

Government College of Engineering, Karad					
Second Year (Sem – III) B. Tech. Civil Engineering					
IOE3345: Open Elective- I- Material Management with SAP S/4HANA					
Teaching Scheme		Examination Scheme			
Lectures	03 Hrs/week	ISE	50		
Tutorials	00 Hrs/week	ESE	50		
Total Credits	03				
		Duration of ESE	As applicable		
Prerequisite :					
Course Outcomes (CO):Students will be able to					
CO1	Demonstrate proficiency in navigating the SAP S/4HANA interface and understanding the fundamental architecture of the Materials Management (MM) module.				
CO2	Describe and configure procurement processes, including enterprise structure, source determination, and document release procedures within the SAP MM environment.				
CO3	Execute core procurement operations such as creating purchase requisitions, purchase orders, goods receipts, and invoice verifications using standard and advanced transactions.				
CO4	Manage and customize master data related to materials, business partners, purchasing info records, and organizational units essential for MM operations.				
CO5	Implement specific procurement processes including self-service requisitioning, invoicing plans, blanket purchase orders, and flexible workflow configuration for document release.				
	Course Contents			CO	Hours
Unit 1	Navigation in SAP S/4HANA: Getting an Overview of SAP S/4HANA, Navigation Processes and Enterprise Structure in Procurement: Delineating Procurement Processes, Identifying the Organizational Units in Procurement			CO1, CO 2	(4)
Unit 2	Plain Procurement Process: Creating a Purchase Order, Posting a Goods Receipt, Entering an Invoice Master Data in Procurement: Maintaining Business Partner Master Data, Maintaining Material Master Data, Maintaining Purchasing Info Record, Analyzing Material Valuation			CO3, CO4	(5)
Unit 3	Stock Material Compared with Consumable Material: Comparing Procurement Processes for Stock and Consumption, Creating a Purchase Requisition, Creating a Purchase Order with Reference to a Purchase Requisition, Entering Valuated and Non-Valuated Goods Receipts. Advanced Transactions in Procurement: Maintaining a Purchasing Contract, Creating a Purchase Requisition with Source Determination, Using Advanced Transactions for Purchase Order Creation, Using the Advanced Transaction for Goods Receipt, Using the Advanced Transaction for Invoice Verification			CO3	(6)
Unit 4	Customizing of Organizational Units: Defining Organizational Units in Materials Management, Defining and Assigning Plants Purchasing Master Data: Extending Material Master Records, Creating Business Partners, Using Partner Functions in Purchasing			CO4	(5)
Unit 5	Sources of Supply and Conditions: Creating Purchasing Info Records, Creating Special Info Records, Using Special Functions in Info Records, Creating Contracts, Creating Contracts for Material Groups, Creating Scheduling Agreements Without Release Documentation Source Determination: Controlling Source Determination with Source Lists, Maintaining Source Lists, Controlling Source Determination with Quota Arrangements, Executing the Planning Run with Quota Arrangements, Identifying Additional Aspects of Source Determination, Blocking Sources of Supply			CO2	(6)
Unit 6	Optimized Purchasing: Processing Unassigned Purchase Requisitions, Processing Assigned Purchase Requisitions, Monitoring Purchase Orders Special User Parameters for Purchasing:			CO2, CO3	(5)

Analyzing Special Aspects in Customizing, Defining Function Authorizations for Buyers			
Unit 7	Document Release Procedure: Releasing Purchase Requisitions, Releasing Purchasing Documents, Configuring Release Procedures in Customizing, Creating Release Procedures, Setting Up Flexible Workflows in Purchasing. Self-Service Requisition: Performing a Self-Service Process, Confirming a Goods Receipt	CO5	(5)
Unit 8	Specific Procurement Processes: Using Invoicing Plans, Creating Blanket Purchase Orders	CO5	(4)
Text Books			
1.	SAP MM (Covers SAP ECC 6.0) Black Book Author: Kogent Learning Solutions Inc. Publisher: Dreamtech Press ISBN: 9788177223804 Edition: Latest		
2.	SAP MM Purchasing: Technical Reference and Learning Guide Author: P.K. Agrawal Publisher: PHI Learning Pvt. Ltd. ISBN: 9788120348516 Edition: Latest		
3.	SAP Materials Management (with CD-ROM) Author: Mukesh Shukla Publisher: Tata McGraw-Hill Education ISBN: 9781259028390 Edition: 2nd Edition		
Reference Books			
1.	Materials Management with SAP S/4HANA Author: Jawad Akhtar Publisher: SAP Press ISBN: 9781493225385 Edition: 3rd Edition, 2024		
Useful Links			
1.	https://www.guru99.com/sap-materials-management.html		
2.	https://www.tutorialspoint.com/sap_mm/index.htm		
3.	https://learning.sap.com/ (Free Learning Journeys for SAP S/4HANA MM)		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	–	–	3	–	–	–	1	2	1	2
CO 2	2	2	3	–	3	–	–	–	1	2	2	2
CO 3	2	2	3	–	3	–	–	–	1	2	2	2
CO 4	2	2	3	–	3	–	–	–	1	2	2	2
CO 5	2	2	3	–	3	–	–	–	2	2	3	3

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	8	8
Understand	8	8
Apply	8	8
Analyse	8	8
Evaluate	8	8
Create	10	10
TOTAL	50	50


BOS Chairman

Dept. of Electronics and Telecommunication

Government College of Engineering, Karad				
Second Year (Sem – III) B. Tech. Civil Engineering				
IOE3346 : OE I Lab- Material Management with SAP S/4HANA LAB				
Laboratory Scheme:			Examination Scheme:	
Practical	2 Hrs/week		ISE	25
Total Credits	1		ESE	25
Prerequisite :				
Course Outcomes (CO): Students will be able to				
CO1	Demonstrate the ability to navigate the SAP S/4HANA environment and understand the structure of procurement-related organizational units.			
CO2	Apply core procurement processes such as purchase requisition, purchase order creation, goods receipt, and invoice verification using SAP MM transactions.			
CO3	Manage and customize SAP MM master data including material masters, business partners, and info records, and extend organizational structures as required.			
CO4	Analyze and configure advanced procurement features such as source determination, purchasing contracts, and optimization of procurement operations.			
Course Contents				CO
Experiment 1	Explore SAP S/4HANA GUI and Fiori Interface Log in to SAP S/4HANA and list the key navigation features in SAP MM. Compare SAP GUI with Fiori. Submit screenshots and descriptions of navigation paths.			CO1
Experiment 2	Define and Explain the Enterprise Structure in SAP MM Identify and describe each organizational unit in procurement (Company Code, Plant, Purchasing Org, and Storage Location). Create a hierarchical chart and explain its role.			CO1
Experiment 3	Simulate a Simple Procurement Cycle Using SAP or simulation software, create a purchase order, post a goods receipt, and enter an invoice. Document each step with screenshots and explanations.			CO2
Experiment 4	Analyse Material and Business Partner Master Data Create a new material and vendor in the system. Explain key fields such as material type, industry sector, account group, etc. Include screenshots.			CO3
Experiment 5	Compare Procurement Processes: Stock vs Consumables Prepare a report comparing procurement workflows for stock materials and consumable materials, including implications on inventory and accounting.			CO2
Experiment 6	Create Purchase Requisition with Source Determination Use source list/quota arrangements to auto-determine the vendor during PR creation. Show transaction flow with screenshots.			CO2, CO4
Experiment 7	Advanced Goods Receipt and Invoice Posting Perform goods receipt using MIGO and invoice verification using MIRO. Explain key fields and accounting impact			CO2
Experiment 8	Define and Assign Organizational Units in SAP MM Configure a company code, plant, purchasing org, and assign them in IMG. Submit step-by-step configuration notes and screenshots.			CO3
Experiment 9	Extend Material Master for New Plant and Purchasing View Use MM01 or MM02 to extend an existing material master to a new plant and add purchasing-specific data. Highlight the differences.			CO3
Experiment 10	Create and Use Info Records and Contracts Create a purchasing info record and outline how it links to PO creation. Also, create a contract and release PO against it.			CO3, CO4
Experiment 11	Configure and Analyze Source Determination Create and maintain a source list and quota arrangement. Explain how the system selects vendors during PR to PO conversion.			CO4
Experiment 12	Process and Monitor Purchase Requisitions Create unassigned and assigned PRs. Process them into POs and monitor the status using ME5A or ME2N. Interpret outputs and explain their importance in procurement tracking.			CO2, CO4

List of Submission:	
1.	Minimum number of Experiments : 10

Mapping of COs and POs

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

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	05	05	
ISE	25	25	25	25	25	25	25	25	25	25	25	25	


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Dept. of Electronics and Telecommunication

Government College of Engineering, Karad					
Second Year (Sem – IV) B. Tech. Civil Engineering					
IOE3447: OE II- SAP HANA					
Teaching Scheme		Examination Scheme			
Lectures	02 Hrs/week	ISE	50		
Tutorials	00 Hrs/week	ESE	50		
Total Credits	02				
		Duration of ESE	As applicable		
Prerequisite :					
Course Outcomes (CO):Students will be able to					
CO1	Analyze procurement reporting and analytical tools in SAP S/4HANA and customize purchasing configurations to enhance procurement operations.				
CO2	Apply core inventory management processes such as goods receipts, goods issues, transfer postings, stock transfers, and physical inventory procedures.				
CO3	Customize inventory and supplier master data, movement types, and valuation settings for effective inventory and procurement control.				
CO4	Perform and configure invoice processing scenarios including taxes, delivery costs, evaluated receipt settlement, and GR/IR account maintenance.				
	Course Contents			CO	Hours
Unit 1	Reporting and Analytics: Using Analytical Apps, Using the Procurement Overview App Further Customizing for Purchasing: Creating Document Types in Purchasing, Adjusting the Screen Layout of Purchasing Documents, Creating Account Assignment Categories, Controlling the Output of Messages in Purchasing, Using Condition Technique for Message Determination, Explaining the SAP S/4 HANA Output Management.			CO1	(06)
Unit 2	Introduction to Inventory Management: Defining Inventory Management and Physical Inventory, Moving Goods with the MIGO Transaction Goods Receipts (GRs): Posting a Goods Receipt Without Reference, Posting a Goods Receipt with Reference, Posting a Goods Receipt with Automatic Generation of a Purchase Order, Posting Cancellations, Return Deliveries, and Returns, Applying Order Price Unit in Inventory Management, Applying Tolerances and the Delivery Completed Indicator, Setting Up Date Checks to Goods Receipt for Purchase Order			CO2	(06)
Unit 3	Stock Transfers and Transfer Postings: Performing Transfer Postings, Performing Stock Transfers Between Storage Locations, Performing Stock Transfers Between Plants Reservations: Creating Manual Reservations, Evaluating Reservations			CO2	(04)
Unit 4	Goods Issues (GIs): Posting Unplanned Goods Issues, Posting a Goods Issue with Reference, Configuring Stock Determination Special Procurement Processes: Performing the Process of Subcontracting, Performing the Process of Vendor Consignment,			CO2	(05)
Unit 5	Physical Inventory: Conducting Physical Inventory, Simplifying Physical Inventory Analyses: Applying Stock Lists and Document Lists, Applying Periodic Processing, Using Analytical Apps for Inventory Management			CO1, CO2	(04)
Unit 6	Further Customizing for Inventory Management: Implementing Settings for Documents, Setting Up Movement Types, Applying Other Customizing Settings. Customizing for Supplier Master Data: Defining Settings for Business Partners			CO3	(04)
Unit 7	Invoice Entry:			CO4	(6)

	Working with Logistics Invoice Verification, Using Different Types of Invoice Verification, Parking of Documents, Applying Taxes, Applying Cash Discounts, Entering Invoices in Foreign Currencies, Creating Invoices for Purchase Orders with Account Assignment Subsequent Debit/Credit, Delivery Costs, and Credit Memos: Entering Subsequent Debits/Credits, Entering Delivery Costs, Entering Invoices Without Reference to a Purchase Order, Handling Credit Memos and Reversals, Evaluated Receipt Settlement (ERS), Performing Evaluated Receipt Settlement, GR/IR Account Maintenance, Performing GR/IR Account Maintenance		
Unit 8	Customizing for Material Master Data: Setting Up Material Master Records, Creating Material Types, Setting Up Field Selection for Material Master Records, Defining Field References for Material Master Records Special Features of Material Valuation: Posting Goods Movements for Material Types UNBW and NLAG, Configuring Split Valuation	CO3	(5)
Text Books			
1.	SAP MM Purchasing: Technical Reference and Learning Guide Author: P. K. Agrawal Publisher: PHI Learning, ISBN- 9788120348516, Edition: 1st Edition		
2.	Materials Management with SAP S/4HANA Author: Jawad Akhtar Publisher: SAP Press, ISBN- 9781493225385, Edition: 3rd Edition		
3.	SAP MM: Functionality and Technical Configuration Author: Martin Murray Publisher: SAP Press, ISBN- 9781592291342, Edition: 1st Edition		
Reference Books			
1.	SAP Purchasing and Procurement with SAP MM: Business User Guide, Author: Matt Chudy and Luis Castedo, Publisher: SAP Press, ISBN- 9781493215171, Edition: 2nd Edition		
Useful Links			
1.	https://fioriappslibrary.hana.ondemand.com		
2.	https://www.sapnuts.com/tutorials/sap-migo.html		
3.	https://www.erpgreat.com/materials/stock-transfer-and-transfer-postings.htm		
4.	https://www.erpfuction.com/inventory-reports-in-sap-mm/		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	3	1	3	–	–	–	1	2	2	2
CO 2	2	2	3	–	3	–	–	–	1	2	2	2
CO 3	2	2	3	–	3	–	–	–	1	2	2	2
CO 4	2	2	3	1	3	–	–	1	1	2	2	2

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	8	8
Understand	8	8
Apply	8	8
Analyse	8	8
Evaluate	8	8
Create	10	10
TOTAL	50	50


BOS Chairman

Dept. of Electronics and Telecommunication

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	8	8
Understand	8	8
Apply	8	8
Analyse	8	8
Evaluate	8	8
Create	10	10
TOTAL	50	50



BOS Chairman

Dept. of Electronics and Telecommunication

Government College of Engineering, Karad					
Third Year (Sem – V) B. Tech. Civil Engineering					
IOE3544: OE III- SAP PEOJECT					
Teaching Scheme			Examination Scheme		
Lectures	02 Hrs/week		ISE	50	
Tutorials	00 Hrs/week		ESE	50	
Total Credits	02				
			Duration of ESE	As applicable	
Prerequisite :					
Course Outcomes (CO): Students will be able to					
CO1	Perform detail literature survey on the research topic of work.				
CO2	Carry out detailed mathematical modelling or experimental validation.				
CO3	Draw inferences from the findings and present conclusion.				
CO4	Develop presentation and technical report writing skills.				
	Course Contents				CO
	The student shall choose any of the topics of interest for Project work using SAP. Project group shall consists of minimum THREE and maximum FIVE students. The group is required to do literature survey, formulate the problem, propose and execute methodology required for project.. - Students will prepare a technical report in prescribed format based on their work. - The assessment of the project will be done at the end of the semester by a committee consisting of three faculty members from the department along with Project Guide. - The students will present their project work before the committee. The presentation of the project shall be of 45 min followed by viva voce. - The project guide will award the marks to the individual student depending on the group average awarded by the committee.				CO 1, CO 2, CO 3, CO 4
	Submission: Project report in standard format.				

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	2	3	2	2	2	1	1	-	2	-	3
CO 2	3	3	3	3	3	1	1	-	2	1	3
CO 3	2	3	2	3	2	1	1	-	3	-	3
CO 4	1	1	1	-	1	-	-	2	3	1	3

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	9	9
Understand	9	9
Apply	9	9
Analyse	9	9
Evaluate	9	9
Create	5	5
TOTAL	50	50


BOS Chairman

Dept. of Electronics and Telecommunication

Institute Level- Industrial orientated Open Elective
OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE) AIDSML

Structure

LIST OF OE COURSES OFFERED SEMESTER WISE									
SEMESTER III									
Sr. No.	Course Code	Course	L	T	P	Credits	ISE	ESE	Total
1.	IOE3315	Open Elective I-Foundations of AI, Data Science, and Machine Learning	3	--	--	3	50	50	100
2.	IOE3316	Open Elective-01 Lab - Foundations of AI, Data Science, and Machine Learning Lab	--	--	2	1	25	25	50
SEMESTER IV									
3.	IOE3417	Open Elective II - AI in Practice: Design to Deployment	2	--	--	2	50	50	100
SEMESTER V									
4.	IOE3514	Open Elective III- AI Applications and Emerging Technologies	2	--	--	2	50	50	100
TOTAL			7	--	2	08	175	175	350

Note * The End Semester Examination (ESE) will be conducted as either theory or oral or presentation





BoS Chairman
 Dept. of Electronics and Telecommunication

Institute Level- Industrial orientated Open Elective
OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE) AIDSML

Government College of Engineering, Karad					
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIDSML					
IOE3315: Open Elective I-Foundations of AI, Data Science, and Machine Learning					
Teaching Scheme		Examination Scheme			
Lectures	03 Hrs/week	ISE	50		
Tutorials	00 Hrs/week	ESE	50		
Total Credits	03	Duration of ESE	As applicable		
Prerequisite : Mathematics, Statistics and Programming for problem solving					
Course Outcomes: Students will be able to					
CO1	Understand the fundamental principles and concepts of Artificial Intelligence (AI) and Data Science.				
CO2	Demonstrate a solid understanding of the mathematical foundations essential for AI and Machine Learning (ML).				
CO3	Apply Python programming skills to perform data manipulation and analysis.				
CO4	Employ techniques for time series analysis and demonstrate in depth understanding of Machine Learning.				
Course Contents			CO	Hours	
Unit 1	Introduction to AI & Data Science: Overview of AI and Data Science, The data science workflow, AI applications across various industries, Ethical considerations in AI and data science			CO1	(05)
Unit 2	Mathematical and Statistical Foundations for AI & ML: Linear algebra basics: vectors, matrices, and operations, Calculus essentials: derivatives and integrals, Probability and statistics for data science.			CO2	(07)
Unit 3	Programming Fundamentals for AI & Data Science Python for data manipulation, Libraries: NumPy and Pandas for data science, Data visualization with Matplotlib and Seaborn, Introduction to Scikit-learn for AI. Introduction to TensorFlow and PyTorch.			CO3	(07)
Unit 4	Data Preprocessing Techniques and Exploratory Data Analysis (EDA): Handling Missing Data, Data Cleaning and Noise Removal, Data Transformation, Encoding and Feature Engineering, Data exploration and visualization techniques			CO3	(06)
Unit 5	Time Series Analysis and Data Science Life Cycle: Time series components (trend, seasonality, noise), Moving averages, smoothing techniques, autocorrelation. Data Science Life Cycle and Overview of MLOps.			CO4	(07)
Unit 6	Fundamentals of Machine Learning: Overview and implementation basics of various machine learning. Supervised Learning: Definition, examples, and algorithms; linear regression, decision trees, SVM. Unsupervised Learning: Definition, examples, and algorithms k-means clustering, hierarchical clustering, PCA.			CO4	(07)
Text Books					
1.	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python" O'Reilly Media, 2017.				
2.	Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani - "Introduction to Statistical Learning: with Applications in R" Springer 2017.				
3	Sanjeev J. Wagh , Manisha S. Bhende, Anuradha D. Thakare "Fundamentals of Data Science, Tayler & Francis CRC press 2021.				
4	Alan Beaulieu - "Learning SQL: Generate, Manipulate, and Retrieve Data" - O'Reilly Media 2009.				
Reference Books					
1.	Joel Grus - "Data Science from Scratch: First Principles with Python" - O'Reilly Media 2015.				
2.	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media 2019.				
Useful Links					
1.	https://onlinecourses.nptel.ac.in/noc21_cs69/preview				
2.	https://onlinecourses.nptel.ac.in/noc22_cs32/preview				
3.	https://nptel.ac.in/courses/106106226/				

*Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.

Signature
HEAD

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	2	1	3	-	-	2	2	-	1
CO 2	3	3	3	3	3	2	-	2	1	-	3
CO 3	2	2	2	2	3	-	-	2	1	-	2
CO 4	3	3	3	3	2	1	2	2	3	1	3

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	5	5
Understand	5	5
Apply	15	15
Analyse	10	10
Evaluate	15	15
Create	-	-
TOTAL	50	50



Kay Gulban

HOD

Department of Information Technology
Govt. College of Engineering, KARAD

Government College of Engineering, Karad				
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIDSML				
IOE3316: Open Elective-01 Lab - Foundations of AI, Data Science, and Machine Learning Lab				
Laboratory Scheme:			Examination Scheme:	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25
Prerequisite: Mathematics, Statistics and Programming for problem solving				
Course Outcomes (CO):Students will be able to				
CO1	Understand the fundamental principles of data science, AI applications, and Python scripting.			
CO2	Apply Python programming skills to perform data manipulation, analysis, and visualization			
CO3	Demonstrate proficiency in linear algebraic computations and exploratory data Analysis			
CO4	Utilize advanced data preprocessing techniques and Time Series Analysis			
Course Contents				CO
Implementation of following concepts				
Experiment 1	Data Science Workflow: Implement a basic data science workflow using a sample dataset.			CO1
Experiment 2	AI Applications: Case study analysis of AI applications in healthcare, finance, and retail.			CO1
Experiment 3	Python Basics: Write Python scripts for basic data operations (CRUD - Create, Read, Update, Delete).			CO2
Experiment 4	NumPy: Perform array operations and linear algebraic computations using NumPy.			CO2
Experiment 5	Pandas: Data manipulation and analysis using Pandas (e.g., merging, grouping, and aggregating data).			CO2
Experiment 6	Matplotlib and Seaborn: Create various types of plots (line, bar, scatter) using Matplotlib and Seaborn.			CO2
Experiment 7	Handling Missing Values: Techniques to handle missing data (e.g., imputation, deletion).			CO3
Experiment 8	Linear Algebra: Implement matrix operations, eigenvalues, and eigenvectors using Python.			CO3
Experiment 9	End to End Data Wrangling: Scaling, Feature Engineering, Outlier Handling etc.			CO4
Experiment 10	Exploratory Data Analysis (EDA): Perform EDA on a dataset to summarize its main characteristics.			CO4
Experiment 11	Visualization: Create histograms, box plots, and pair plots to visualize data distributions.			CO4
Experiment 12	Forecasting using basic Time Series Analysis			CO4
List of Submission:				
	Minimum number of Experiments: 10			

*Note: End Sem Exam (ESE) will be conducted either practical/oral or presentation mode.

Rajeshwar
HEAD
 Department of Information Technology
 Govt. College of Engineering, KARAD

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	2	3	3	3	3	-	-	-	-	-	2
CO 2	2	2	2	2	2	-	-	2	2	2	2
CO 3	3	3	3	3	3	1	2	1	2	3	2
CO 4	2	3	2	3	2	2	2	2	2	1	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	5	5	5	5	5	5	5	5	5	5	5	5	5
Task II	10	10	10	10	10	10	10	10	10	10	10	10	10
Task III	10	10	10	10	10	10	10	10	10	10	10	10	10
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

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HEAD

Department of Information Technology
Govt. College of Engineering, KARAD

Government College of Engineering, Karad

Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- AIDSML

IOE3417: Open Elective II - AI in Practice: Design to Deployment

Teaching Scheme		Examination Scheme	
Lectures	02 Hrs/week	ISE	50
Tutorials	00 Hrs/week	ESE	50
Total Credits	02	Duration of ESE	As applicable

Prerequisite : Foundations of AI, Data Science, and Machine Learning

Course Outcomes (CO): Students will be able to

CO1	Implement supervised and unsupervised algorithms using Scikit-learn.
CO2	Enhance model performance through feature engineering and model selection.
CO3	Develop and apply CNNs and RNNs for deep learning and NLP tasks.
CO4	Utilize advanced data mining techniques for analytics and Neural Networks for Computer Vision.

Course Contents		CO	Hours
Unit 1	Supervised Machine Learning with Python: Introduction to Scikit-learn library, Implementing Supervised Learning Algorithms: Implementation of algorithms like linear regression, logistic regression, decision trees, and SVM using Scikit-learn,	CO1	(04)
Unit 2	Unsupervised Machine Learning with Python: Implementing Unsupervised Learning Algorithms: Implementation of algorithms like k-means clustering, hierarchical clustering using Scikit-learn.	CO1	(05)
Unit 3	Feature Engineering & Model Selection: Feature Extraction: Techniques for extracting features from raw data, Feature Transformation: Techniques for transforming features to improve model performance., Model Selection: Strategies for selecting the best model, cross-validation, and hyperparameter tuning.	CO2	(05)
Unit 4	Deep Learning Fundamentals: Basics of neural networks, activation functions, and architectures., Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs): Structure, applications, and implementation basics	CO3	(06)
Unit 5	Natural Language Processing (NLP): Text processing: tokenization, stemming, lemmatization, stop-word removal, vectorization methods and word embeddings, sentiment analysis.	CO3	(04)
Unit 6	Computer Vision and Advanced Data Mining Techniques: Computer Vision Fundamentals: Image processing techniques, object detection, and recognition,	CO4	(03)

Text Books

1. Ethem Alpaydin - "Introduction to Machine Learning" - MIT Press (2020)
2. Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media (2019)
3. Richard Szeliski - "Computer Vision: Algorithms and Applications" - Springer (2010)

Reference Books

1. Jiawei Han, Micheline Kamber, and Jian Pei - "Data Mining: Concepts and Techniques" - Morgan Kaufmann (2011)
2. Alice Zheng and Amanda Casari - "Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists" - O'Reilly Media (2018)
3. S. J. Wagh, Manisha S. Bhende, Anuradha D. Thakare "Fundamentals of Data Science, Tayler & Fransic CRC press 2021

Useful Links

1. <https://nptel.ac.in/courses/106102220/>
2. <https://nptel.ac.in/courses/106106145/>
3. <https://nptel.ac.in/courses/106106212/>
4. <https://nptel.ac.in/courses/106105152/>

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

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Mapping of COs and POs

Mapping Table:

PO→ CO↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	2	3	2	-	-	-	1	-	3
CO 2	2	3	2	3	3	-	-	-	2	-	2
CO 3	2	2	3	2	2	1	-	2	-	1	3
CO 4	2	3	3	3	2	1	1	2	3	1	3

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern

Knowledge Level	ISE	ESE
Remember	5	5
Understand	5	5
Apply	15	15
Analyse	15	15
Evaluate	10	10
Create	-	-
TOTAL	50	50



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Government College of Engineering, Karad

Third Year (Sem – V) OE- Institute Level- Industrial orientated Open Elective- AIDSML

IOE3514: Open Elective III- AI Applications and Emerging Technologies

Teaching Scheme		Examination Scheme	
Lectures	02 Hrs/week	ISE	50
Tutorials	00 Hrs/week	ESE	50
Total Credits	02	Duration of ESE	As applicable

Prerequisite: Advanced AI Integration

Course Outcomes (CO): Students will be able to

CO1	Utilize GANs for generating creative content and explore advanced techniques like conditional GANs.
CO2	Utilize vector databases for semantic retrieval and Analyze and use Large Language Models (LLMs) for various generative tasks
CO3	Design RAG systems to enhance LLM output with external knowledge and Apply prompt engineering techniques for task-specific responses
CO4	Implement reinforcement learning algorithms and apply them in autonomous systems.
CO5	Deploy AI on edge devices and integrate with IoT for applications in smart cities, industry, and healthcare.

Course Contents		CO	Hours
Unit 1	Generative Adversarial Networks (GANs) and Creative AI: Understanding the concept of GANs and their architecture, Applications of GANs in generating realistic images, videos, and creative content, Exploring conditional GANs and style transfer techniques, Case studies in art, design, and content creation.	CO1	(04)
Unit 2	Introduction to Generative AI: Fundamentals of Generative AI, Vector Databases, Large Language Models (LLM), Key use cases: content generation, code assistance, image synthesis	CO2	(04)
Unit 3	Generative AI: Retrieval-Augmented Generation (RAG), Prompt Engineering, Fine-Tuning of LLMs, LoRA (Low-Rank Adaptation), PEFT (Parameter-Efficient Fine-Tuning). Hugging Face Transformers. Real-world applications: chatbots, search assistants, enterprise AI	CO3	(05)
Unit 4	Reinforcement Learning and Autonomous Systems: Introduction to reinforcement learning principles, Applications of reinforcement learning in autonomous systems, Deep dive into algorithms such as Q-learning and deep Q-networks, Case studies on robotics, gaming, and control systems.	CO4	(04)
Unit 5	Edge AI and Internet of Things (IoT) Integration: Deploying AI algorithms on edge devices for real-time processing, Integration of AI with IoT ecosystems for smart applications, Use cases in smart cities, industrial IoT, and healthcare monitoring, Challenges and opportunities in edge AI and IoT convergence.	CO4	(05)
Unit 6	AI for Healthcare and Biomedical Applications: Role of AI in medical imaging analysis and diagnosis, AI-driven drug discovery and personalized medicine, Patient care management using AI-based solutions, Ethical considerations and regulatory challenges in AI-driven healthcare.	CO5	(04)

Text Books

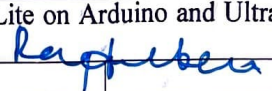
- David Foster - "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" - O'Reilly Media (2019)
- Maxim Lapan - "Deep Reinforcement Learning Hands-On" - Packt Publishing (2018)
- Bharat S. Chaudhari, Sheetal N. Ghorpade, Marco Zennaro, "TinyML for Edge Intelligence in IoT and LPWAN Networks", Elsevier, Academic Press (2024).
- Perry Lea ,IoT and Edge Computing for Architects - Second Edition Paperback – Import, 6 March 2020

Reference Books

- Peter Wittek - "Quantum Machine Learning: What Quantum Computing Means to Data Mining" - Academic Press (2016)
- S. Kevin Zhou, Hayit Greenspan, Dinggang Shen - "Deep Learning for Medical Image Analysis" - Academic Press (2017)
- Pete Warden and Daniel Situnayake - "TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers" - O'Reilly Media (2020)

Useful Links

- <https://nptel.ac.in/courses/106106139/>
- <https://nptel.ac.in/courses/106105215/>


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3.	https://nptel.ac.in/courses/106106143/
3.	https://nptel.ac.in/courses/106105158/
4.	https://nptel.ac.in/courses/106106213/

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	3	3	3	-	-	2	2	1	3
CO 2	2	3	1	2	3	-	-	3	-	3	2
CO 3	2	2	2	3	3	1	3	3	3	3	3
CO 4	2	2	3	3	3	-	1	2	3	3	3
CO 5	2	2	3	3	3	-	1	2	3	3	3

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember		
Understand	5	5
Apply	15	15
Analyse	15	15
Evaluate	15	15
Create	-	-
TOTAL	50	50



Raydubhai

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OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE)

Industry oriented Open Elective : AIOT

Structure

LIST OF OPEN ELECTIVE COURSES OFFERED SEMESTER WISE									
SEMESTER III									
Sr. No.	Course Code	Course	L	T	P	Credits	ISE	ESE	Total
1.	IOE3321	Open Elective -01 : IoT Hardware and Sensors	3	--	-	3	50	50	100
2.	IOE3322	Open Elective -01 Lab IoT Hardware and Sensors lab	--	--	2	1	25	25	50
SEMESTER IV									
3.	IOE3423	Open Elective -02 Fundamentals of AIoT	2	--	-	2	50	50	100
SEMESTER V									
4.	IOE3524	Open Elective -03 Cloud Services for IoT	2	--	-	2	50	50	100
TOTAL			7	--	2	08	175	175	350

Note * The End Semester Examination (ESE) will be conducted as either theory or oral or presentation



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Government College of Engineering, Karad						
Second Year (Sem – III) B. Tech. Information Technology						
IOE3321: Open Elective I IoT Hardware and Sensors						
Teaching Scheme		Examination Scheme				
Lectures	03 Hrs/week	ISE		50		
Tutorials	00 Hrs/week	ESE		50		
Total Credits	03	Duration of ESE		As applicable		
Prerequisite : Mathematics, Programming for problem solving/Computer fundamentals						
Course Outcomes (CO): Students will be able to						
CO1	Understand the foundational principles and hardware of IoT					
CO2	Apply IoT circuit and programming software:					
CO3	Develop AI models and integrate with IoT:					
CO4	Analyze and implement AIoT applications:					
	Course Contents				CO	Hours
Unit 1	Introduction to IoT Hardware: Overview of IoT development kits (e.g., Raspberry Pi, Arduino, ESP32) Understanding the components and capabilities of IoT hardware platforms Types of sensors (temperature, humidity, motion, light, etc.) Exploring actuators (motors, servos, relays) and their applications in IoT.				CO1	(05)
Unit 2	IoT Circuit and Programming Software: IoT Circuit Designing Software: Software with drag & drop features to build a circuit, Block Designer Software for IoT Programming, Introduction to IoT hardware components and connectivity, Simulation of IoT circuits in a virtual environment, Hands-on practice with IoT development boards and sensors				CO2	(07)
Unit 3	AI and Python Programming Software: Block Designer Software for AI Programming, Python Direct Software for Python Programming, Introduction to AI concepts and machine learning basics, Developing AI models using block-based programming, Implementing Python scripts for data analysis and AI applications, Integrating AI models with IoT devices for smart solutions.				CO3	(06)
Unit 4	Introduction to Artificial Intelligence and Internet of Things (AIoT) Overview of Artificial Intelligence (AI) and its applications across various industries. Introduction to the Internet of Things (IoT) and its significance in the modern interconnected world. Understanding the concept of Artificial Intelligence of Things (AIoT) and its potential to revolutionize technology integration.				CO4	(09)
Unit 5	Connecting Mobile Devices to IoT Gateways Exploring the role of IoT gateways in bridging the gap between mobile devices and IoT networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobile-to-IoT connections.				CO1	(06)
Unit 6	Sensor Technologies and Academic Concepts Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.				CO4	(07)
Text Books						
1.	Matt Richardson and Shawn Wallace - "Getting Started with Raspberry Pi" - O'Reilly Media - 2016					
2.	Eric Matthes - "Python Crash Course" - No Starch Press - 2019					
3.	Arshdeep Bahga and Vijay Madisetti - "Internet of Things: A Hands-On Approach" - VPT - 2014					



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Reference Books			
1.	Michael Margolis - "Arduino Cookbook" - O'Reilly Media - 2011		
2.	Patrick F. Dunn - "Fundamentals of Sensors for Engineering and Science" - CRC Press - 2010		
3.	Aurélien Geron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media – 2019		
Useful Links			
1.	https://nptel.ac.in/courses/106105195		
2.	https://www.coursera.org/learn/iot		
3.	https://www.tinkercad.com/things?type=circuits&sort=staff&view_mode=small		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	1	1	3	3	-	-	2	-	-
CO 2	2	2	2	2	3	1	-	-	3	-	3
CO 3	2	1	3	2	3	3	1	1	3	2	3
CO 4	2	2	3	3	3	2	1	-	2	1	3

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember		
Understand	10	10
Apply	15	15
Analyse	15	15
Evaluate	10	10
Create		
TOTAL	50	50




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Government College of Engineering, Karad				
Second Year (Sem – III) B. Tech. Information Technology				
IOE3322 : Open Elective -01 Lab - IoT Hardware and Sensors Lab				
Laboratory Scheme:			Examination Scheme:	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25
Prerequisite : Mathematics, Programming for problem solving				
Course Outcomes (CO):Students will be able to				
CO1	Understand IoT hardware fundamentals and development kits.			
CO2	Apply IoT circuit design and programming using software tools.			
CO3	Demonstrate proficiency in sensor technologies for IoT applications.			
CO4	Integrate AI concepts and Python programming with IoT devices for smart solutions.			
Course Contents				CO
Implementation of following concepts				
Experiment 1	Setting up Raspberry Pi for IoT applications			CO1
Experiment 2	Configuring Arduino for sensor data collection			CO1
Experiment 3	Using ESP32 for wireless communication in IoT			CO1
Experiment 4	Designing IoT circuits using drag & drop software			CO2
Experiment 5	Programming IoT devices with block-based software			CO2
Experiment 6	Measuring temperature and humidity with DHT11 sensor			CO3
Experiment 7	Detecting motion with PIR sensor			CO3
Experiment 8	Controlling LEDs with relay modules			CO3
Experiment 9	Developing AI models with block designer software			CO4
Experiment 10	Implementing Python scripts for data analysis			CO4
Experiment 11	Integrating AI models with IoT devices for smart applications			CO4
Experiment 12	Mini Project on the basis of learning			CO4
List of Submission:				
	Minimum number of Experiments : 10			

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	1	1	3	3	2	-	1	1	1
CO 2	2	3	1	2	3	-	3	-	2	2	2
CO 3	2	1	3	2	3	3	3	1	3	2	3
CO 4	2	2	2	3	3	1	2	1	3	3	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25




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Government College of Engineering, Karad					
Second Year (Sem – IV) B. Tech. Information Technology					
IOE3423: Open Elective II Fundamentals of AIoT					
Teaching Scheme			Examination Scheme		
Lectures	02 Hrs/week		ISE	50	
Tutorials	00 Hrs/week		ESE	50	
Total Credits	02		Duration of ESE	As applicable	
Prerequisite : IoT Hardware & Sensors, Programming for problem solving					
Course Outcomes (CO): Students will be able to					
CO1	Understand the concepts of AIoT and their significance in modern industries.				
CO2	Apply techniques to connect mobile devices to IoT gateways, bridging the gap between different networks.				
CO3	Analyze sensor technologies in IoT and their academic foundations to showcase practical understanding.				
CO4	Develop and Evaluate AIoT applications to address real-world challenges.				
Course Contents				CO	Hours
Unit 1	Introduction to Artificial Intelligence and Internet of Things (AIoT) Overview of Artificial Intelligence (AI) and its applications across various industries. Introduction to the Internet of Things (IoT) and its significance in the modern interconnected world. Understanding the concept of Artificial Intelligence of Things (AIoT) and its potential to revolutionize technology integration.			CO1, CO2	(04)
Unit 2	Connecting Mobile Devices to IoT Gateways Exploring the role of IoT gateways in bridging the gap between mobile devices and IoT networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobile-to-IoT connections.			CO1, CO2	(05)
Unit 3	Sensor Technologies and Academic Concepts Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.			CO3	(06)
Unit 4	AIoT Application Development Introduction to tools and platforms essential for building AIoT applications. Practical Aspects of AIoT applications, including: Smart Traffic Signal System for Color Blind Individuals Plant Health Analysis Smart Door Access Control System.			CO4	(05)
Unit 5	Unit 5: Weather Forecasting with AIoT Design and implementation of a weather forecasting system leveraging AIoT technologies. Integration of real-time weather data from sensors with AI algorithms for accurate predictions. Hands-on exercises for building, testing, and refining weather forecasting systems.			CO4	(05)
Unit 6	Unit 6: Smart Solutions Development Development and deployment of smart solutions utilizing AIoT principles. Case studies and real-world examples of successful smart solutions in various domains. Project-based learning allowing students to conceptualize, design, and implement their own AIoT solutions.			CO4	(06)
Text Books					
1.	Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Pearson Education, 2021				
2.	Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann, 2016				
3.	Michael J. McGrath, "Sensor Technologies: Healthcare, Wellness and Environmental Applications", Apress, 2013				




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Reference Books			
1.	Chandra Singh, K V S S S S Sairam, Niranjana N Chiplunkar, Rathishchandra R Gatti Create citation, "Self-Powered Aiot Systems" :Apple Academic Press 2024		
2.	Kashif Naseer Qureshi, Thomas Newe Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems, CRC Press 2024		
Useful Links			
1.	https://www.linkedin.com/learning/ai-in-connected-products-aiot		
2.	https://www.coursera.org/learn/iot		
3.	https://www.tinkercad.com/things?type=circuits&sort=staff&view_mode=small		

Mapping of COs and POs

PO→ CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1	2	1	2	2	-	-	-	-	-
CO 2	2	2	1	2	3	2	-	-	-	1	-
CO 3	3	2	3	3	3	2	2	1	1	1	1
CO 4	2	3	2	3	3	2	1	-	1	2	1

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	5	5
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	15	15
Create	-	-
TOTAL	50	50




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Dept. of Electronics and Telecommunication

Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Information Technology				
IOE3524: Open Elective III Cloud Services for IoT				
Teaching Scheme		Examination Scheme		
Lectures	02 Hrs/week	ISE	50	
Tutorials	00 Hrs/week	ESE	50	
Total Credits	02	Duration of ESE	As applicable	
Prerequisite : Fundamentals of AIoT				
Course Outcomes (CO): Students will be able to				
CO1	Understand cloud computing's benefits for IoT and grasp various cloud service models.			
CO2	Apply cloud storage solutions for IoT data storage and retrieval.			
CO3	Implement cloud compute services to deploy, manage IoT applications & its security concerns.			
CO4	Integrate AI/ML capabilities into IoT projects using cloud services and ensure cloud security and compliance for IoT data.			
Course Contents			CO	Hours
Unit 1	Introduction to Cloud Computing Overview of cloud computing and its benefits for IoT, Understanding different cloud service models (IaaS, PaaS, SaaS)		CO1	(03)
Unit 2	Cloud Storage Solutions Introduction to cloud storage services (Amazon S3, Google Cloud Storage) exercises on storing and retrieving data from cloud storage platforms.		CO2	(04)
Unit 3	Cloud Compute Services: Overview of cloud compute services (Amazon EC2, Google Compute Engine) Deploying IoT applications on cloud compute instances.		CO2	(05)
Unit 4	AI/ML Services in the Cloud: Introduction to AI/ML services provided by cloud platforms (Amazon SageMaker, Google AI Platform, Azure AI), Integrating AI/ML capabilities into IoT applications using cloud services.		CO4	(04)
Unit 5	Cloud Security and Compliance: Security best practices for cloud-based IoT solutions. Compliance requirements and regulations for IoT data stored in the cloud.		CO3	(05)
Unit 6	Project Work and Case Studies: Developing and deploying IoT applications leveraging cloud services Analyzing case studies of successful IoT projects using cloud platforms		CO3, CO4	(06)
Text Books				
1.	Buyya R, Vecchiola C, Selvi S T “Mastering Cloud Computing” , McGraw Hill Education (India), 2013			
2.	Praveen Kukreti Google Cloud Platform All-In-One Guide: Get Familiar with a Portfolio of Cloud-based Services in GCP,2023			
3.	Pawan Varma “Cloud Native Development with Azure: A practical guide to build cloud-native apps on Azure cloud platform, 2024			
Reference Books				
1.	Cloud Computing Bible, Barrie Sosinsky ,Wiley Publishing Inc. 2011			
2.	Cloud Computing from Beginning to End by Ray J Rafaels			
3.	Cloud Computing: Concepts, Technology & Architecture by Zaigham Mahmood, Ricardo Puttini, Thomas Erl			
Useful Links				
1.	https://www.udemy.com/course/exploring-aws-iot/			
2.	https://www.coursera.org/specializations/mlops-machine-learning-duke			
3.	https://learn.microsoft.com/en-us/training/paths/microsoft-azure-architect-design-prerequisites/			




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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	2	1	3	-	-	-	-	-	-
CO 2	2	2	3	2	3	1	-	-	-	-	-
CO 3	3	3	2	3	3	2	1	1	1	-	2
CO 4	2	2	2	3	3	1	1	1	1	1	1

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	5	5
Understand	10	10
Apply	15	15
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50




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OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE)

Industry orientated Open ElectivE : ARVR

Structure

LIST OF OE COURSES OFFERED SEMESTER WISE										
SEMESTER III										
Sr. No.	Course Code	Course	L	T	P	Credits	ISE	ESE	Total	
1.	IOE3331	Open Elective -01 AR/VR Application Development	3	--	--	3	50	50	100	
2.	IOE3332	Open Elective -01 Lab AR/VR Application Development lab	--	--	2	1	25	25	50	
SEMESTER IV										
3.	IOE3433	Open Elective -02 Fundamentals of Real-time Rendering	2	--	--	2	50	50	100	
SEMESTER V										
4.	IOE3534	Open Elective -03 Game Development with Unreal Engine	2	--	--	2	50	50	100	
TOTAL			7	--	2	08	175	175	350	

Note * The End Semester Examination (ESE) will be conducted as either theory or oral or presentation



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Government College of Engineering, Karad
Second Year (Sem – III) B. Tech. Information Technology
IOE3331: Open Elective I AR/VR Application Development

Teaching Scheme		Examination Scheme		
Lectures	03 Hrs/week	ISE	50	
Tutorials	00 Hrs/week	ESE	50	
Total Credits	03	Duration of ESE	As applicable	
Prerequisite : Mathematics, Programming for problem solving/Computer fundamentals				
Course Outcomes (CO): Students will be able to				
CO1	Recall fundamentals and real-time 3D content creation basics & scripting.			
CO2	Understand software interface and tools for scene creation and optimization.			
CO3	Apply 3D modeling, animation, and physics in 3d design tool.			
CO4	Analyze and optimize audio, visual effects using hardware and performance in software.			
Course Contents			CO	Hours
Unit 1	Introduction to Real-time 3D Content & Unity Game Engine: Understanding 3D content creation: The concept of real-time rendering, comparison with offline rendering, and the importance of optimization, Exploring different game engines features and capabilities, Unity components and its features.		CO1	(05)
Unit 2	Fundamentals of Unity Game Engine: Exploring Unity's interface and tools: Scene view, Game view, Hierarchy, Project, and Inspector windows, various tools Transform, Creating and organising scenes and objects in Unity from scratch, importing 3D models, textures, audio files, and other resources into Unity, and optimizing them for use in the project.		CO2	(07)
Unit 3	3D Modelling, Animation, and Physics: Basics of 3D modelling concepts, tools, and techniques. Animating objects and characters: Understanding key frame animation, skeletal animation, and animation blending. Creating animations. Introduction to Unity's physics engine and components like Rigid body, Collider, and Physics materials. Implementing basic physics interactions.		CO3	(06)
Unit 4	User Interface Design & Application Scripting: Principles of UI/UX design, creating UI elements using Unity's UI system (Canvas, Image, Text, Button, etc.), Basics of C# programming language, syntax, variables, data types, control structures, functions, and classes. Writing scripts for various applications, UI interactions, and coding to reinforce learning.		CO1	(08)
Unit 5	Audio, Visual Effects, and Optimization: Adding and managing audio assets, implementing sound effects, background music, and spatial audio. Incorporating visual effects for enhanced immersion (VFX Graph) creating particle effects, shaders, post-processing effects, and other visual enhancements. Techniques for optimizing performance in Unity projects, LOD (Level of Detail), batching, occlusion culling, and more.		CO4	(06)
Unit 6	Augmented Reality & Virtual Reality Development: Understanding AR and VR: hardware, setting up AR sessions. Detecting and tracking surfaces, placing virtual objects in the real world, and interactions. Developing a VR experience for the Meta Quest platform, configuring Unity for Oculus development, implementing VR interactions (grabbing, teleportation), optimizing the VR experience for performance.		CO4	(07)
Text Books				
1.	Mastering Unity 2D Game Development - Second Edition, Ashley Godbold, Simon Jackson, Packt Publishing, October 2016, ISBN: 9781786463456			
2.	Zeynep Tacgin, "Virtual and Augmented Reality: An Educational Handbook", Cambridge Scholars Publisher, 2020			
3	Joe Hocking, Unity in Action: Multiplatform Game Development in C# with Unity, Manning Publications, 2018			
4	Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009			
Reference Books				
1.	Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016			
2.	John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.			

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3.	Joe Hocking Unity in Action: Multiplatform Game Development in C# with Unity 5		
Useful Links			
1.	https://stanford.edu/class/ee267/syllabus.html Prof. Ivan Sutherland, Stanford University		
2.	https://nptel.ac.in/courses/106/106/106106138/ Prof. Steve Lavalle,IIT Madras.		
3.	https://nptel.ac.in/courses/121/106/121106013/ Prof. Dr. M. Manivannan,IIT Madras.		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	1	-	-	-	-	-	-	1
CO 2	2	3	2	2	2	-	-	-	-	-	-	1
CO 3	3	3	3	2	3	1	-	-	1	-	1	2
CO 4	2	2	3	3	3	1	1	-	2	1	-	3

: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50




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Dept. of Electronics and Telecommunication

Government College of Engineering, Karad				
Second Year (Sem – III) B. Tech. Information Technology				
IOE3332: Open Elective -01 Lab - AR/VR Application Development Lab				
Laboratory Scheme:			Examination Scheme:	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25
Prerequisite : Mathematics, Programming for problem solving				
Course Outcomes (CO):Students will be able to				
CO1	Apply real-time 3D scene creation with basic physics interactions.			
CO2	Design user interfaces utilizing UI system for game or application prototypes.			
CO3	Develop and test C# scripts to control game behaviour and player interactions.			
CO4	Integrate audio-visual effects and optimize performance.			
Course Contents				CO
Implementation of following concepts				
Experiment 1	Create a real-time 3D scene in Unity incorporating basic physics interactions.			CO1
Experiment 2	Design and implement a user interface for a game or application prototype using Unity's UI system.			CO2
Experiment 3	Write and test scripts in C# to control game behavior, such as player movement and object interactions.			CO3
Experiment 4	Integrate audio effects and visual enhancements into a Unity project to enhance immersion. e. Optimize a Unity project for performance on different platforms, focusing on techniques like LOD, batching, and occlusion culling.			CO4
Experiment 5	Experiment with augmented reality using Unity's AR Foundation package to develop basic AR interactions.			CO1
Experiment 6	Develop a VR experience for the Meta Quest platform, implementing VR interactions like grabbing and teleportation.			CO1
Experiment 7	Develop a simple web-based mini-game using Unity WebGL, incorporating basic gameplay mechanics and visual effects.			CO1
Experiment 8	Create an AR sample app for Android devices using Unity and AR Foundation.			CO2
Experiment 9	Implement AR features such as plane detection, object placement, and basic interactions like tapping to spawn virtual objects.			CO3
Experiment 10	Develop a VR sample app for the Meta Quest platform using Unity and Oculus integration.			CO4
Experiment 11	Design immersive VR environments and implement VR interactions using Oculus controllers.			CO4
Experiment 12	Optimize the VR experience for smooth performance on the Meta Quest headset, considering factors like frame rate and rendering quality			CO4
List of Submission:				
	Minimum number of Experiments : 10			




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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	3	1	1	2	-	-	1	2
CO 2	2	1	3	2	3	2	2	1	2	2	2	2
CO 3	3	2	3	2	3	-	1	2	1	2	3	2
CO 4	2	3	2	3	3	2	2	-	2	2	1	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	5	5	5	5	5	5	5	5	5	5	5
Task II	10	10	10	10	10	10	10	10	10	10	10
Task III	10	10	10	10	10	10	10	10	10	10	10
ISE	25	25	25	25	25	25	25	25	25	25	25




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Government College of Engineering, Karad					
Second Year (Sem – IV) B. Tech. Information Technology					
IOE3433: Open Elective II Fundamentals of Real-time Rendering					
Teaching Scheme			Examination Scheme		
Lectures	02 Hrs/week		ISE	50	
Tutorials	00 Hrs/week		ESE	50	
Total Credits	02		Duration of ESE	As applicable	
Prerequisite : AR/VR Application Development					
Course Outcomes (CO): Students will be able to					
CO1	Understand virtual production techniques' historical evolution and applications.				
CO2	Apply green screen technology effectively for virtual production setups.				
CO3	Utilize Game Engine proficiently in virtual production.				
CO4	Implement real-time rendering techniques for high-quality visuals in virtual environment				
Course Contents				CO	Hours
Unit 1	Introduction to Virtual Production: Historical overview and evolution of virtual production techniques. Applications and benefits of virtual production in film, television, and other media industries..			CO1	(03)
Unit 2	Fundamentals of Green Studio: Exploring Green Screen Studios, exploring green screen technology and its significance in virtual production. Setup and operation of green screen studios and Lighting techniques.			CO2	(04)
Unit 3	Unity for Virtual Production: Overview of Unity Game Engine and its role in virtual production. Importing assets and setting up virtual environments in Unity for production purposes.			CO3	(04)
Unit 4	Real-time Rendering & Visualisation: Real-time Rendering and Visualization, basics and its importance in virtual production, Techniques for achieving realistic visuals in real-time environments. Utilizing Unity's rendering capabilities for high-quality visual output.			CO4	(06)
Unit 5	Virtual Design: Virtual Set Design principles and layout., Designing immersive virtual environments for different production needs., Incorporating props, set dressing, and lighting to enhance realism and aesthetics..			CO1 & CO4	(06)
Unit 6	Virtual Camera system and Scene composition: Virtual Camera Systems and their role in virtual production, Types of virtual cameras and their functionalities. Operating virtual cameras within Unity for scene composition and framing.			CO2 & CO3	(06)
Text Books					
1.	Tomas Akenine-Möller, Eric Haines, and Naty Hoffman, <i>Real-Time Rendering, Fourth Edition</i> , A K Peters/CRC Press, 2018				
2.	Noah Kadner, <i>The Virtual Production Field Guide</i> , Epic Games, 2020				
3.	Jeremy Hanke and Michele Yamazaki, <i>Green Screen Made Easy: Keying and Compositing Techniques for Indie Filmmakers</i> , Michael Wiese Productions, 2017				
4	Jeff Foster, <i>The Green Screen Handbook: Real-World Production Techniques</i> , Sybex, 2014				
Reference Books					
1.	Joe Hocking, <i>Unity in Action: Multiplatform Game Development in C# with Unity</i> , Manning Publications, 2018				
2.	Blain Brown, <i>Cinematography: Theory and Practice: Image Making for Cinematographers and Directors</i> , Routledge, 2016				
3.	Laura Frank, <i>Real-Time Video Content for Virtual Production & Live EntertainmentA Learning Roadmap for an Evolving Practice</i> , Routledge, 2023				
Useful Links					
1.	https://www.udemy.com/course/unitycourse/				
2.	https://archive.nptel.ac.in/courses/121/106/121106013/				
3.	https://unity.com/resources				
4.	https://www.classcentral.com/classroom/youtube-learn-unity-multiplayer-free-complete-course-netcode-for-game-objects-unity-tutorial-2023-135735				

Rajesh Kumar

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[Signature]

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1	1	2	2	-	-	-	-	-	2
CO 2	2	2	2	2	3	2	-	-	-	1	-	2
CO 3	3	2	3	2	3	2	2	2	1	1	1	3
CO 4	2	3	2	3	3	2	1	-	-	2	1	3

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern

Knowledge Level	ISE	ESE
Remember	5	5
Understand	10	10
Apply	10	10
Analyse	15	15
Evaluate	10	10
Create	-	-
TOTAL	50	50




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Government College of Engineering, Karad					
Third Year (Sem – V) B. Tech. Information Technology					
IOE3534: Open Elective III Game Development with Unreal Engine					
Teaching Scheme			Examination Scheme		
Lectures	02 Hrs/week		ISE		50
Tutorials	00 Hrs/week		ESE		50
Total Credits	02		Duration of ESE		As applicable
Prerequisite : Fundamentals of Real-time Rendering					
Course Outcomes (CO): Students will be able to					
CO1	Understand the basics of game development Engine, including interface navigation and asset management.				
CO2	Apply advanced gameplay mechanics, such as controls, movement, animation, and interactivity.				
CO3	Analyze and implement visual effects, audio assets, and concepts in game development engine.				
CO4	Evaluate and optimize game performance, preparing projects for distribution across platforms in Unreal Engine				
Course Contents					CO
					CO1
Unit 1	Introduction to Unreal Engine: Introduction to Unreal Engine: Overview of Unreal Engine and its interface, Installation and setup, Basics of game assets and importing.				(04)
Unit 2	Fundamentals of Game development: Game Development Fundamentals, Level design and environment creation, Introduction to Blueprint visual scripting, Implementing basic gameplay mechanics.				(05)
Unit 3	Gameplay and Blending: Advanced Gameplay Mechanics, Player controls and character movement, Animation blending and state machines, Adding interactive elements and game mechanics.				(05)
Unit 4	Virtual effects: Audio, and Multiplayer, incorporating visual effects and particle systems, integrating audio assets for sound effects and music, Introduction to networking and multiplayer concepts.				(05)
Unit 5	Optimization and performance enhancement: Techniques for optimizing game performance, profiling tools and performance monitoring, Best practices for improving frame rate and reducing memory usage..				(05)
Unit 6	Packaging and Distribution: Packaging and Distribution, Preparing the game for distribution, Building and packaging for different platforms, Showcase and presentation of completed projects.				(05)
Text Books					
1.	Joanna Lee - "Learning Unreal Engine Game Development" - Packt Publishing - 2016				
2.	Tracy Fullerton - "Game Design Workshop: A Playcentric Approach to Creating Innovative Games" - A K Peters/CRC Press - 2014				
3.	Scott Rogers - "Level Up! The Guide to Great Video Game Design" - Wiley - 2014				
Reference Books					
1.	Joshua Glazer - "Multiplayer Game Programming: Architecting Networked Games" - Addison-Wesley Professional - 2015				
2.	Jesse Schell - "The Art of Game Design: A Book of Lenses" - CRC Press - 2008				
3.	Jason Gregory - "Game Engine Architecture" - CRC Press - 2018				
Useful Links					
1.	https://www.udemy.com/course/unrealcourse/				
	https://archive.nptel.ac.in/courses/121/106/121106013/				
2.	https://www.udemy.com/course/unreal-engine-5-the-complete-beginners-course/				
3.	https://www.coursera.org/specializations/cplusplusunrealgamedevelopment				




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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	2	1	3	-	-	-	-	-	-	1
CO 2	2	2	3	2	3	1	-	-	-	-	-	2
CO 3	3	3	3	3	3	2	1	2	1	-	-	1
CO 4	2	2	2	2	2	1	1	2	1	1	1	2

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember		
Understand	10	10
Apply	10	10
Analyse	15	15
Evaluate	15	15
Create	-	-
TOTAL	50	50




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