and Applications	Leandro Nunes de Castro	CRC Press Taylor & Francis Group	1st Edition, 2007
Reference Books				
1	Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies	Floreano D. and Mattiussi C	MIT Press, Cambridge, MA,	1st Edition 2008
2	Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications	S. Rajasekaran, G.A. Vijayalakshmi Pai,	PHI Learning Pvt.Ltd	1st Edition,2017
3	Handbook of Nature-Inspired and Innovative Computing	Albert Y. Zomaya	Springer	1st Edition, 2006

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/live/HA3ooBOEYAk?si=8sVXXv4cMmyvOQhl
- https://youtu.be/W1hjD8QRFFs?si=izZPgo_0R6ckTUPz
- https://youtu.be/CGioNXsTgiw?si=aBFJGDAw3l9iJuM4
- https://youtu.be/uRF7xSQwNeU?si=V5WA6TePLfMeJqBl
- https://youtu.be/GjKTJ9E-7RM?si=ZmTsIBuiT_HTKnLm
- https://youtu.be/d86McbWXh4E?si=gPnwFDkqb-abSYHR
- https://youtu.be/ccbBB-irv70?si=4uz4SDGiS2ZDkLmM
- https://youtu.be/4uJUFTeol3Q?si=JaWXe6QMfr0PtG0s

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22AIM743.1	2	-	-	-	-	-	-	-	-	-	-	1	
22AIM743.2	2	2	-	-	-	-	-	-	-	-	-	-	-
22AIM743.3	-	2	3	-	-	-	-	-	-	-	-	2	-
22AIM743.4	2	2	-	2	-	-	-	-	-	-	-	-	-
22AIM743.5	2	-	2	-	-	-	-	-	-	-	-	-	-
22AIM743.6	-	2	3	2	1	-	-	-	-	-	-	3	-

1: Low 2: Medium 3: High

Augmented and Virtual Reality			
Course Code	**22AIM744**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Understand the fundamentals of Virtual Reality (VR) and its key components.
- Explore input and output devices used in VR, including trackers, displays, and haptic feedback.
- Differentiate between Virtual Reality (VR) and Augmented Reality (AR) technologies.
- Apply modeling techniques for interactive VR and AR environments.
- Evaluate human factors, safety concerns, and applications of VR/AR in various fields.

Module-1 Introduction to Augmented and Virtual Reality (8 hours)

Introduction: What is Augmented Reality? Augmented Reality Concepts**,** The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Virtual Reality and Virtual Environment:** Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.

TB1: Ch 1, TB2: Ch 1, Ch 2

Module-2 Input and Output Devices (8 hours)

Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, Navigation and Manipulation, Gesture interfaces. **Output Devices:** Graphics displays, Sound displays, Haptic feedback.

TB1: Ch 2, Ch 3

Module-3 AR/VR System Architecture and Modeling Techniques (8 hours)

Computing Architectures for VR: The Rendering Pipeline, PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures

Modeling: Geometric modeling, Kinematics modeling, Physical modeling, Behavior modeling, Model management.

TB1: Ch 4, Ch 5

Module-4 VR Programming (8 hours)

Toolkits and Scene Graphs, WorldToolKit, Java 3D, General Haptics Open Software Toolkit, PeopleShop.

TB1: Ch 6

Module-5 Human Factors and Applications (8 hours)

Human Factors: Methodology and terminology, User performance studies, VR health and Safety issues. **Traditional VR Applications:** Medical applications, Education, Arts, and Entertainment, Military applications. **Emerging Applications of VR**: VR Applications in Manufacturing, Applications of VR in Robotics, Information Visualization.

TB1: Ch 7, Ch 8, Ch 9

Course Outcomes: At the end of the course the student will be able to:	
22AIM744.1	Explain the fundamental principles, concepts, and historical development of AR/VR.
22AIM744.2	Identify and compare various input and output devices used in VR systems.
22AIM744.3	Apply VR programming techniques using toolkits to develop interactive virtual environments.
22AIM744.4	Design and manage models in VR/AR systems using modeling approaches.

22AIM744.5	Analyze human factors, safety issues, and VR/AR applications in diverse fields.
22AIM744.6	Integrate knowledge of AR/VR technologies to develop innovative solutions for real-world applications

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Virtual Reality Technology	Grigore C. Burdea, Philippe Coiffet	John Wiley & Sons	2nd Edition, 2003
2	Understanding Augmented Reality Concepts and Applications	Alan B. Craig	Morgan Kaufmann	1st Edition, 2013
Reference Books				
1	Virtual Reality	Steven M. LaValle	Cambridge University Press	1st Edition, 2016
2	Spatial Augmented Reality: Merging Real and Virtual Worlds	Oliver Bimber and Ramesh Raskar	A K Peters, Ltd.	1st Edition, 2005

Web links and Video Lectures (e-Resources):

- https://youtu.be/Mu5wyuqmqXI?si=_ivff3sI4kJYalhW
- https://youtu.be/04AMaTsXFJU?si=_WlE53wbhYtLdGWG
- https://youtu.be/QpbJwad6v_s?si=8fb3aADTONFQU7nO
- https://youtu.be/sfsHfCAOBuQ?si=lGzWsZ0X3GoGBzsD
- https://youtu.be/XLP4YTpUpBI?si=4yAuacr3AxQShSvm
- https://www.geeksforgeeks.org/virtual-reality-augmented-reality-and-mixed-reality/
- https://www.intel.com/content/www/us/en/tech-tips-and-tricks/virtual-reality-vs-augmented-reality.html
- https://forwork.meta.com/blog/difference-between-vr-ar-and-mr/

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22AIM744.1	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
22AIM744.2	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
22AIM744.3	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
22AIM744.4	**3**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
22AIM744.5	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
22AIM744.6	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**

1: Low 2: Medium 3: High

Major Project Phase II			
Course Code	**22AIM75**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:6)	SEE	3 Hrs
Total Hours	72 hours	Credits	06

Course Learning Objectives: The objective of the course is to

- Utilize fundamental principles of engineering and interdisciplinary knowledge to identify, analyse, and solve complex problems in the project domain.
- Develop and execute a comprehensive project plan that includes designing, prototyping, testing, and evaluating a system, component, or process to meet specific needs and constraints.
- Conduct in-depth research, critically review literature, and integrate innovative solutions or techniques within the project framework.
- Demonstrate effective teamwork, communication, and collaboration skills in a multidisciplinary environment to achieve project objectives.
- Incorporate ethical considerations, societal impact, and sustainable practices in the project development, while adhering to professional engineering standards.
- Prepare and present a well-structured project report, supported by technical documentation and visual aids, and confidently defend the work during project viva-voce or presentations.

1. Project Execution

- **Regular Meetings**: Students should meet regularly with their project-guide to discuss progress, challenges, and next steps.
- **Documentation**: Maintain detailed documentation throughout the project in a project work-dairy, including design decisions, experiments, and testing results.
- **Milestones**: Set clear milestones and deadlines to ensure steady progress. These could include design completion, initial prototype, testing, etc.

2. Mid-term Review

- **Progress Presentation**: DPEC shall conduct a mid-term review where students present their progress to a panel of faculty members.
- **Feedback**: Provide constructive feedback and guidance to help students refine their projects.

3. Final Submission

- **Report**: The project report should include an abstract, introduction, literature review, methodology, implementation, results, discussion, conclusion, and references.
- **Code and Data**: If applicable, students should submit their code, datasets, and any other relevant materials.

4. Project Presentations

- **Oral Presentation**: Students should present their projects to a panel, explaining their work, findings, and contributions.
- **Demonstration**: If possible, include a live demonstration of the project or show relevant simulations and results.
- **Q&A**: Be prepared to answer questions from the panel and justify the project's methodology and conclusions.

5. Evaluation Criteria

- **Originality and Innovation**: Assess the novelty and creativity of the project.
- **Technical Competence**: Evaluate the depth of technical knowledge and problem-solving ability demonstrated.
- **Project Execution**: Consider the effectiveness of project planning, adherence to timelines, and quality of implementation.
- **Presentation and Communication**: Judge the clarity and coherence of the final report, presentation, and the ability to answer questions.

6. Plagiarism Check
• **Academic Integrity**: Ensure that the work submitted is original and properly cites all references and sources. • **Plagiarism Check**: Run all reports through plagiarism detection software and ensure that similarity index is less than the threshold value (25%).
7. **Mentorship and Feedback**
• **Feedback:** Students are required to consult with their project guide regularly throughout the project work to seek guidance and feedback. • **Weekly Meetings:** At least one mentorship meeting every week shall be held and recorded in the project work-dairy.
8. Post Submission
• **Publication**: DPEC shall encourage students to publish their work in conferences or journals, especially if it contributes significantly to their field. • **Project Archive**: Store all projects in the department's digital archive for future reference.

Continuous Internal Evaluation (CIE)		
Description	**Proposed Dates**	**CIE Weightage (Max 100 marks)**
Project Progress Evaluation -I	Beginning of the 7th Semester	20 marks
Project Progress Evaluation -II	Middle of the 7th Semester	30 marks
Project Report Evaluation(Phase II)	End of the 7th Semester	50 marks
Semester End Examinations (SEE)		
SEE will be conducted for 100 marks (after the last working day of the 7th semester) in the presence of the external examiner with the weightage as **Project Report: 50 marks, Project Presentation: 25 marks and Question & Answer Session: 25 marks**. Marks awarded for Project Report is same for all batch-mates.		

Course Outcomes: At the end of the course the student will be able to :	
22AIM75.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
22AIM75.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
22AIM75.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
22AIM75.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
22AIM75.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.
22AIM75.6	Exhibit strong written and oral communication skills by preparing technical reports, project documentation, and delivering persuasive project presentations.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22AIM75.1	2	3	-	-	1	-	-	-	-	-	-	-	-
22AIM75.2	-	-	3	-	-	2	1	-	-	-	-	-	-
22AIM75.3	1	2	-	3	-	-	-	-	-	-	-	-	-
22AIM75.4	-	-	-	-	-	1	-	-	3	2	2	-	-
22AIM75.5	-	-	1	-	-	-	2	3	-	-	-	-	-
22AIM75.6	-	-	-	-	-	-	-	-	-	3	2	-	-

1: Low 2: Medium 3: High

VIII Semester

Professional Elective – IV (Online Course)			
Course Code	**22AIM81**	CIE Marks	50 *
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50 *
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE	3 Hrs
Total Hours	36 hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Understand and apply foundational concepts and principles of the chosen elective domain to real-world engineering problems.
- Develop the ability to learn independently and navigate MOOC platforms effectively to acquire domain-specific knowledge and skills.
- Demonstrate analytical and problem-solving abilities by engaging in course assessments, simulations, case studies, or project-based activities.
- Interpret and evaluate course content critically from multiple sources including video lectures, reading materials, and peer discussions.
- Integrate interdisciplinary knowledge gained from the MOOC into core engineering subjects for innovative applications or design thinking.
- Communicate technical ideas and solutions effectively, both in written and oral form, based on the knowledge acquired through the online course.

*Note: In case of MOOCs certificates submitted by the students, the marks/grade shall be awarded based on the percentage of marks/grade reflected in the certificates.

1. Selection of MOOCs

1.1 Accredited Platforms: Students shall select MOOCs from accredited platforms such as Coursera, edX, SWAYAM/NPTEL, Udacity, or any online learning platform recognized by the respective Engineering Department / Board of Studies (BoS). Engineering Departments with the approval of BoS shall publish a list of MOOCs courses in the beginning of every semester/academic session.

1.2 Prerequisites: Students shall ensure that he/she has completed any foundational courses or prerequisites required for the chosen MOOCs.

1.3 Relevant Courses: Students shall choose courses that are relevant to the Student's Engineering discipline and career goals. Students shall NOT opt for the course which is part of their curriculum (I to VIII semester B.E program) and Honors Degree/Minor Degree courses. In case of any overlapping in the contents of the MOOC Course with that in the curriculum or other courses, the maximum permitted overlapping in the course contents (syllabus) is 20-25%.

1.4 Credit Value: Students shall ensure that the selected MOOCs collectively account for 3 credits. Typically, a 3-credit MOOC will require around 35-40 hours of study , a 2-credit MOOC will require around 20-25 hours of study and a 1-credit MOOC will require 10-12 hours of study.

1.5 Duration of Course: A 4-weeks MOOCs is eligible for 1-credit. Students are advised to enroll for one 12-weeks MOOCs course to earn 3 credits. However, Students can also take one 8-weeks MOOCs + one 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied. The total performance in the MOOCs will be average of performances considering both MOOCs courses.

2. Approval Process

2.1 Pre-Approval: Students must seek pre-approval from the Department MOOCs Coordinator before enrolling in MOOCs.

2.2 Submission of Proposal: Students can submit a detailed proposal to Department MOOCs Coordinator including the name of the MOOCs, the platforms, course duration, credit value, and relevance to their field of study.

If a Student has already completed any MOOCs course/s from the beginning of the III semester B.E, that satisfies the criteria mentioned in the clause 1. Selection of MOOCs, such course/s can be considered by the Department for credit transfer, provided the student has NOT already claimed the benefit of completing the MOOCs under any assessment in any of the subject.

2.3 Evaluation: The Department will evaluate the proposal for relevance, academic rigor, and credit equivalence and will communicate the decision to the Students.
3. Registration and Enrollment
3.1 Official Enrollment: Students shall register for the approved MOOCs on the respective platforms. **3.2 Documentation:** Students shall keep documentation of registration and course details for future reference and provide the same when asked by the Department.
4. Course Completion
4.1 Active Participation: Students shall engage actively in all course activities including lectures, assignments, quizzes, and discussion forums. **4.2 Completion Certificate:** Students shall obtain a verified certificate of completion for MOOC Course. Free versions without certificates are NOT eligible for credit.
5. Assessment and Evaluation
5.1 Performance Tracking: Students shall maintain records of performance in all assessments throughout the course. **5.2 Final Assessment:** The Department may conduct a final assessment (proctored exam) to ensure that the knowledge gained aligns with the academic standards. This summative assessment (proctored exam) by the Engineering Department is mandatory in the absence of such assessment in the MOOC course/s by the online platform.
6. Credit Transfer
6.1 Submission of Certificates: Students shall submit the completion certificate/s and performance records to the Department MOOCs Coordinator. **6.2 Credit Evaluation:** The Department will evaluate the certificates and performance records to approve the credit transfer. **6.3 Grade Conversion:** College will take care to convert the grades from the MOOCs into the grading system as per established Academic Rules and Regulations.
7. Integration into Academic Record
7.1 Transcript Update: Upon approval, the credits and grades will be integrated into the student's academic transcript. **7.2 Grade Point Average (GPA) Calculation:** The MOOC grades are included in the calculation of the student's GPA.
8. Support and Resources
8.1 Academic Advising: The Department MOOCs Coordinator shall provide guidance and support to the students throughout the process. **8. 2 Technical Support:** The Department MOOCs Coordinator shall ensure that students have access to the necessary technical resources to complete MOOCs courses.
9. Feedback and Improvement
9.1 Student Feedback: Department MOOCs Coordinator shall collect feedback from students on their MOOC experiences to improve future implementations. **9.2 Continuous Improvement:** MOOCs guidelines and processes will be updated based on student feedback, Department feedback and evolving educational standards.

Course Outcomes: At the end of the course the student will be able to :	
22AIM81.1	Demonstrate comprehensive understanding of the key concepts, tools, and techniques in the chosen elective domain.
22AIM81.2	Apply the acquired knowledge to solve domain-specific engineering problems using appropriate methods and tools.
22AIM81.3	Analyze and interpret information from MOOC resources to support decision-making and problem-solving.
22AIM81.4	Exhibit self-directed learning skills and effective time management to complete the MOOC as per defined timelines.

22AIM81.5	Collaborate and communicate effectively in online learning environments through discussions, peer reviews, and group tasks (if applicable).
22AIM81.6	Integrate the knowledge gained from the MOOC into interdisciplinary engineering contexts and reflect on its professional relevance.

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22AIM81.1	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM81.2	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
22AIM81.3	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
22AIM81.4	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
22AIM81.5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**
22AIM81.6	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1: Low 2: Medium 3: High

Open Elective – II (Online Course)			
Course Code	**22AIM82**	CIE Marks	50*
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50*
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE	3 Hrs
Total Hours	36 hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Gain foundational and interdisciplinary knowledge in a subject outside the core engineering specialization to promote broader intellectual development.
- Understand key theories, models, and practices related to the open elective topic, as delivered through MOOC lectures, readings, and assessments.
- Develop the ability to learn independently and manage learning schedules, leveraging the flexibility of the MOOC platform.
- Apply the acquired knowledge to real-world contexts, demonstrating the relevance of interdisciplinary learning to personal, professional, or societal challenges.
- Enhance digital learning competencies, including navigating online resources, participating in online discussions, and completing online assessments effectively.
- Foster critical thinking, creativity, and lifelong learning mindset by exploring new domains and expanding personal and professional interests.

*Note: In case of MOOCs certificates submitted by the students, the marks/grade shall be awarded based on the percentage of marks/grade reflected in the certificates.

1. Selection of MOOCs

1.1 Accredited Platforms: Students shall select MOOCs from accredited platforms such as Coursera, edX, SWAYAM/NPTEL, Udacity, or any online learning platform recognized by the respective Engineering Department / Board of Studies (BoS). Engineering Departments with the approval of BoS shall publish a list of MOOCs courses in the beginning of every semester.

1.2 Prerequisites: Students shall ensure that he/she has completed any foundational courses or prerequisites required for the chosen MOOCs.

1.3 Relevant Courses: Students shall choose courses that are relevant to the Student's Engineering discipline and career goals. Students shall NOT opt for the course which is part of their curriculum (I to VIII semester B.E program) and Honors Degree/Minor Degree courses. In case of any overlapping in the contents of the MOOC Course with that in the curriculum or other courses, the maximum permitted overlapping in the course contents (syllabus) is 20-25%.

1.4 Credit Value: Students shall ensure that the selected MOOCs collectively account for 3 credits. Typically, a 3-credit MOOC will require around 35-40 hours of study , a 2-credit MOOC will require around 20-25 hours of study and a 1-credit MOOC will require 10-12 hours of study.

1.5 Duration of Course: A 4-weeks MOOCs is eligible for 1-credit. Students are advised to enroll for one 12-weeks MOOCs course to earn 3 credits. However, Students can also take one 8-weeks MOOCs + one 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied. The total performance in the MOOCs will be average of performances considering both MOOCs courses.

2. Approval Process

2.1 Pre-Approval: Students must seek pre-approval from the Department MOOCs Coordinator before enrolling in MOOCs.

2.2 Submission of Proposal: Students can submit a detailed proposal to Department MOOCs Coordinator including the name of the MOOCs, the platforms, course duration, credit value, and relevance to their field of study.

If a Student has already completed any MOOCs course/s from the beginning of the III semester B.E, that satisfies the criteria mentioned in the clause 1. Selection of MOOCs, such course/s can be considered by the Department for credit transfer, provided the student has NOT already claimed the benefit of completing the MOOCs under any assessment in any of the subject.

2.3 Evaluation: The Department will evaluate the proposal for relevance, academic rigor, and credit equivalence and will communicate the decision to the Students.
3. Registration and Enrollment
3.1 Official Enrollment: Students shall register for the approved MOOCs on the respective platforms. **3.2 Documentation:** Students shall keep documentation of registration and course details for future reference and provide the same when asked by the Department.
4. Course Completion
4.1 Active Participation: Students shall engage actively in all course activities including lectures, assignments, quizzes, and discussion forums. **4.2 Completion Certificate:** Students shall obtain a verified certificate of completion for MOOC Course. Free versions without certificates are NOT eligible for credit.
5. Assessment and Evaluation
5.1 Performance Tracking: Students shall maintain records of performance in all assessments throughout the course. **5.2 Final Assessment:** The Department may conduct a final assessment (proctored exam) to ensure that the knowledge gained aligns with the academic standards. This summative assessment (proctored exam) by the Engineering Department is mandatory in the absence of such assessment in the MOOC course/s by the online platform.
6. Credit Transfer
6.1 Submission of Certificates: Students shall submit the completion certificate/s and performance records to the Department MOOCs Coordinator. **6.2 Credit Evaluation:** The Department will evaluate the certificates and performance records to approve the credit transfer. **6.3 Grade Conversion:** College will take care to convert the grades from the MOOCs into the grading system as per established Academic Rules and Regulations.
7. Integration into Academic Record
7.1 Transcript Update: Upon approval, the credits and grades will be integrated into the student's academic transcript. **7.2 Grade Point Average (GPA) Calculation:** The MOOC grades are included in the calculation of the student's GPA.
8. Support and Resources
8.1 Academic Advising: The Department MOOCs Coordinator shall provide guidance and support to the students throughout the process. **8. 2 Technical Support:** The Department MOOCs Coordinator shall ensure that students have access to the necessary technical resources to complete MOOCs courses.
9. Feedback and Improvement
9.1 Student Feedback: Department MOOCs Coordinator shall collect feedback from students on their MOOC experiences to improve future implementations. **9.2 Continuous Improvement:** MOOCs guidelines and processes will be updated based on student feedback, Department feedback and evolving educational standards.

Course Outcomes: At the end of the course the student will be able to :	
22AIM82.1	Demonstrate a clear understanding of the fundamental concepts and frameworks in the selected open elective domain.
22AIM82.2	Apply interdisciplinary knowledge gained from the MOOC to analyze and address real-life or cross-domain problems.
22AIM82.3	Exhibit the ability to learn independently, manage time effectively, and complete the online course requirements within the stipulated duration.
22AIM82.4	Interpret and evaluate information from diverse MOOC resources (videos, readings, forums) to support critical analysis and decision-making.

22AIM82.5	Communicate insights, reflections, and applications of the course content effectively in written or multimedia formats.
22AIM82.6	Integrate the learning from the MOOC to enhance personal, academic, or professional development beyond the engineering curriculum.

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22AIM82.1	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
22AIM82.2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
22AIM82.3	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
22AIM82.4	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
22AIM82.5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**
22AIM82.6	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**22AIM83**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	14-16 Weeks	SEE	3 Hours
		Credits	10

Research Internship

Course Learning Objectives:

1. To equip students with the knowledge of fundamental research principles, methodologies, and techniques applicable to their engineering discipline.
2. To enable students to formulate research questions, design experiments or studies, and use appropriate data collection and analysis tools.
3. To foster the ability to think critically and innovatively while solving complex engineering problems during the research process.
4. To guide students in developing the skills necessary for writing clear and well-structured research reports, papers, and presentations.
5. To instill an understanding of ethical practices in research, including integrity, responsible data handling, and respect for intellectual property.
6. To prepare students to work effectively in research teams, communicate their ideas clearly, and present their findings to both technical and non-technical audiences.

Pre-Internship Preparation

1. **Orientation Session:** Attend an orientation session with the academic mentor (allotted from the Department) and the Research Supervisor to understand the research goals, expectations, and assessment criteria.
2. **Documentation:** Complete necessary documentation, including the approval from the Department, processing of the internship request application, research agreements and confidentiality agreements, if applicable.
3. **Research Proposal:** Develop a research proposal in consultation with the Research Supervisor and academic mentor outlining the objectives, methodology, and expected outcomes.

During the Internship

1. **Work Plan:** Follow a structured research plan provided by the supervising researcher or mentor.
2. **Literature Review:** Conduct a comprehensive literature review to understand the current state of research in the chosen area.
3. **Regular Meetings:** Participate in regular meetings with academic and research mentors to discuss progress, challenges, and next steps.
4. **Lab Work/Field Work:** Engage in experimental work, simulations, or field studies as required by the research project.
5. **Data Collection and Analysis:** Collect, analyze, and interpret data using appropriate tools and techniques.
6. **Documentation:** Maintain detailed records of research activities, experiments, and findings.

Deliverables

1. **Weekly Reports:** Submit weekly progress reports to academic and research mentors.
2. **Monthly Reports:** Submit monthly progress reports to academic and research mentors.
3. **Mid-Term Review:** Participate in a mid-term review meeting to assess progress and realign research goals if necessary.
4. **Report and Research Paper:** Prepare a draft report and a research paper detailing the research problem, methodology, results and discussions, and conclusions.
5. **Presentation:** Deliver a presentation summarizing the research work to faculty, peers, and other stakeholders upon completion of the internship.

Assessment Criteria
1. **Research Quality:** Evaluate the quality and rigor of the research conducted. 2. **Report Quality:** Assess the clarity, organization, and thoroughness of the report and the research paper. 3. **Presentation:** Evaluate the effectiveness and clarity of the final presentation. 4. **Innovation and Creativity:** Consider the originality and innovative aspects of the research. 5. **Self-Reflection:** Review the student's ability to critically reflect on their research experience and identify areas for future growth.
Post-Internship
1. **Feedback Session:** Attend a feedback session with academic mentors to discuss the research experience and areas of improvement. 2. **Publication:** Explore opportunities to publish the research findings in academic journals or conferences. 3. **Networking:** Maintain professional relationships established during the internship for future research collaborations.
Additional Tips
• **Curiosity:** Cultivate a curious mindset and a willingness to explore new ideas. • **Collaboration:** Work collaboratively with other researchers and team members. • **Adaptability:** Be open to modifying research approaches based on findings and feedback. • **Communication:** Develop strong written and oral communication skills to effectively present research findings. • **Time Management:** Prioritize tasks and manage time efficiently to meet research deadlines.

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (Only OFFLINE)	Will be conducted during the 7th semester BE. Students shall submit the Research Internship Proposal and make a presentation and answer questions raised by the Departmental Internship Evaluation Committee (DIEC). Marks split-up: Research Internship Proposal – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): II (ONLINE/OFFLINE)	Will be conducted during the middle of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on progress done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): III (Only OFFLINE)	Will be conducted at the end of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final internship report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
CIE Marks (Max 100)	Average of the CIE:I , CIE-II and CIE:III marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.

Course Outcomes: At the end of the course the student will be able to:	
22AIM83.1	Apply appropriate research methodologies and tools to design and conduct experiments, analyze data, and draw conclusions.
22AIM83.2	Demonstrate the ability to identify and solve complex engineering problems through innovative and systematic research approaches.
22AIM83.3	Acquire proficiency in using advanced technologies, tools, and techniques relevant to their field of research.
22AIM83.4	Develop skills in writing comprehensive research reports, documentation, and effectively presenting research findings.
22AIM83.5	Understand and apply ethical standards in research, including plagiarism avoidance, proper citations, and data integrity.
22AIM83.6	Gain experience in working collaboratively within a research team and contributing effectively to the shared goals of the project.

References

1. AICTE Internship Policy : Guidelines and Procedures 2019.
Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

2. UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.
Available at https://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf

3. VTU Mandatory Internship Guidelines 2021.
Available at https://vtu.ac.in/pdf/regulations2021/anex4.pdf

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22AIM83.1	**1**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM83.2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22AIM83.3	**-**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
22AIM83.4	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**
22AIM83.5	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**1**	**-**	**-**
22AIM83.6	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**-**	**-**

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**22AIM83**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	14-16 Weeks	SEE	3 Hours
		Credits	10

Industry Internship

Course Learning Objectives:

1. To develop practical engineering skills through hands-on experience in a real-world industrial environment.
2. To enhance the ability to identify, analyze, and solve complex engineering problems encountered during the internship.
3. To gain an understanding of the functioning of the industry, including exposure to its standards, practices, and emerging technologies.
4. To improve communication, collaboration, and teamwork skills by working with professionals in a multidisciplinary team setting.
5. To foster adaptability by learning to work in dynamic and fast-paced industrial environments while embracing lifelong learning.
6. To instill a sense of professional ethics, responsibility, and accountability in engineering practice by adhering to industry-specific codes of conduct.

Pre-Internship Preparation

1. **Orientation Session:** Attend an orientation session with the academic mentor (allotted from the Department) to understand the internship goals, expectations, and assessment criteria.
2. **Documentation:** Complete necessary documentation, including the approval from the Department, processing of the internship request application, internship agreements if applicable etc.
3. **Goal Setting:** Define specific, measurable, achievable, relevant, and time-bound (SMART) goals in consultation with academic and industry mentors.

During the Internship

1. **Work Plan:** Follow a structured work plan provided by the host organization.
2. **Mentorship:** Regularly meet with assigned industry and academic mentors to review progress and seek guidance.
3. **Work Diary/Daily Report/Learning Diary:** Maintain a diary/logbook documenting daily activities, learnings, challenges, and reflections.
4. **Professional Conduct:** Adhere to the professional and ethical standards of the host organization, including dress code, punctuality, and communication protocols.
5. **Skill Application:** Actively participate in projects and tasks assigned, applying theoretical knowledge to practical situations.

Deliverables

1. **Weekly Reports:** Submit the weekly progress reports to academic and industry mentors.
2. **Monthly Reports:** Submit the monthly progress reports to academic and industry mentors.
3. **Mid-Term Review/Evaluation:** Participate in a mid-term review meeting/evaluation to assess progress and realign goals if necessary.
4. **Final Report:** Prepare a comprehensive final report in the specified format detailing the projects undertaken, skills acquired, challenges faced, and overall learning experience.
5. **Presentation:** Deliver a presentation summarizing the internship experience to faculty evaluators and peers upon completion of the internship.

Assessment Criteria

1. **Performance Evaluation:** Receive feedback from the industry mentor based on work performance, technical skills, and professional behaviour.

2. **Report Quality:** Evaluate the quality, clarity, and comprehensiveness of the final report. 3. **Presentation:** Assess the effectiveness and clarity of the final presentation. 4. **Self-Reflection:** Review the student's ability to critically reflect on their learning experience and identify areas for future growth.
Post-Internship
1. **Feedback Session:** Attend a feedback session with academic mentors to discuss the internship experience and areas of improvement. 2. **Certification:** Obtain an internship completion certificate from the host organization. 3. **Networking:** Maintain professional relationships established during the internship for future opportunities.
Additional Tips
• **Professionalism:** Demonstrate a professional attitude and work ethic at all times. • **Adaptability:** Be open to learning and adapting to new environments and technologies. • **Communication:** Develop strong communication skills to effectively collaborate with colleagues and mentors. • **Time Management:** Prioritize tasks and manage time efficiently to meet deadlines.

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (ONLINE/OFFLINE)	Will be conducted during the middle of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on work done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
Continuous Internal Evaluation (CIE): II (Only OFFLINE)	Will be conducted at the end of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
CIE Marks (Max 100)	Average of the CIE:I and CIE:II marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.

Course Outcomes: At the end of the course the student will be able to:	
22AIM83.1	Apply engineering concepts and theoretical knowledge to solve real-world industry problems.
22AIM83.2	Enhance their problem-solving abilities by identifying, analyzing, and providing innovative solutions to engineering challenges in the industry.
22AIM83.3	Develop key professional skills such as teamwork, communication, and time management in a corporate or industrial environment.
22AIM83.4	Gain exposure to industry-standard tools, technologies, methodologies, and regulatory standards relevant to their field of study.
22AIM83.5	Demonstrate understanding and adherence to professional ethics, safety regulations, and responsibilities in an industrial setting.
22AIM83.6	Build a network of industry professionals and gain insights into career opportunities, preparing them for future employment in the engineering sector.

References
1. AICTE Internship Policy : Guidelines and Procedures 2019. Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf **2. UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.** Available at https://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf **3. VTU Mandatory Internship Guidelines 2021.** Available at https://vtu.ac.in/pdf/regulations2021/anex4.pdf

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22AIM83.1	3	2	-	-	-	1	-	-	-	-	1	-	-
22AIM83.2	-	3	2	1	-	-	-	-	-	-	1	-	-
22AIM83.3	-	-	-	-	-	-	-	-	3	2	-	-	-
22AIM83.4	-	-	-	-	3	2	-	-	-	-	1	-	-
22AIM83.5	-	-	-	-	-	2	-	3	-	-	-	-	-
22AIM83.6	-	-	-	-	-	-	-	-	2	3	1	-	-

1: Low 2: Medium 3: High

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Core Values of the Institution

SERVICE

A Josephite will keep service as the prime goal in everything that is undertaken. Meeting the needs of the stakeholders will be the prime focus of all our endeavors.

EXCELLENCE

A Josephite will not only endeavor to serve, but serve with excellence. Preparing rigorously to excel in whatever we do will be our hallmark.

ACCOUNTABILITY

Every member of the SJEC Family will be guided to deliver on assurances given within the constraints set. A Josephite will always keep budgets and deadlines in mind when delivering a service.

CONTINUOUS ADAPTATION

Every member of the SJEC Family will strive to provide reliable and continuous service by adapting to the changing environment.

COLLABORATION

A Josephite will always seek to collaborate with others and be a team-player in the service of the stakeholders.

Objectives

- Provide Quality Technical Education facilities to every student admitted to the College and facilitate the development of all round personality of the students.
- Provide most competent staff and excellent support facilities like laboratory, library and internet required for good education on a continuous basis.
- Encourage organizing and participation of staff and students in in-house and outside Training programmes, seminars, conferences and workshops on continuous basis.
- Provide incentives and encouragement to motivate staff and students to actively involve in research-innovative projects in collaboration with industry and R &D centres on continuous basis
- Invite more and more number of persons from industry from India and abroad for collaboration and promote Industry-Institute Partnership.
- Encourage consultancy and testing and respond to the needs of the immediate neighbourhood.

St Joseph Engineering College

AN AUTONOMOUS INSTITUTION

Affiliated to VTU, Belagavi | Recognised by AICTE, New Delhi
Accredited by NAAC with A+ Grade
B.E. (ECE, EEE, ME, CIV), MBA & MCA Accredited by NBA, New Delhi

Vamanjoor, Mangaluru - 575 028, Karnataka, India
Ph: 91-824-2868100 / 2263753 / 54 / 55
E-mail: sjec@sjec.ac.in| Website: www.sjec.ac.in