Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	**: Diploma In Artificial Intelligence / Artificial Intelligence and Machine Learning**		
Programme Code	**: AI / AN**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 12 Weeks (Industry) + 10 Weeks (Institute)**
Semester	**: Fifth** **NCrF Entry Level : 4.0**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																								
1	OPERATING SYSTEM	OSY	DSC	315319	-	5	-	2	2	9	3	3	30	70	100	40	25	10	25@	10	25	10	175
2	AI & ML ALGORITHM	AMA	DSE	315330	-	4	-	4	1	9	3	3	30	70	100	40	25	10	25@	10	25	10	175
3	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	ENDS	AEC	315002	-	1	-	2	-	3	1	-	-	-	-	-	50	20	25@	10	-	-	75
4	SEMINAR AND PROJECT INITIATION COURSE	SPI	AEC	315003	-	-	-	1	2	3	1	-	-	-	-	-	25	10	25@	10	25	10	75
5	INTERNSHIP(12 WEEKS)	ITR	INP	315004	-	-	-	-	-	36 - 40	10	-	-	-	-	-	100	40	100#	40	-	-	200
Elective 1 (Any - One)																								
6	ADVANCE DATABASE MANAGEMENT	ADM	DSE	315324	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
	CLOUD COMPUTING FOR DATA SCIENCE	CCD	DSE	315327	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
	NATURAL LANGUAGE PROCESSING	NLP	DSE	315329	1	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
Total					**1**	**14**		**11**	**5**		**20**		**90**	**210**	**300**		**250**		**225**		**75**		**850**

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities. **Note:** Notional learning hours for **internship represents the student engagement hours.**

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , AbilityEnhancement Course (AEC) , Skill Enhancement Course (SEC) , GenericElective (GE)

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Software Technology/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CST/ CW/ DS/ HA/ IF/ IH/ SE**
Semester	**: Fifth**
Course Title	**: OPERATING SYSTEM**
Course Code	**: 315319**

I. RATIONALE

An Operating System is to manage a Computer Hardware and software resources efficiently and provide user friendly environment. An Operating System is a System Program that controls the execution of application program and acts as an interface between applications and the computer hardware. It also place a curtail role in maintaining system security, protecting data and ensuring that processes do not interfere with one another. This course enables to learn internal functioning of Operating System and will help in identifying appropriate Operating System for given Application/Task.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Interpret features of Operating System.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Explain the services and components of an Operating System.
- CO2 - Describe the different aspects of Process Management in an Operating System.
- CO3 - Implement various CPU Scheduling algorithms and evaluate their effectiveness.
- CO4 - Analyze the Memory Management techniques used by an Operating System.
- CO5 - Apply techniques for effective File Management in an Operating System.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315319	OPERATING SYSTEM	OSY	DSC	5	-	2	2	9	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

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2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe functions of an Operating System. TLO 1.2 Explain different services of Operating System. TLO 1.3 Explain use of system call of Operating System. TLO 1.4 Explain activities of Operating System in concern with their components.	**Unit - I Operating System services and components** 1.1 Operating System: concept, functions 1.2 Different types of Operating System: Batch Operating System, Multi-programmed, Time Shared Operating System, Multiprocessor System, Distributed System, Real Time System, Mobile OS (Android OS) 1.3 Command line based Operating System: DOS, UNIX GUI based Operating System: WINDOWS, LINUX, MaC OS 1.4 Different Services of Operating System, System Calls: Concept, types of system calls 1.5 Operating System Components: Process Management, Main Memory Management, File Management, IO Management, Secondary Storage Management	Presentations Lecture Using Chalk-Board

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain the different states of a process. TLO 2.2 Describe the functions of different component of process stack in PCB (Process Control Block). TLO 2.3 Explain multiple processes access shared resources without interfering each other. TLO 2.4 Compare Multithreading models.	**Unit - II Process Management** 2.1 Processes: process state, process control block 2.2 Process Scheduling: scheduling queues, types of schedulers, context switch 2.3 Inter Process Communication: Shared memory system, Message passing system 2.4 Threads: Benefits, User and Kernel level threads, Multithreading Models: One to One, Many to One, Many to Many 2.5 Execute process commands like: top, ps, kill, wait, sleep, exit, nice	Lecture Using Chalk-Board Presentations
3	TLO 3.1 Justify the need of given scheduling criteria with relevant example. TLO 3.2 Explain with example the procedure of allocating CPU to the given process. TLO 3.3 Calculate turnaround time and average waiting time of the given scheduling algorithm. TLO 3.4 Explain functioning of the given necessary conditions leading to Deadlock.	**Unit - III CPU Scheduling** 3.1 Scheduling: Basic concept, CPU and I/O burst cycle 3.2 Preemptive and Non-preemptive scheduling, scheduling criteria 3.3 Types of Scheduling algorithms: First Come First Serve(FCFS), Shortest Job First (SJF), Shortest Remaining Time Next (SRTN), Round Robin (RR), Priority Scheduling, Multilevel Queue Scheduling 3.4 Deadlock: System Models, Necessary conditions Leading to Deadlock, Deadlock Handling: Deadlock prevention, Deadlock avoidance- Banker's Algorithm	Presentations Lecture Using Chalk-Board
4	TLO 4.1 Compare fixed and variable memory partitioning. TLO 4.2 Differentiate between Bit map and Linked list technique. TLO 4.3 Explain working of various partitioning algorithm. TLO 4.4 Calculate page fault for given page reference string.	**Unit - IV Memory Management** 4.1 Basic Memory Management: Partitioning - Fixed and Variable, Free Space Management Techniques: Bit map, Linked List 4.2 Swapping, Compaction, Fragmentation, Partitioning Algorithms: First fit, Best fit, Worst fit 4.3 Non-contiguous Memory Management Techniques: Paging, Segmentation 4.4 Virtual Memory: Basics, Demand paging, Page Fault 4.5 Page Replacement Algorithm: First In First Out (FIFO), Least Recently Used (LRU), Optimal	Lecture Using Chalk-Board Presentations Video Demonstrations
5	TLO 5.1 Explain structure of the given file system with example. TLO 5.2 Describe mechanism of file access method. TLO 5.3 Explain procedure to create access directories and assign the given file access permissions.	**Unit - V File Management** 5.1 File Concepts: Attributes, Operations, File types and File system structure 5.2 Accessing Methods: Sequential, Direct 5.3 File Allocation Methods: Contiguous allocation, Linked allocation, Indexed allocation 5.4 Directory Structure: Single level, Two level, Tree structured Directory	Presentations Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Execute the system call commands.	1	* System call commands in Linux such as fork(), exec(), getpid, pipe, exit, open, close, stat, uname.	2	CO1
LLO 2.1 Execute process related commands.	2	* Process related commands in Linux - top, ps, kill, wait, sleep, nice, renice,bg,fg.	2	CO2
LLO 3.1 Execute message passing and shared memory commands.	3	* a. Commands for Sending Messages to Logged-in Users -who, cat, wall, write, mesg. * b. List Processes Attached to a Shared Memory Segment: ipcs.	2	CO2
LLO 4.1 Implement First Come First Serve (FCFS) Scheduling algorithm.	4	* Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with First Come First Serve (FCFS) CPU scheduling algorithm.	2	CO3
LLO 5.1 Implement Shortest Job First (SJF) Scheduling algorithm.	5	Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with Shortest Job First (SJF) CPU scheduling algorit hm.	2	CO3
LLO 6.1 Implement Priority Scheduling algorithm.	6	Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with Priority CPU scheduling algorithm.	2	CO3
LLO 7.1 Implement Round Robin (RR) Scheduling algorithm.	7	Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with Round Robin (RR) CPU scheduling algorithm.	2	CO3
LLO 8.1 Implement Banker's algorithm for deadlock avoidance.	8	Write a C/Python program to implement Banker's Algorithm.	2	CO3
LLO 9.1 Execute memory management commands.	9	Basic memory management commands - df, free, vmstat, /proc/meminfo, htop.	2	CO4
LLO 10.1 Implement First In First Out (FIFO) Page Replacement algorithm .	10	* Write a C/Python program on First In First Out (FIFO) Page Replacement algorithm.	2	CO4
LLO 11.1 Implement Least Recently Used (LRU) Page Replacement algorithm.	11	Write a C/Python program on Least Recently Used (LRU) Page Replacement algorithm.	2	CO4
LLO 12.1 Implement sequential file allocation method.	12	* Write a C/Python program on sequential file allocation method.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Find out the total number of page faults using – i) First In First Out ii) Least recently used page replacement ii) Optimal page replacement Page replacement algorithms of memory management, if the page are coming in the order 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1
- Compare between CLI based Operating System and GUI based Operating System.
- Differentiate between process and thread (any two points). Also discuss the benefits of multithreaded programming.
- Enlist different file allocation methods? Explain contiguous and indexed allocation method in detail.

Micro project

- Create a report depicting features of different types of operating systems- Batch operating system, Multi programmed, Time shared, Multiprocessor systems, Real time systems, Mobile OS with examples.
- Implement and Compare Memory Allocation Strategies - First Fit, Best Fit, Worst Fit
- Create a report on different operating system tools used to perform various functions.

Self learning

- Complete any one course related to the operating system on MOOCS such as NPTEL, Coursera, Infosys Springboard etc.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system with basic configuration. Linux or alike operating system such as Ubuntu, CentOS or any other.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Operating System services and components	CO1	10	2	8	4	14
2	II	Process Management	CO2	10	4	4	6	14
3	III	CPU Scheduling	CO3	10	2	6	8	16
4	IV	Memory Management	CO4	12	2	6	8	16
5	V	File Management	CO5	8	2	4	4	10
Grand Total				**50**	**12**	**28**	**30**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering 1) 60% weightage is to process 2) 40% weightage to product

Summative Assessment (Assessment of Learning)

- End Semester Examination, Lab Performance, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	-	2	-	-	1			
CO2	1	-	-	2	1	-	-			
CO3	1	1	1	2	1	-	-			
CO4	2	2	2	2	1	-	2			
CO5	2	2	2	2	1	-	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dhananjay M. Dhamdhere	Operating System: A Concept-Based Approach	McGraw Hill Education 3rd edition, ISBN: 978-1259005589
2	William Stallings	Operating Systems : Internals and Design Principles	Pearson Education 9th Edition, ISBN: 978-9352866717
3	Richard Petersen	Linux The Complete Reference	McGraw Hill, 6th edition, ISBN: 978-0071492478
4	Richard Blum	Linux command line and shell scripting	Wiley India, ISBN: 978-1118983843
5	Abraham Silberschatz and James Peterson	Operating System Concepts	Wiley India, ISBN: 9781119454083

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://archive.nptel.ac.in/courses/106/105/106105214/	Introduction to Operating System
2	https://www.geeksforgeeks.org/processes-in-linuxunix/	Process Related commands
3	https://ubuntu.com/download/desktop	Installation of Ubuntu
4	https://developers.redhat.com/products/rhel/download	RedHat Linux download
5	https://www.digitalocean.com/community/tutorials/linux-commands	Basic Linux commands
6	https://www.geeksforgeeks.org/what-is-an-operating-system/	Operating System

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s : **Artificial Intelligence/ Artificial Intelligence and Machine Learning**
Programme Code : **AI/ AN**
Semester : **Fifth**
Course Title : **AI & ML ALGORITHM**
Course Code : **315330**

I. RATIONALE

Artificial Intelligence (AI) includes the ability to carry out operations that have historically required human intelligence, such as speech recognition, visual perception, language translation, and decision-making. Machine Learning (ML) is a subset of Artificial Intelligence (AI) which is the study of patterns and structures in data analysis and interpretation. Students will be able to apply AI/ML techniques to real-world problems through projects and case studies.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Classify real world problem and apply knowledge of AI and ML.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Implement relevant search algorithms as applicable to Artificial Intelligence.
- CO2 - Apply method for knowledge representation to make informed decisions for various applications.
- CO3 - Analyze different forms of data with respect to different phases of Machine Learning.
- CO4 - Create data model for Machine Learning Algorithms.
- CO5 - Classify the data by performing different Regression Techniques.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
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															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315330	AI & ML ALGORITHM	AMA	DSE	4	-	4	1	9	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs

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V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the different terminologies of AI. TLO 1.2 Analyze the types of AI agent. TLO 1.3 Explain the process of turing test in AI. TLO 1.4 Explain the functioning of Heuristic Search Techniques by examples. TLO 1.5 Describe beyond classical search algorithms.	**Unit - I Basics of AI and Problem Solving Techniques** 1.1 Basic Definition and Terminology: Foundation and Evaluation of AI, Scope of AI, Components of AI, Types of AI, Application of AI 1.2 Intelligent Agent in AI: Types of AI agent, Concept of Rationality, Nature of environment, Structure of agents, Turing Test in AI 1.3 Search Algorithms in Artificial Intelligence: Properties of Search Algorithms, Types of Search Algorithms 1.4 Heuristic Search Techniques: Generate-and-Test; Hill Climbing. Properties of A* algorithm, Depth-First Search, Best-First Search, Greedy Best-First, Problem Reduction 1.5 Beyond Classical Search: Local search algorithms and optimization problem, Local search in continuous spaces, Searching with nondeterministic action and partial observation, Online search agent and unknown environments	Lecture Using Chalk-Board Presentations Flipped Classroom

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Describe the architecture of knowledge-based agent in AI. TLO 2.2 Explain forward and backward chaining in AI. TLO 2.3 Explain the different types of Reasoning in AI. TLO 2.4 Apply Bayes' theorem for probabilistic reasoning.	**Unit - II Knowledge and Reasoning** 2.1 Knowledge-Based Agent in Artificial intelligence: Architecture, Approaches to designing a knowledge-based agent, Techniques of knowledge representation, Propositional logic, Rules of Inference, First-Order Logic, Forward Chaining & Backward Chaining in AI 2.2 Reasoning in Artificial intelligence: Definition of Reasoning, Types of Reasoning 2.3 Probabilistic reasoning in AI: Uncertainty, Causes of Uncertainty, Need of probabilistic reasoning in AI, Bayes' Theorem	Lecture Using Chalk-Board Presentations Flipped Classroom
3	TLO 3.1 Differentiate between AI and ML. TLO 3.2 Explain different phases of Machine Learning Life Cycle. TLO 3.3 Explain different forms of data. TLO 3.4 Explain different data preprocessing methods. TLO 3.5 Differentiate Training vs Testing data set. TLO 3.6 Explain the techniques of Data Cleaning.	**Unit - III Introduction to ML** 3.1 History and Evaluation of ML, AI vs ML 3.2 Machine Learning Life Cycle: Gathering data, Data Preparation, Data Wrangling, Data Analysis, Train Model, Test Model, Deployment 3.3 Different forms of Data: Data Mining, Data Analytics, Statistics Data, Statistics vs. Data Mining, Data Analytics vs Data Science 3.4 Dataset for ML: Training Dataset, Testing Datasets, Training vs Testing 3.5 Data Cleaning: Missing Data, Outliers	Lecture Using Chalk-Board Presentations Demonstration
4	TLO 4.1 Differentiate characteristics of Supervised and Unsupervised Learning. TLO 4.2 Explain Supervised Machine Learning Algorithms. TLO 4.3 Explain Unsupervised Machine Learning Algorithms. TLO 4.4 Test the validity of Datasets by applying the Cross-Validation.	**Unit - IV Types of Learning** 4.1 Types of Learning: Supervised, Unsupervised, Semi-Supervised Learning 4.2 Supervised Learning: Learning a Class from Examples, Introduction of different types of Supervised Machine Learning Algorithms: Linear Regression, Logistic Regression, Decision Tree, K - Nearest Neighbors, Random Forest 4.3 Unsupervised Learning: Introduction of different types of Unsupervised Learning Algorithm: K-means clustering, KNN (k-Nearest Neighbors), Hierarchical Clustering, Neural Networks 4.4 Model evaluation: Introduction of Cross-validation, benefits of cross-validation, Positive and Negative class cross-validation	Lecture Using Chalk-Board Presentations Demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Describe different types of Regression. TLO 5.2 Differentiate between overfitting and underfitting by example. TLO 5.3 Explain the logistic regression techniques. TLO 5.4 Create classification matrix for given Dataset.	**Unit - V Regression and Classification** 5.1 Linear Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting 5.2 Multiple Linear Regression: Multiple Linear regression equation, Implementation of multiple linear regression 5.3 Metrics for Regression: Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE) 5.4 Logistic Regression: Binary and Multiclass Classification, Assessing Classification Performance, Handling more than two classes, Multiclass Classification: One vs One, One vs Rest 5.5 Metrics for Classification: Confusion Matrix, AUC/ROC Curve, F1 Score, Accuracy, Precision, Recall	Lecture Using Chalk-Board Presentations Flipped Classroom

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install given IDE for python.	1	* Install given Python IDE software and Python “scikit learn” for ML	2	CO1
LLO 2.1 Implement Breadth First Search Algorithm.	2	Write program to Implement Breadth First Search Algorithm (Uninformed) in Python	2	CO1
LLO 3.1 Develop Depth First Search Algorithm.	3	*Write program to implement Depth First Search Algorithm (Uninformed) in Python	2	CO1
LLO 4.1 Implement Greedy Best-First Search Algorithm.	4	Write program to implement Greedy Best-First (Informed Type) Search Algorithm in python	4	CO1
LLO 5.1 Develop A* search Algorithm.	5	* Write program to implement A* search (Informed Type) Algorithm in Python	2	CO1
LLO 6.1 Develop a program using Bayes’s theorem.	6	* Write program to implement Bayes’ Theorem	4	CO2
LLO 7.1 Analyze the process of turing test for given Dataset.	7	Analyze the given Case study: How Turing test is performed between Responder and an Interrogator?	2	CO3
LLO 8.1 Analyze different datasets with respect to its use.	8	* Explore different dataset finders e.g. Google Dataset Search, Kaggle	2	CO3
LLO 9.1 Develop program based on training and testing datasets.	9	* Write program in python to split any dataset into train and tests sets	4	CO3
LLO 10.1 Analyze the mail filtering process.	10	Analyze E-mail spam and non-spam filtering using Machine Learning through case study	4	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Implement Supervised Learning.	11	*Create and display a Decision Tree on given dataset	2	CO4
LLO 12.1 Develop program on Unsupervised Learning.	12	Write program to implement K-means Algorithm	2	CO4
LLO 13.1 Implement cross validation in python.	13	* Write program to calculate cross validation score for any Dataset like IRIS	2	CO4
LLO 14.1 Develop program for Simple Linear Regression.	14	*Write program to implement Simple Linear Regression using Python	2	CO5
LLO 15.1 Implement Multiple Linear Regression in Python.	15	Write program to implement Multiple Linear Regression using Python	2	CO5
LLO 16.1 Implement program for confusion matrix.	16	*Write program to create confusion matrix to calculate different measures to quantify the quality of the model	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop a micro project for Movie Recommendation System: Use a dataset like the MovieLens dataset, preprocess the data (split into training and test sets),train a collaborative filtering model and generate and evaluate recommendations for users.
- Develop a micro project for Simple Chatbot: define a set of intents and responses and train a dataset to classify user inputs.
- Develop a micro project for Spam Email Classifier in which collect a dataset of labelled emails (spam or not spam), pre-process the text data (remove stop words, tokenize, etc.)
- Case study on Natural Language Generation (NLG) for E-commerce Product Descriptions

Other

- Complete the course Artificial Intelligence and Machine Learning on Infosys Springboard.
- Develop a code for given problem suggested by teacher.

Assignment

- Can Artificial Intelligence replace human Intelligence? Justify it
- Describe role of artificial intelligence in banking.
- Compare OpenAI and ChatGPT.
- Identify & List out the equipment / machine available in your Institute where AI technology is used. Describe the role of AI in that equipment.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer (i5 preferable), RAM minimum 8 GB onwards	All
2	Operating System: Windows-10 onward	All
3	Software: Python IDE	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of AI and Problem Solving Techniques	CO1	8	4	4	6	14
2	II	Knowledge and Reasoning	CO2	6	2	2	8	12
3	III	Introduction to ML	CO3	8	2	4	8	14
4	IV	Types of Learning	CO4	8	2	2	10	14
5	V	Regression and Classification	CO5	10	2	4	10	16
Grand Total				**40**	**12**	**16**	**42**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering

60% weightage to process
40% weightage to product

- A continuous assessment based on term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	2	2	-	2			
CO2	2	1	2	2	2	1	2			
CO3	2	1	2	1	2	1	2			
CO4	2	1	2	2	2	1	2			
CO5	2	1	2	2	2	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Stuart Russell and Peter Norvig, Editors	Artificial Intelligence A modern Approach Third edition	Pearson Education, Inc ISBN-13: 978-0-13-604259-4 ISBN-10: 0-13-604259-7
2	Dr. Jeeva Jose	Introduction to Machine Learning with Python	Khanna Book Publishing Co.(P) Ltd. ISBN 9789389139068 ISBN 9789389139068
3	Dipanjan Sarkar Raghav Bali Tushar Sharma	Practical Machine Learning with Python A Problem-Solver's Guide to Building Real-World Intelligent Systems	Apress publication ISBN-13 (pbk): 978-1-4842-3206-4 ISBN-13 (electronic): 978-1-4842-3207-1
4	Andreas C. Müller & Sarah Guido	Introduction to Machine Learning with Python	O'Reilly Media, Inc ISBN 9352134575 ISBN 9789352134571
5	Manaramjan Pradhan, U Dinesh Kumar	Machine Learning using Python	Wiley India ISBN 978-81-265-7990-7 ISBN 9 788126 579907

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.python.org/downloads/	Python IDE download

AI & ML ALGORITHM **Course Code : 315330**

Sr.No	Link / Portal	Description
2	https://www.pdfdrive.com/machine-learning-step-by-step-guide-to-implement-machine-learning-algorithms-with-python-d158324853.html	AI and ML E-Books
3	https://www.geeksforgeeks.org/how-to-install-python-pycharm-on-windows	Guidelines for Installation of python
4	https://stackabuse.com/courses/graphs-in-python-theory-and-implementation/lessons/a-star-search-algorithm	A* algorithm
5	https://www.javatpoint.com/turing-test-in-ai	Turing test
6	https://www.v7labs.com/blog/best-free-datasets-for-machine-learning	Datasets
7	https://www.geeksforgeeks.org/how-to-split-a-dataset-into-train-and-test-sets-using-python	Training and Testing Dataset
8	https://towardsdatascience.com/email-spam-detection-1-2-b0e06a5c0472	Filtering Dataset

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Software Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ SE/ TE**
Semester	**: Fifth**
Course Title	**: ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS**
Course Code	**: 315002**

I. RATIONALE

Entrepreneurship and Startups are introduced in this curriculum to develop the entrepreneurial traits among the students before they enter into professional life. Exposing and interacting with entrepreneurship and startup eco-system, students will develop entrepreneurial mind set. The innovative thinking with risk-taking ability along with other traits will be inculcated in the students through micro-projects and training. This exposure will be instrumental in orienting the students in transforming them to become job generators after completion of Diploma in Engineering.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop project proposals for launching small scale enterprises and starts up.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify one's entrepreneurial traits.
- CO2 - Use information collected from stakeholder for establishing/setting up/founding starts up
- CO3 - Use support systems available for Starts up
- CO4 - Prepare project plans to manage the enterprise effectively

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315002	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	ENDS	AEC	1	-	2	-	3	1	-	-	-	-	-	50	20	25@	10	-	-	75

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare advantages and disadvantages of Entrepreneurship TLO 1.2 Identify entrepreneurial traits through self-analysis TLO 1.3 Compare risk associated with different type of enterprise	**Unit - I Introduction to Entrepreneurship Development** 1.1 Entrepreneurship as a career – charms, advantages, disadvantages , scope- local and global 1.2 Traits of successful entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking, learning from failure 1.3 Types of enterprises and their features : manufacturing, service and trading	Presentations Lecture Using Chalk-Board
2	TLO 2.1 Explain Important factors essential for selection of product/service and selection of process TLO 2.2 Suggest suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. TLO 2.3 Suggest steps for the selection process of an enterprise for the specified product or service with justification. TLO 2.4 Plan a market study /survey for the specified enterprise	**Unit - II Startup Selection Process** 2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Instries Commission[KVIC]	Presentations Lecture Using Chalk-Board

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain categorization of MSME on the basis of turnover and investment TLO 3.2 Describe support system provided by central and state government agencies TLO 3.3 State various schemes of government agencies for promotion of entrepreneurship TLO 3.4 Describe help provided by the non governmental agencies for the specified product/service TLO 3.5 Compute breakeven point, ROI and ROS for the specified business enterprise, stating the assumptions made	**Unit - III Support System for Startup** 3.1 Categorization of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment (ROI) and return on sales (ROS).	Presentations Lecture Using Chalk-Board
4	TLO 4.1 Explain key elements for the given business plan with respect to their purpose/size TLO 4.2 Justify USP of the given product/ service from marketing point of view. TLO 4.3 Formulate business policy for the given product/service. TLO 4.4 Choose relevant negotiation techniques for the given product/ service with justification TLO 4.5 Identify risks that you may encounter for the given type of business/enterprise with justification. TLO 4.6 Describe role of the incubation centre and accelerators for the given product/service.	**Unit - IV Managing Enterprise** 4.1 Techno commercial Feasibility study, feasibility report preparation and evaluation criteria 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project 4.3 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 4.4 Preparing strategies of handling business: policy making, negotiation and bargaining techniques 4.5 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, definition of startup cycle, ecosystem , angel investors, venture capitalist 4.6 Incubation centers and accelerators : Role and procedure	Presentations Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Collect information of successful entrepreneurial traits	1	*Preparation of report on entrepreneurship as	2	CO1
LLO 2.1 Identify different traits as an entrepreneur from various field LLO 2.2 Suggest different traits from identified problem	2	Case study on ‘Traits of Entrepreneur’	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Explore probable risks for identified enterprise.	3	*Case study on 'Risks associated with enterprise	2	CO1
LLO 4.1 Identify new product for development LLO 4.2 Prepare a newly developed product	4	*Preparation of report on 'Development of new Product	2	CO1 CO2
LLO 5.1 Identify Process for development of product for new startup	5	Preparation of Report on ' Process selection 'for new startup	2	CO1 CO2 CO3
LLO 6.1 Develop questioner for market survey	6	*Market survey for setting up new Start up	2	CO2 CO3
LLO 7.1 Interpret the use of Technology Life Cycle	7	A Case study on ' Technology life cycle' of any successful entrepreneur.	2	CO3
LLO 8.1 Use information related to support of startups from Government and non-government agencies' LLO 8.2 Prepare report for setting up startup	8	*Preparation of report on 'Information for setting up new startup' from MCED/MSME/KVIC etc	2	CO3 CO4
LLO 9.1 Compute ROI of successful enterprise.	9	Case study on 'Return on Investment (ROI)'of any successful startup	2	CO3
LLO 10.1 Calculate of ROS of any successful enterprise	10	Case study on 'Return on sales (ROS)'of any successful startup	2	CO3
LLO 11.1 Calculate Brake even point of any enterprise	11	Preparation of report on 'Brake even point calculation' of any enterprise.	2	CO3 CO4
LLO 12.1 Prepare feasibility report of given business	12	*Preparation of report on 'feasibility of any Techno-commercial business"	2	CO4
LLO 13.1 Plan a USP of any enterprise.	13	*A case study based on 'Unique selling Proposition (USP) of any successful enterprise	2	CO4
LLO 14.1 Prepare a project report using facilities of Atal Incubation center.	14	*Prepare project report for starting new startup using 'Atal incubation center (AIC)	2	CO1 CO2 CO3 CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare a 'Pitch- desk' for your start up
- Prepare a business plan for a. Market research b. Advertisement agency c. Placement Agency d. Repair and Maintenance agency e. Tour and Travel agency
- Prepare a 'Social entrepreneurship business plan, plan for CSR funding.
- Prepare a ' Women entrepreneurship business plan ' Choose relevant government scheme for the product/service

- Prepare a business plan for identified projects by using entrepreneurial eco system for the same (Schemes, incentives, incubators etc.)

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computers with internet and printer facility	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Entrepreneurship Development	CO1	4	0	0	0	0
2	II	Startup Selection Process	CO2	2	0	0	0	0
3	III	Support System for Startup	CO3	2	0	0	0	0
4	IV	Managing Enterprise	CO4	2	0	0	0	0
Grand Total				**10**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assessment during practicals

Summative Assessment (Assessment of Learning)

- End of term examination

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	2	-	-	3	2			
CO2	2	2	2	2	-	3	2			
CO3	2	2	2	2	-	3	2			
CO4	2	2	2	2	-	3	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dr. Nishith Dubey, Aditya Vyas , Annu Soman , Anupam Singh	Un- boxing Entrepreneurship your self help guide to setup a successful business	Indira Publishing House ISBN 2023,978-93-93577-70-2
2	Gujral, Raman	Reading Material of Entrepreneurship Awareness Camp	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad
3	Chitale, A K	Product Design and Manufacturing	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
4	Charantimath, Poornima	Entrepreneurship Development Small Business Entrepreneurship	Pearson Education India, New Delhi; ISBN: 9788131762264
5	Khanka, S.S.	Entrepreneurship and Small Business Management	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.mced.nic.in/allproduct.aspx	MCED Product and Plan Details
2	http://niesbud.nic.in/Publication.html	The National Institute for Entrepreneurship and Small Business Development Publications
3	http://niesbud.nic.in/docs/1standardized.pdf	Courses : The National Institute for Entrepreneurship and Small Business Development
4	https://www.nabard.org/Tenders.aspx?cid=501andid=24	NABARD - Information Centre
5	http://www.startupindia.gov.in/pdffile.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandc ontent_type=Actionandsubmenupoint=action	Start Up India
6	http://www.ediindia.org/institute.html	About - Entrepreneurship Development Institute of India (EDII)
7	http://www.nstedb.com/training/training.htm	NSTEDB - Training

ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS **Course Code : 315002**

Sr.No	Link / Portal	Description

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Software Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Manufacturing Technology/ Metallurgical Engineering/ Production Engineering/ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ MRT/ MY/ PG/ SE/ TE**
Semester	**: Fifth**
Course Title	**: SEMINAR AND PROJECT INITIATION COURSE**
Course Code	**: 315003**

I. RATIONALE

Most of the diploma graduates lack the confidence and fluency while presenting papers or interacting verbally and expressing themselves with a large gathering. Seminar presentation boosts the confidence of the students and prepares them precisely for facing the audience, interviews and group discussions. The course on seminar is to enhance student's ability in the art of academic writing and to present it. It also helps broaden the minds of the participants. Through this course on Seminar, students will develop new ideas and perspectives of the subject /themes of emerging technologies and services of their area of studies. Project initiation enhances project planning skill which establishes measurable objectives and interaction skills.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Present a seminar on the selected theme/area of study effectively and confidently to the specific audience and stakeholders. Plan innovative solutions independently or collaboratively to the identified problem statement.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify topics of seminar presenting to the large gathering at the institute/conference.
- CO2 - Collect relevant and updated research-based data and information to prepare a paper of seminar presentation.
- CO3 - Apply presentation skills.
- CO4 - Create conducive environment for learning and discussion through seminar presentation.
- CO5 - Identify a problem statement and establish the action plan for the successful completion of the project.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
315003	SEMINAR AND PROJECT INITIATION COURSE	SPI	AEC	-	-	1	2	3	1	-	-	-	-	-	25	10	25@	10	25	10	75	

V. General guidelines for SEMINAR and Project Initiation

- The seminar must be related to emerging trends in engineering / technology programme or may be inter/ multi-disciplinary, based on the industry expected outcomes of the programme.
- The individual students have different aptitudes and strengths. Therefore, SEMINAR should match the strengths of students. For this purpose, students shall be asked to select the TITLE (Theme)of SEMINAR they would like to prepare and present.

- Seminar titles are to be finalized in consultation with the faculty mentor.
- Seminar must involve logic development of applications of various technologies/ processes applicable in industry.
- Seminar must be assigned to the single student. However, support of other students may be sorted while presenting the seminar
- Students are required to prepare using relevant software tools, write ups for presentation
- Students shall submit One Hard copy and one Soft copy each of the presentation and may be encouraged to keep a recorded copy of the presentation made during the seminar.
- Batch of 3-4 students shall be formed for project initiation.
- Projects give a platform for the students to showcase an attitude of inquiry to identify the problem statement related to the programme. Students shall Identify the information suggesting the cause of the problem and possible solutions
- Students shall study and assess the feasibility of different solutions and the financial implications.
- Students should collect relevant data from different sources (books/internet/market/suppliers/experts through surveys/interviews).
- Students shall prepare required drawings/ designs and detailed plan for the successful execution of the work.
- Students may visit the organisation pertaining to the problem statement as part of initial study.

VI.Guidelines for Seminar preparation and presentation :

Once the title/topic of a seminar has been finalized and allotted to the student, the teacher's role is important as guide, mentor and motivator, to promote learning and sustain the interest of the students.

Following should be kept in mind while preparing and presenting the seminar:

- **Seminar Orientation cum -briefing**: the seminar topics/themes should be innovative, novel and relevant to the curriculum of the programme, and also aligned to the expectations of industry.
- **Seminar Literature survey**: Information search and data collection: the information and data should be authentic, realistic and relevant to the curriculum of the programme.
- **Seminar Preparation, and presentation**: The seminar shall be present with suitable software tools and supporting handout/notes. The presentation of seminar should not be more than 20 minutes including Q-A session.

The following guidelines may be followed for Project Initiation

- **Establishing project scope:** Determine the boundaries of the project.
- **Defining project objectives:** Set clear and measurable objectives that align with the project's purpose.
- **Stakeholder identification and analysis:** Perform an exercise in identifying all stakeholders involved in the project and analyzing their needs and expectations.
- **Team Formation:** Carefully build a team with the necessary skills and expertise to execute the project successfully.
- **Documentation.** Create a project planner showcasing the action plan, define the project's scope, outline the project definition, and design of the project. The document has to be made available to all stakeholders

VII. Criteria of Assessment /Evaluation of Seminar

A. Formative Assessment (FA) criteria

The assessment of the students in the fifth semester Progressive Assessment (PA) for 50 marks is to be done based on following criteria.

A. Suggestive RUBRICS for assessment

Sr. No.	Criteria	Marks
1	Selection Topic/Theme of seminar	05
2	Literature review and data presentation	05
3	Quality of Preparation and innovativeness	05
4	Q-A handling	05
5	Time Management	05
6	Seminar Presentation report	10

Rubrics for assessment of Project Initiation

Sr. No.	Criteria	Marks
1	Selection of Theme of Problem Statement and its innovativeness	05
2	Stages of development of Action plan	05
3	Prototyping	05

The total marks as per above out of 50, shall be converted in proportion of 25 marks.

B. Summative Assessment criteria/

The summative assessment of the students in the fifth semester End-Semester-Examination (ESE) for 50 marks is to be done based on following criteria. This assessment shall be done by the Faculty.

Suggestive **RUBRICS** may be developed by the faculty

Sr. No.	Criteria	Marks
1	Quality of information/Knowledge presented in SEMINAR	10
2	Creativity, Innovation in SEMINAR presentation	10
3	Response to the question during seminar presentation	10
4	Establishment of Innovative Problem Statement and its presentation	10
5	Objectives of the project and action plan	10

The total obtained marks shall be converted in proportion of 25 marks.

VIII. Suggestive CO-PO Mapping

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	1	0	-	2	2	3		
CO-2	2		2	-	2	1	3		
CO-3	3	1	1	2	1	2	3		
CO-4	2	0	0	2	1	2	3		
CO-5	3	3	3	2	2	3	3		

VIII.Typographical instructions/guidelines for seminar preparation & presentation

- The seminar PPT shall be computer typed (English- British)
- Text Font -Times New Roman (TNR), Size-12 point
- Subsection heading TNR- 12 point bold normal
- Section heading TNR- 12 capital bold
- Chapter Name/ Topic Name – TNR- 14 Capital
- All text should be justified. (Settings in the Paragraph)
- Different colors text/diagrams /tables may used
- The name of the candidate, diploma (department), year of submission,name of the institute shall be printed on the first slide of PPT.

IX.Seminar and Project Initiation Report

On completion and presentation of Seminar, every student will submit a brief report which should contain the following:

- Cover Page (as per annexure 1)
- Title page (as per annexure 2)
- Certificate by the Guide (as per annexure 3)
- Acknowledgment (The candidate may thank all those who helped in the execution of the project).
- Abstract of Paper presented in the seminar (It should be in one page and include the purpose of the seminar & methodology if any .)
- Index

- List of Figures
- Introduction
- Literature Review
- Information/Chapters related to Seminar topic
- Advantages and Disadvantages
- Conclusion
- Project Initiation : a) Description of problem statement. b) Scope and objectives. c) State holder d) Platform/ Equipment/ Resources identification.
- Bibliography
- References

NOTE: Seminar report must contain only relevant – technology or platform or OS or tools used and shall not exceed 25-30 pages.

Details of Softcopy to be submitted:
The soft copy of seminar presentation is required to be provided on the back cover of the seminar report in clear packet, which should include the following folders and contents:

1.Presentation (should include a PPT about project in not more than 15 slides)
2.Documentation (should include a word file of the project report)

NOTE: Soft copy must be checked for any harmful viruses before submission.

X. Sample Formats

1) Cover Page - Annexure-I

2) Index - Annexure-II

3) Assessment - Annexure-III

Annexure - I

MSBTE LOGO

SEMINAR Report

Institute Logo

"SEMINAR Title_ _ _ _ _ _ _ _ _ _ _ _ _"

as a partial fulfilment of requirement of the

THIRD YEAR DIPLOMA IN

Submitted by

Name of Student **Enrollment Number**

FOR THE ACADEMIC YEAR 20___20___

(H.O.D) **(Principal)**

(Internal Guide) **(External Examiner)**

Annexure - II

Institute Name

(An Affiliated Institute of Maharashtra State Board of Technical Education)

Table of Contents

INDEX

Sr. No.	Chapter	Page No.
1.	Chapter–1 Introduction (background of the seminar)	**1**
2.	Chapter–2 Literature review for the seminar topic/theme	**5**
3.	Chapter–3 -	
-	-	
-	Seminar Report	
-	**Bibliography**	
-	**Referances**	

***Students can add/remove/edit chapter names as per the discussion with their guide**

Annexure - III

Format for SEMINAR and PROJECT INITIATION Assessment /Evaluation

Formative Assessment

CRITERIA AND WEIGHTAGE

Enrollment No	**1** Selection Topic/Theme of seminar (5)	**2** Literature review and data presentation (5)	**3**. Quality of Preparation and innovativeness (5)	**4** Q-A handling (5)	**5** Time Management (5)	6. Seminar Presentation report (10)	**7** Selection of Theme of Problem Statement and its innovativeness (5)	**8** Stages of development of Action plan (5)	**9.** Prototyping (5)	**10.** Total (50)	Scaled to (25)

SummativeAssessment

CRITERIA AND WEIGHTAGE

Enrollment No	**1.** Quality of information/Knowledge presented in SEMINAR **10**	**2** Creativity, Innovation in SEMINAR presentation 10	**3**. Response to the question during seminar presentation 10	**4** Establishment of Innovative Problem Statement and its presentation 10	**5** Objectives of the project and action plan 10	Total **(50)**	Scaled to **(25)**

Sign: **Name: ----------** **(Course Expert/s)**	**Sign:** **Name: ----------** **(Program Head)** **(Information Technology)**

Programme Name/s	**: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Software Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Manufacturing Technology/ Metallurgical Engineering/ Production Engineering/ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ MRT/ MY/ PG/ SE/ TE**
Semester	**: Fifth**
Course Title	**: INTERNSHIP(12 WEEKS)**
Course Code	**: 315004**

I. RATIONALE

Globalization has prompted organizations to encourage skilled and innovative workforce. Internships are educational and career development opportunities, providing practical/ hands-on experience in a field or discipline. Summer internship is an opportunity for students to get accustomed to modern industry practices, apply the knowledge and skills they've acquired in the classroom to real-world situations and become familiar with industry environments before they enter the professional world. Keeping this in mind, industrial training is incorporated to all diploma programmes as it enables the student to get equipped with practical skills, soft skills and life skills

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Apply skills and practices to industrial processes.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Observe time/resource management and industrial safety aspects.
- CO2 - Acquire professional experience of industry environment .
- CO3 - Establish effective communication in working environment.
- CO4 - Prepare report of assigned activities and accomplishments.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315004	INTERNSHIP(12 WEEKS)	ITR	INP	-	-	-	-	36 - 40	10	-	-	-	-	-	100	40	100#	40	-	-	200

Legends: # External Assessment

Note: Credits for Industrial Training are in-line of guidelines of NCrF : The industrial training is of 12 weeks considering 36-40 hours per week engagement of students (as per Guidlines of GR of Maharashtra Govt.) under Self Learning with guidance of industry supervisor / Mentor

V General guidelines for organizing Industrial training

The Industry/organization selected for Industrial training/ internships shall be Government/Public Limited/ Private limited / Startup /Centre of Excellence/Skill Centers/Skill Parks etc.

1. Duration of Training - 12 weeks students engagement time
2. Period of Time slot - Between 4th and 5th semester (12 weeks) i.e. commencement of internships will be immediately following the 4th semester exams.
3. Industry area - Engineering Programme Allied industries of large, medium or small-scale, Organization/Govt./ Semi Govt Sectors.

VI Role(s) of Department at the Institute:

Following activities are expected to be performed by the concerned department at the Polytechnics.

Table of activities to be completed for Internship

S.No	Activity	Suggested Schedule WEEKS
1	Collection of information about industry available and ready for extending training with its offered capacity of students (**Sample Format 1**)	1st to 3rd week of 4th Semester
2	Allocations of Student and Mentor as per availability (Mentor: Student Ratio (1:15)	4th to 6th week of 4th semester
3	Communication with Industry and obtaining its confirmation Sample letter Format	6th to 8th week of 4th semester
4	Securing consent letter from parents/guardians of students (Sample Format 2)	Before 10th week of 4th semester
5	Enrollment of Students for industrial training (Format 3)	Before 12th week of 4rd semester

6	Issue of letter to industry for training along with details of students and mentor (Format 4)	Before 14th week of 4th Semester
7	Organize Internship Orientation session for students	Before end of 4th Semester
8	Progressive Assessment of industry training by Mentor	Each week during training period
9	Assessment of training by institutional mentor and Industry mentor	5th Semester ESE

Suggestions-

1. Department can take help of alumina or parents of students having contact in different industries for securing placement.
2. Students would normally be placed as per their choices, in case of more demand for a particular industry, students would be allocated considering their potentials. However preference for placement would be given to students who have arranged placement in company with the help of their parents or relatives.
3. Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the industry during training before relieving students for training.
4. The faculty members during the visit to industry or sometimes through online mode will check the progress of the student in the training, student attendance, discipline, and project report preparation each week.

VII Roles and Responsibilities of students:

1. Students may interact with the mentor to suggest choices for suitable industry, if any. If students have any contact in industry through their parents or relatives then the same may be utilized for securing placement for themselves and their peers.
2. Students have to fill the forms/formats duly signed by institutional authorities along with a training letter and submit it to a training officer/mentor in the industry on the first day of training.
3. Students must carry with him/her Identity card issued by the institute during the training period.
4. Students should follow industrial dressing protocols, if any. In absence of specific protocol students must wear college uniform compulsorily.
5. Students will have to get all necessary information from the training officer/mentor at industry regarding schedule of training, rules and regulation of the industry and safety norms to be followed. Students are expected to observe these rules, regulations and procedures.
6. Students must be fully aware that if they disobey any rule of industry or do not follow the discipline then non-disciplinary action will be taken .
7. Students must maintain a weekly diary (**Format 6**) by noting daily activities undertaken and get it duly signed from industry mentor or Industrial training in charge.

8. In case students face any major problems in industry such as an accident or any disciplinary issue then they should immediately report the same to the mentor at the institute.

9. Prepare a final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from a mentor as well as industry training in charge.

10. Students must submit the undertaking as provided in **Format 5**.

VIII Typographical guidelines for Industry Training report

Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following

1. The training report shall be computer typed (English- British) and printed on A4 size paper.

2. Text Font -Times New Roman (TNR), Size-12 point

3. Subsection heading TNR- 12 point bold normal

4. Section heading TNR- 12 capital bold

5. Chapter Name/ Topic Name – TNR- 14 Capital

6. All text should be justified. (Settings in the Paragraph)

7. The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.

8. The training report must be hardbound/ Spiralbound with a cover page in black color. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover.

9. The training report, the title page should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.

IX Suggestive format of industrial training report

Following format may be used for training report. Actual format may differ slightly depending upon the nature of Industry/ Organization.

- Title Page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1	Organization structure of Industry and general layout.
Chapter 2	Introduction to Industry / Organization (history, type of products and services, turn over and number of employees etc.)
Chapter 3	Types of Major Equipments/raw materials/ instruments/machines/ hardware/software used in industry with their specifications, approximate cost, specific use and routine maintenance done
Chapter 4	Processes/ Manufacturing Manufacturing techniques and methodologies and material handling procedures

Chapter 5	Testing of Hardware/Software/ Raw materials/ Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 6	Safety procedures followed and safety gears used by industry.
Chapter 7	Particulars of Practical Experiences in Industry/Organization if any in Production/Assembly/Testing/Maintenance
Chapter 8	Detailed report of the tasks undertaken (during the training).
Chapter 9	Special/challenging experiences encountered during training if any (may include students liking & disliking of workplaces).
Chapter 10	Conclusion
Chapter 11	References / sources of information

X Suggested learning strategies during training at Industry

- Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.
- They should also refer to the handbook of the major machines and operations, testing, quality control and testing manuals.
- Students may also visit websites related to other industries wherein similar products are being manufactured.

XI Tentative week wise schedule of Industry Training

Industrial training is a common course to all Diploma programmes , therefore the industry selection will depend upon the nature of the programme and its related industry. The training activity may vary according to nature and size of industry.

The following table details of activities to be completed during industrial training.

Details of Activities to be completed during Industry training
Introduction of Industry and departments.
Study of Layout of Industry, Specifications of Machines , raw materials, components available in the industry
Study of setup and manufacturing processes
Execute given project or work assigned to the students, study of safety and maintenance procedures
Validation from industry mentor regarding project or work allocated
Report writing

XII CO-PO Mapping Table to be created by respective Department/faculty.

XIII. Formative Assessment of training : Suggested RUBRIC

(Note : Allot the marks in proportion of presentations and outcome observed. Marks excluding component of week 11 are to be filled by Institute mentor)

Week No	**Task to be assessed**	**Outcome Achievement - Poor**	**Outcome Achievement - Moderate**	**Outcome Achievement - High**		**Week-wise total Marks**
		Poor Marks	Average Marks	Good Marks	Excellent Marks	

1	Introduction of Industry	Minimal Knowledge of Departments, processes, products and work culture of the company **(Marks –1)**	Moderate Knowledge of Departments, processes, products and work culture of the company **(Marks –2)**	Good Knowledge of Departments, processes, products and work culture of the company **(Marks –3/4)**	Extensive Knowledge of Departments, processes, products and work culture of the company **(Marks –5)**	
2	Presentation of Layout of Industry, Specifications of Machines, raw materials, components available in the industry	Minimal w.r.t. tasks **(Marks –1)**	Moderate w.r.t. tasks **(Marks –2)**	Good w.r.t. tasks **(Marks –3/4)**	Extensive w.r.t. tasks **(Marks –5)**	
3	Participation in setup and manufacturing processes/platforms	Minimal Participation with poor understanding **(Marks –1-8)**	Moderate Participation with poor understanding **(Marks –9-12)**	Good Participation with poor understanding **(Marks –13-17)**	Extensive Participation with poor understanding **(Marks –18-20)**	
4 to 10	Execution of given project or work to the students, Follow of safety and maintenance procedures	Minimal Participation with poor understanding **(Marks –1-8)**	Moderate Participation with lower level understanding **(Marks – 9-12)**	Good Participation with Good understanding **(Marks – 13-17)**	Extensive Participation with excellent understanding **(Marks – 18-20)**	
11	Validation by industry mentor regarding project or work allocated	Minimal Participation with poor performance **(Marks –1-10)**	Moderate Participation with acceptable performance **(Marks – 11-15)**	Good Participation with Good performance **(Marks – 16-20)**	Extensive Participation with excellent performance **(Marks – 21-25)**	

12	Diary writing	• Results are not Presented properly, • Project work is summarized and concluded not acceptable • Future extensions are not specified **(Marks –1-10)**	• Results are Presented just casually • Project work is summarized and concluded casually • Future extensions are casually specified **(Marks –11-15)**	• Results are Presented well and properly, • Project work is summarized and concluded to a Good level • Future extensions are well specified **(Marks –16-20)**	• Results are Presented exhaustively • Project work is summarized and elaborated in excellent manner , concluded • Future extensions are excellently specified **(Marks –21-25)**	
Total Out of :100						

Marks for (FA) are to be awarded for each week considering the level of completeness of activity observed as per table specified in Sr.No. XIII above, from the daily diary maintained . Feedback from industry supervisor shall also be considered.

XIV Summative Assessment (SA) of training:

Academic year : 20 -20

i) Suggested RUBRIC for SA

	Observations from Orals				**Presentations**				**Total (100)**
Enrollment Number	Tasks undertaken (20)	Overall Understanding (20)	Creativity /Innovation demonstrated (10)	Knowledge acquired (10)	Speech Clarity (10)	Body Language (10)	Presentations (10)	Diary , Report writing and / Product (10)	

Name of mentor:
Signature of Mentor

XV FORMATS

Format-1: Collecting Information about Industry/Organization available for training along with capacity

1) Name of the industry/organization:
2) Address/communication details with email :
3) Contact person details:
   a) Name:
   b) Designation:
   c) Email
   d) Contact number/s:

4) Type:

   Govt / PSU / Pvt /

   Large scale / Medium scale / Small scale …..

5) Products/services offered by industry:

6) a) Whether willing to offer Industrial training facility during May/ June for Diploma in Engineering students: **Yes / No.**
   b) If yes, whether you offer 12 weeks training: **Yes/No**
   c) Possible Industrial Capacity:

Students	Programme name/ Title					Total
	Civil	Mechanical	Chemical			
Male						
Female						
Total						

7) Whether accommodation available for interns **Yes / No.**
If yes capacity:_____

8) Whether internship is charged or free:
If charged please specify amount per candidate: _____

Signature of responsible person at Industry:

Format-2: Obtaining Consent Letter from parents/guardians

(Undertaking from Parents)

To,

The Principal,
_____,

Subject: Consent for Industrial Training.
Sir/Madam,

I am fully aware that -
i) My ward studying in _____ semester at your _____ institute has to undergo 12 weeks of Industrial training for partial fulfillment towards completion of Diploma in _____ Engineering.
ii) For this fulfillment he/she has been deputed at_____ industry, located at _____ for Industrial training /internship for the period from _____ to _____ .
With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –
a) My ward will undergo the training at his/her own cost and risk during training and/or stay.
b) My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
c) My ward is NOT entitled to any leave during the training period.
d) My ward will regularly submit a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward, who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :
Name : _____
Address : _____

Phone Number :

Format-3: Students Enrollment for Industrial Training

(Academic Year –)

Sr No	Enrollment Number	Name of Student	Name of Industry	Name of Mentor at Institute

Format-4: Issue Letter to the Industry/Organization for the training along with details of students and mentors

To,

The HR Manager,

_____

Subject: Placement for Industrial training of ___ weeks in your organization….

Reference: Your consent letter no: ….

Sir,

With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.

The purpose of this training is to equip the student with some essential skills relevant to the demands of the industry and world of work, as well as to provide exposure to the professional environment and work culture. It is hoped that this training may enhance his/her employability and livelihood opportunities. In view of the above, we kindly request your support in facilitating this Industrial Training for the student. He/she has been adequately oriented and guided on the expectations of this training, including the maintenance of a daily diary during the training period. Additionally, the institute has secured the necessary consent and undertaking from the parent/guardian regarding the guidelines for exit training. In view of all the above industry shall refrain from involving students into the mundane and housekeeping activities. Your cooperation in this regard will be highly appreciated.

Diploma programme in _____ Engg.

Sr.No	Enrollment No	Name of Student	Name and designation of Mentor

Diploma programme in _____ Engg.

Sr.No	Enrollment No	Name of Student	Name and Designation of Mentor

Kindly extend all possible cooperation to the students for above.

Thanking you

Yours sincerely,

(Principal)
Name of the Institute:
with Seal

Cc- To HoD/Mentor

Format-5: Undertaking by the students

TO

Principal

Subject: Undertaking regarding Placement for Industrial training of 12/16/18 weeks duration

I ……Reg No:…….. S/o/D/o. ……Studying in ---------- ---------- at ---------- Institute at ----------fully aware of the Industrial Training requirement and related responsibilities and participation in the ……, Industrial training between From: …… To……..

I assure you that I will be of good behavior and be obedient to the staff and mentor during the ……/Industrial training. I will also abide and will not participate in all activity. I will also discipline myself within the rules and regulations of the Institution. I am also aware that I am participating in the …….. at my own risk and I will not hold the ----------Institute responsible in any way in any eventuality namely Accident /Injury/death or whatever mishap and I myself will be solely responsible for my safety.

Place :Signature of the student

Date :Reg. No.

Format-6: Internships Daily Diary

Name of the Student: _____ Name of the mentor (Faculty) : _____

Enrollment Number: _____ Semester: _____ Academic Year _____

Week	Day & Date	Discussion Topics/Activity	Details of Work Allotted Till Next Session /Corrections Suggested/Faculty Remarks	Signature of Industry Mentor
Week 01	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			
.	Mon, Date			
	Tue, Date			
.	Wed, Date			
	Thu, Date			
.	Fri, Date			
	Sat, Date			
Week n	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Data Sciences/ Information Technology/ Computer Science & Information Technology**
Programme Code	**: AI/ AN/ DS/ IF/ IH**
Semester	**: Fifth**
Course Title	**: ADVANCE DATABASE MANAGEMENT**
Course Code	**: 315324**

I. RATIONALE

Advance Database Management Systems (ADBMS) encompass a wide range of topics related to database systems, including their design and management. This course curriculum extensively covers parallel and distributed database systems, database transactions, and recent developments in database technologies, providing knowledge of both structured and unstructured databases like MongoDB, SQL, and XML, while emphasizing the importance of database architecture, data mining, and techniques for managing large datasets in today's information-driven business world.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Manage both structured and unstructured data using various tools for Database.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Apply the concept of concurrency control.
- CO2 - Analyse various database architectures
- CO3 - Use Object Oriented and XML queries on Database.
- CO4 - Manipulate data using NoSQL commands.
- CO5 - Use data mining and warehousing concepts.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315324	ADVANCE DATABASE MANAGEMENT	ADM	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Use the given locking protocols for concurrency control. TLO 1.2 Describe the architecture and functionality of various database models. TLO 1.3 Differentiate between Transaction Server and Data Server.	**Unit - I Database System Architecture** 1.1 Concurrency Control Techniques: Concurrency control protocols: Locked Based protocols, granting of locks, Two Phase Locking protocol 1.2 Database Model: Centralized Database System, Server System Architecture, Transaction Server, Data Server	Video Demonstrations Presentations Lecture Using Chalk-Board
2	TLO 2.1 Explain the functioning of parallel database system. TLO 2.2 Explain the architecture of distributed database system. TLO 2.3 Differentiate between Parallel and Distributed Database.	**Unit - II Parallel & Distributed Database System.** 2.1 Introduction to parallel Systems: Parallel database system architecture, Measure of Performance-Throughput, Response time, scaleup and speed up 2.2 Introduction to distributed database, Types of Distributed Database Systems, Benefits of distributed database system, Advantages and Disadvantages of Distributed Database 2.3 Transaction Processing in Parallel and Distributed Database Systems	Lecture Using Chalk-Board Presentations Video Demonstrations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the characteristics of object-based database. TLO 3.2 Write the given SQL queries using Table Inheritance. TLO 3.3 Write the given SQL queries using Array and Multiset. TLO 3.4 Write SQL queries to refer the given object using object identity. TLO 3.5 Write XML queries on given data.	**Unit - III Object Based Database & XML** 3.1 Object Based Database: Overview, Complex data types, Structured types and inheritance in SQL 3.2 Table inheritance 3.3 Array and multiset types in SQL 3.4 Object-oriented vs. Object-Relational database 3.5 XML: Introduction, Structure of Xml Data, Xml Document Schema, Xpath, XQuery: FLWOR Expressions, Joins, Nested Queries, Sorting of Functions, Functions and Types	Lecture Using Chalk-Board Presentations Video Demonstrations
4	TLO 4.1 Differentiate between structured and Unstructured Data. TLO 4.2 Write NoSQL query to solve given problem. TLO 4.3 Differentiate SQL and NoSQL database. TLO 4.4 Write query to execute find() function on given data. TLO 4.5 Explain basic operations performed on MongoDB shell on given data.	**Unit - IV NoSQL & MongoDB** 4.1 Structured versus Unstructured Data 4.2 NoSQL database concepts: Types of NoSQL database, NoSQL data modeling, Benefits of NoSQL, comparison between SQL and NoSQL database system 4.3 NoSQL using MongoDB: Introduction to MongoDB Shell, Running the MongoDB shell, MongoDB client, Basic operations with MongoDB shell, Basic Data Types ,Arrays, Embedded Documents 4.4 Querying with MongoDB: find() function, specifying which keys to return, query criteria, OR queries, Types specific querying	Lecture Using Chalk-Board Presentations Hands-on
5	TLO 5.1 Describe the given data warehouse architecture. TLO 5.2 Explain the Functions of Data warehouse Tools. TLO 5.3 Perform redundancy and correlation analysis for the given database. TLO 5.4 Analyze given data using data mining to extract useful pattern. TLO 5.5 Understand Data Lakehouse for data management.	**Unit - V Data Mining & Warehousing** 5.1 Data warehousing: Components of a Data Warehouse, virtual warehouse 5.2 Functions of Data warehouse Tools: Extraction, Transformation and loading 5.3 Data Mining: Classification, Decision-Tree Classifiers, Regression, Validating a Classifier 5.4 Association Rules, Clustering, Other Forms of Data Mining 5.5 Introduction to Data Lake House	Lecture Using Chalk-Board Video Demonstrations Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

ADVANCE DATABASE MANAGEMENT **Course Code : 315324**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Understanding Server System Architecture in Databases	1	1. Install suitable Database. 2 .Configure a server-based database and establish client-server connections.	2	CO1
LLO 2.1 Implement Locked Based protocols.	2	*Execute query to implement Locked Based protocols.	2	CO1
LLO 3.1 Understand Parallel and Distributed Systems through Case Study	3	Study Parallel and Distributed system using Case.	2	CO2
LLO 4.1 Create database using XML Attributes and Elements.	4	Create database using XML 1. Create a xml file for given Application 2. Create database using xml file 3. Confirm database path 4.Show database	2	CO3
LLO 5.1 Implement queries based on FLWOR expressions using XQuery. LLO 5.2 Implement joins queries using XQuery. LLO 5.3 Implement nested queries using XQuery.	5	*4.1 Implement queries based on FLWOR expressions 1. Create a xml file 2. Confirm the path expression 3. Use FLWOR expression for given criteria to display result from xml file 4. Execute Join queries *4.2 Implement queries based on nested queries and sorting of results using XQuery 1. Create a xml file 2. Execute queries based on Nested queries and sorting of results using XQuery	2	CO3
LLO 6.1 Execute queries using type inheritance and table inheritance in SQL.	6	*Execute query using type inheritance and table inheritance 1. Create Parent Table and child table for given application 2. Execute queries using inheritance approach by combining a data from parent, child tables	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Implement queries using Array and Multiset types in SQL.	7	*Execute query using Array and Multiset types in SQL 1. Create an array Type and Multiset type 2. Use array type and Multiset type as a column name in table 3. Insert and display the data from table	2	CO4
LLO 8.1 Develop MongoDB Queries using basic operations.	8	*Execute MongoDB Query using basic operations 1. Create a database for given application 2. Use DATABASE statement 3. Insert, update and delete the record for given application	2	CO4
LLO 9.1 Implement aggregation Queries using MongoDB. LLO 9.2 Implement MongoDB Queries Using find () function.	9	*9.1 : Implement aggregation queries 1. Write MongoDB queries using aggregate function for given application *9.2: Execute query using find() function 1. Write MongoDB queries using find () for given application	2	CO4
LLO 10.1 Use extract, transform, and load (ETL) data warehousing tool.	10	*Use Data warehousing tool (ETL) 1. Extract the relevant data from the source database 2. Transform the data so that it is better suited for analytics 3. Load the data into the target database	2	CO5
LLO 11.1 Understand the concept of classification in data mining	11	Implement Classification Techniques in Data Mining	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop and maintain XML database for Employee Attendance System
- Develop a MongoDB database for tracking patient history in a healthcare system.
- Develop a MongoDB database for tracking issued and pending books in a library.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Any DBMS software (MySQL/Oracle/SQL server/MongoDB or any suitable database software)	All
2	Computer system (Any computer system with basic configuration)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Database System Architecture	CO1	6	4	4	2	10
2	II	Parallel & Distributed Database System.	CO2	8	4	4	4	12
3	III	Object Based Database & XML	CO3	10	2	6	10	18
4	IV	NoSQL & MongoDB	CO4	10	4	4	10	18
5	V	Data Mining & Warehousing	CO5	6	4	4	4	12
Grand Total				**40**	**18**	**22**	**30**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- A continuous assessment based term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	1	1	-	2			
CO2	2	2	2	1	1	-	2			
CO3	2	2	2	2	-	-	2			
CO4	2	2	2	2	-	-	2			
CO5	2	2	1	1	1	-	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Korth Henery	Database System Concepts	McGraw Hill Education, New Delhi, 6th Edition ,ISBN -13:978-93-329-0138-4
2	Chakrabarti, Dasgupta, Shinde, KLSI	Advanced Database Management System	Dreamtech Press ,ISBN 13 :9789351194552
3	Bayross Ivan	SQL, PL/SQL The Programming Language of ORACLE	BPB Publications, New Delhi, 3rd Edition ISBN-13: 978-8176569644
4	Jiawei Han,Micheline Kamber,Jian Pei	Data Mining Concepts and Techniques	Morgan Kaufmann ,USA,3rd Edition, ISBN-978-0-12-381479-1

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://docs.mongodb.com/manual/tutorial/install-mongodb-on-windows/	MangoDB installation
2	www.learn-with-video-tutorials.com/data-warehouse-tutorial-video	Advanced database management system concept
3	https://www.javatpoint.com/xml-database	XML Tutorial
4	https://www.javatpoint.com/data-warehouse	Data Warehouse and Data Mining
5	https://www.youtube.com/watch?v=L54ajG7vtZA&list=PLPphbOQYOrDrTLR_4BBxYpaJAtluFEkS9	ADVANCED DATABASE CONCEPTS-(DATABASE SYSTEM ARCHITECTURES)

ADVANCE DATABASE MANAGEMENT **Course Code : 315324**

Sr.No	Link / Portal	Description

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s : **Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Data Sciences**
Programme Code : **AI/ AN/ DS**
Semester : **Fifth**
Course Title : **CLOUD COMPUTING FOR DATA SCIENCE**
Course Code : **315327**

I. RATIONALE

Cloud Computing play an important role for Data Science and Machine Learning Algorithm. It provides a flexible, scalable and cost-effective environment for data science which is important for computational needs, enhancing collaboration and ensuring robust data management with security. This Course will cover basic architecture of Cloud environment, use of various available cloud Services, build and develop machine learning algorithm to train and test the machine learning Model.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use Cloud computing platform to solve real-world data science problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Use Cloud-Based software services by comprehending the cloud Computing Architecture.
- CO2 - Configure Virtual Machines using Virtualization techniques.
- CO3 - Implement Virtualized storage system in Cloud.
- CO4 - Use Machine Learning algorithms in Cloud Environment.
- CO5 - Deploy Machine Learning Models on Cloud.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315327	CLOUD COMPUTING FOR DATA SCIENCE	CCD	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the Evolution of Cloud Computing. TLO 1.2 Explain characteristics of Cloud Computing. TLO 1.3 Describe the Architecture of Cloud Computing.	**Unit - I Introduction to Cloud Computing** 1.1 Introduction to Cloud Computing: Definition, Evolution of Cloud computing (from Mainframes to Clouds), Service – Oriented Architecture, Web Services, Grid Computing, Utility Computing 1.2 Characteristics of a Cloud computing 1.3 Cloud computing architecture: Basic components: front-end platform, back-end, platform, Networking, cloud-based delivery 1.4 Cloud Service Models: Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Continuous delivery using PaaS	Lecture Using Chalk-Board Flipped Classroom Presentations
2	TLO 2.1 Explain Concept of Virtualization. TLO 2.2 Explain the given type of Virtualization. TLO 2.3 Compare various cloud service models. TLO 2.4 Describe various Cloud Deployment Models. TLO 2.5 Explain role of Cloud computing in Data Science.	**Unit - II Virtualization and Cloud Computing** 2.1 Introduction to Virtualization, types of Virtualization, Application Virtualization, Network Virtualization, Desktop Virtualization, Storage Virtualization, Server Virtualization, Data virtualization 2.2 Cloud Deployment Models: Public, Private, Community, Hybrid 2.3 Role of Cloud computing in data Science 2.4 Advantages of Cloud Computing in Machine Learning	Lecture Using Chalk-Board Presentations Flipped Classroom

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain Cloud Storage. TLO 3.2 Describe the given Cloud storage system. TLO 3.3 Explain features and limitations of Key-Value databases. TLO 3.4 Compare Batch data and Streaming data in Machine learning. TLO 3.5 Explain GCP BigQuery cloud platform.	**Unit - III Cloud Storage** 3.1 Cloud Storage: Introduction, Benefits of using Cloud Storage, Use cases of Cloud Storage (Backup, Archiving, Disaster recovery, Data processing, Content delivery) 3.2 Cloud storage system: Block-Based, File-Based, Object-Based Storages 3.3 Key-Value Databases: Introduction, features, limitations 3.4 Batch data and Streaming data in Machine learning 3.5 Cloud Data Warehouse– AWS Redshift 3.6 Various Cloud-based tools used for data science in ML– GCP BigQuery	Lecture Using Chalk-Board Presentations Demonstration
4	TLO 4.1 Explain benefits of using Machine Learning in the Cloud. TLO 4.2 Explain the given type of Cloud-Based Machine Learning Service. TLO 4.3 Describe various Machine Learning systems. TLO 4.4 Describe features of the given Cloud Machine Learning Platforms.	**Unit - IV Cloud Computing for Data Science** 4.1 Machine Learning in the Cloud: Benefits and Limitations 4.2 Types of Cloud-Based Machine Learning Services: Artificial Intelligence as a Service (AIaaS), GPU as a Service (GPUaaS) 4.3 Introduction to various ML systems and benefits of using Managed ML platforms 4.4 Cloud Machine Learning Platforms: AWS SageMaker, Azure Machine Learning studio, Google Cloud AutoML	Lecture Using Chalk-Board Presentations Demonstration
5	TLO 5.1 Explain factors for Selection of Cloud Machine Learning Platform. TLO 5.2 Describe ETL and ELT Pipelines. TLO 5.3 Explain Pre-Tuned AI Services. TLO 5.4 Write step wise procedure to train a Machine Learning Project.	**Unit - V Training and Deployment of ML on Cloud** 5.1 Factors for Selection of Cloud Machine Learning Platform, Support for ETL or ELT Pipelines, Support for Scale-Up and Scale-Out Training, Support for Machine Learning Frameworks, Pre-Tuned AI Services, Monitor Prediction Performance 5.2 Training Machine Learning Projects in the Cloud: Steps to train Machine Learning project in the Cloud, Identify and Understand Data Sources, Engineer the Features, Train and Validate Model, Deploy and Monitor Model	Lecture Using Chalk-Board Presentations Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use Google Cloud Software Services.	1	* Use Google Services to create Doc/Sheet/Keep/Forms	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Create Virtual Machine.	2	*Create Virtual Machine using VMware workstation for Windows/Linux	2	CO2
LLO 3.1 Create Web Server on Virtual Machine.	3	Create Web server (WAMP/XAMP/APACHE) on Virtual Machine	2	CO2
LLO 4.1 Create account on any cloud platform.	4	*Create an account on AWS or Azure, or Google Cloud Platform	2	CO2
LLO 5.1 Use BigQuery to create tables and views.	5	Create an account on Google Cloud Platform. a) Create a project and access BigQuery. b) Query data directly from Google Sheets. c) Create tables and views using BigQuery	2	CO3
LLO 6.1 Create instance and configure Block-Based storage.	6	Launch an EC2 instance with a specified configuration and configure Block-Based storage	2	CO3
LLO 7.1 Configure File-Based storage.	7	*Create and Configure File-Based storage on EC2 instance	2	CO3
LLO 8.1 Configure Object-Based storage.	8	Create and Configure Object-Based storage on EC2 instance	2	CO3
LLO 9.1 Upload dataset to Aws S3 bucket using Python script.	9	Write a script in Python to upload a dataset to an S3 bucket, list the files in the bucket, and download a file	2	CO3
LLO 10.1 Use Amazon Sagemaker notebook.	10	*Create instance of Amazon Sagemaker notebook	2	CO4
LLO 11.1 Build and Deploy a model using Amazon Sagemaker.	11	* Build, test, tune, train, deploy and validate a model using Amazon Sagemaker	2	CO4 CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Use AWS Glue, Google Dataflow, or Azure Data Factory to create a data pipeline that ingests, transforms, and loads data from one storage service to another. Document the pipeline configuration and execution results.
- Create a Machine on AWS and make basic services available on machine like word, power point etc.
- Set up a relational database using AWS RDS, Azure SQL Database, or Google Cloud SQL. Create a database schema, insert sample data, and perform queries using SQL. Document the steps and results.
- Launch an EC2 instance with a specified configuration (e.g., type, region). Install software (e.g., Python, Jupyter Notebook) on the instance. Connect to the instance and run a basic Python script.
- Create a local cloud on Virtual Machine on VmWare workstation. Deploy a web application and make it accessible by URL.

- Write and deploy a simple AWS Lambda function or Azure Function that processes data (e.g., transforms a JSON file). Test the function with sample data and set up triggers for automatic execution.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	VmWare Workstation Software	2,3
2	Aws, EC2 and Sagemaker instance with services	5,6,7,8,9,10,11
3	Minimum Hardware requirement: Personal computer, (i3-i7 preferable), RAM minimum 8 GB.	All
4	Minimum system requirement: 64-bit operating system such as Windows 10, macOS 10.13, or a recent version of Linux.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Cloud Computing	CO1	6	4	8	0	12
2	II	Virtualization and Cloud Computing	CO2	8	4	6	4	14
3	III	Cloud Storage	CO3	8	4	6	4	14
4	IV	Cloud Computing for Data Science	CO4	10	4	8	4	16
5	V	Training and Deployment of ML on Cloud	CO5	8	4	6	4	14
Grand Total				**40**	**20**	**34**	**16**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Laboratory Performance, Unit Tests , Midterm Exam,Term Work, Seminar/Presentations.
- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering 60% weightage to process and 40% weightage to product

Summative Assessment (Assessment of Learning)

- End Semester Exam, Practical exam, viva voce.

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	2	1	2	1	1			
CO2	2	3	2	3	3	1	1			
CO3	2	2	2	2	2	1	1			
CO4	3	2	3	3	2	1	1			
CO5	3	2	3	3	2	2	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dr. Anand Nayyar	Handbook of Cloud Computing	BPB Publication First Edition (1 January 2019) ISBN-10:9388176669 ISBN-13:978-9388176668
2	Toby Velte, Anthony Velte, Robert C	Cloud Computing: A Practical Approach By Toby Velte, Anthony Velte, Robert C	McGraw Hill Professional ISBN-978-0-07-162965-8
3	Noah Gift, Alfredo Deza	Cloud Computing for Data Analysis	Pragmatic AI Labs (No ISBN)
4	Valliappa Lakshmanan	Data Science on the Google Cloud Platform: Implementing End-to-End Real-Time Data Pipelines	O'Reilly Media, Inc. ISBN: 9781098118952
5	Abhishek Mishra	Machine Learning in the AWS Cloud: Add Intelligence to Applications with Amazon SageMaker	Wiley Publication ISBN: 978-1-119-55671-8

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.geeksforgeeks.org/virtualization-cloud-computin g-types/	Introduction to virtualization and cloud Computing and its types
2	https://www.javatpoint.com/virtualization-in-cloud-computing	Introduction to virtualization and cloud Computing

CLOUD COMPUTING FOR DATA SCIENCE **Course Code : 315327**

Sr.No	Link / Portal	Description
3	https://www.hostitsmart.com/blog/types-of-virtualization-in-cloud-computing-complete-overview/	Overview of cloud computing, types of Virtualization advantages and Application
4	https://aws.amazon.com/what-is/virtualization/	How can AWS help with virtualization and cloud computing?
5	https://www.run.ai/guides/machine-learning-in-the-cloud	Machine Learning in the Cloud,AWS Sagemaker Service for Machine Learning

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s : **Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Computer Software Technology/ Data Sciences/**

Programme Code : **AI/ AN/ CST/ DS**

Semester : **Fifth**

Course Title : **NATURAL LANGUAGE PROCESSING**

Course Code : **315329**

I. RATIONALE

This course emphasizes foundational knowledge and practical skills in language processing. It equips students with the ability to develop text-based applications, handle text data processing and preparing them for role of NLP Engineer in the software industry.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Design and develop NLP-based applications and use NLP toolkits.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Explain key concepts linguistics and NLP.
- CO2 - Implement Text Normalization and Text Preprocessing techniques to the text.
- CO3 - Apply Part Of Speech ,Parsing ,Named Entity Recognition techniques to the text.
- CO4 - Generate text embedding in NLP.
- CO5 - Use Transformer in NLP applications.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315329	NATURAL LANGUAGE PROCESSING	NLP	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 1 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the significance of Language Syntax, Structure and Semantics. TLO 1.2 Use different Text Corpora. TLO 1.3 Describe various applications of NLP.	**Unit - I Natural Language Basics** 1.1 Overview of NLP ,The need of NLP, Areas of study under linguistics 1.2 Language Syntax and Structure: Words, Phrases, Clauses, Grammar, Word Order Typology, Word Order–Based Language Classification 1.3 Language Semantics: Lexical Semantic Relations,Semantic Networks and Models 1.4 Text Corpora:Corpora Annotation and Utilities, Popular Corpora 1.5 Applications of NLP.	Lecture Using Chalk-Board Presentations
2	TLO 2.1 Apply regex patterns to match and manipulate text. TLO 2.2 Apply Text normalization techniques. TLO 2.3 Apply word tokenization , lemmatization, stemming techniques. TLO 2.4 Generate N-grams.	**Unit - II Text Normalization and Preprocessing** 2.1 Regular Expressions :Basic Regular Expression Patterns ,Disjunction, Grouping, and Precedence, sets of characters, operators for counting 2.2 Text Preprocessing: Removing Special Characters ,Expanding Contractions , Case Conversions , Removing Stopwords 2.3 Word Tokenization: rule-based tokenization, Byte-Pair Encoding 2.4 Lemmatization and Stemming ,porter stemmer, snowball stemmer 2.5 N-grams Vectors :unigram,bigram, trigram,n-gram	Lecture Using Chalk-Board Demonstration Hands-on

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Assign grammatical categories to individual words in a text. TLO 3.2 Perform NER for chunks of text. TLO 3.3 Perform dependency parsing to construct dependency tree. TLO 3.4 Perform constituency-based parsing to generate parse trees.	**Unit - III Text Syntax and Structure** 3.1 Part-of-speech tagging : English Word Classes ,Part-of-Speech Tagging 3.2 Named entity recognition :Named Entities and Named Entity Tagging ,IOB/ BIO tagging 3.3 Parsing Techniques :Partial parsing/chunking ,Dependency parsing	Lecture Using Chalk-Board Demonstration Hands-on
4	TLO 4.1 Explain the process of Vector Space Models . TLO 4.2 Apply Cosine Similarity to measure and compare the similarity between word vectors. TLO 4.3 Use TF-IDF vector embedding. TLO 4.4 Use Word2Vec embedding. TLO 4.5 Use contextual embedding.	**Unit - IV Text Feature Extraction** 4.1 Vector Space Models :Words and Vectors , Cosine for measuring similarity 4.2 One hot encoding ,Bag-of-words ,TF-IDF 4.3 Word2vec:continuous bag of words, skip gram 4.4 Contextual Embeddings : Contextual Embeddings ,Word Sense	Lecture Using Chalk-Board Demonstration Hands-on
5	TLO 5.1 Explain different phases of implementing Sentiment analysis. TLO 5.2 Explain Need of Transformer. TLO 5.3 Explain Transfer Learning. TLO 5.4 Use Hugging face Transformer. TLO 5.5 Enlist challenges in Transformer.	**Unit - V NLP Application and Transformers** 5.1 NLP application for text classification :NLP application pipeline ,Evaluating Classification Model, Develop a text classification application 5.2 Transformers :Encoder-Decoder Framework ,Attention Mechanisms ,Transformer architecture ,Challenges with Transformers 5.3 Transfer Learning in NLP 5.4 Hugging Face Transformers : Transformer Applications ,The Hugging Face Hub, Hugging Face Tokenizers ,Hugging Face Datasets ,Hugging Face Accelerate	Lecture Using Chalk-Board Demonstration Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use different type of Text corpus.	1	Implement a program to use text corpus. i)Brown corpus, ii)Penn Treebank Corpus.	2	CO1
LLO 2.1 Use Regular Expression LLO 2.2 Word Segmentation using Re and nltk.	2	i)Write program for Sentence Segmentation Techniques. ii)Write program Word Segmentation using Re and nltk.	2	CO2
LLO 3.1 Apply tokenization on text .	3	Implement Penn Treebank tokenization, word_tokenize,wordpunct_tokenize,sent_tokenize,WhitespaceTokenizer.	2	CO2
LLO 4.1 Use various Stemmer and Lemmatizer for text processing .	4	*Apply various Lemmatization Techniques and Stemming Techniques such as porter stemmer,Lancaster Stemmer,Snowball Stemmer on text.	2	CO2
LLO 5.1 Apply text normalization techniques LLO 5.2 Generate unigram ,bigram, trigram.	5	*Write program on Text Normalization using nltk: i)Tokenizing text ii)Removing special charactersiii)Expanding contractions iv)case conversion. ii)*Generate unigram, bigram, trigram for given text.	2	CO2
LLO 6.1 Perform POS using ntlk or spacy.	6	*Write program for POS tagging on the given text.	2	CO3
LLO 7.1 Implement Named Entity Recognizer.	7	*Write program to find Named Entity Recognition(NER) for the given text .	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 8.1 Generate Dependency parse tree LLO 8.2 Perform chunking on text.	8	i)Implement a program for dependency parse tree on the sentence using nltk or spacy. ii)Write program for performing chunking on the given text .Extract Noun Phrases, Verb Phrases, Adjective Phrases.	2	CO3 CO4
LLO 9.1 Use Word Embedding.	9	*Write program to generate word embedding using word2Vec and BERT embedding(use Hugging Face).	2	CO4
LLO 10.1 Sentiment analysis. LLO 10.2 Detect fake content.	10	Perform the prediction task using NLP and ML classifiers: a)Sentiment analysis b) Fake news detection.	2	CO5
LLO 11.1 Implement text classification using Hugging Face.	11	* Implement program to fine-tune a pre-trained model from Hugging Face's for text classification.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- 1)Sentiment Analysis – Develop a model to classify text as positive, negative, or neutral using NLP techniques. 2)Fake News Detection – Train a classifier to differentiate between real and fake news articles based on linguistic patterns. 3)Keyword Extraction – Extract the most relevant keywords from a document using NLP algorithms like TF-IDF or RAKE.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system - (Computer System which is available in lab with 4GB RAM)	All
2	Python 3.7 onwards	All
3	Colab	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Natural Language Basics	CO1	4	4	4	4	12
2	II	Text Normalization and Preprocessing	CO2	10	2	8	6	16
3	III	Text Syntax and Structure	CO3	8	2	2	12	16
4	IV	Text Feature Extraction	CO4	10	2	4	8	14
5	V	NLP Application and Transformers	CO5	8	2	4	6	12
Grand Total				**40**	**12**	**22**	**36**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two unit tests of 30 marks each conducted during the semester.
- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering 60% weightage to process, 40% weightage to product. A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	1	1	-	-			
CO2	2	3	2	3	1	-	1			
CO3	2	3	2	3	1	-	1			
CO4	2	3	2	3	1	-	1			
CO5	2	3	3	3	2	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Daniel Jurafsky	Speech and Language Processing -ch2 2.1,2.3,2.4 ch3,ch4	Pearson Publication ISBN :978-0131873216
2	Dipanjan Sarkar	Text Analytics with Python ch1 ch5 5.1	Apress ISBN-13 (pbk): 978-1-4842-2387-1
3	Steven Bird, Ewan Klein, and Edward Loper	Natural Language Processing with python ch5 5.2 5.3 5.4	Oreally ISBN:978-0-596-51649-9
4	Akshay Kulkarni Adarsha Shivananda	Natural Language Processing Recipes_ Unlocking Text Data with Machine Learning and Deep Learning using Python . for lab 1 to 11	Apress ISBN-13 (pbk): 978-1-4842-4266-7
5	Pushpak Bhattacharyya and Aditya Joshi	Natural Language Processing ch2-2.5 ch3-3.3	Willey ISBN:978-93-5746-238-9

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://web.stanford.edu/~jurafsky/slp3/	NLP e-book and PPT
2	https://github.com/Donges-Niklas/Intro-to-NLP-with-NLTK/blob /master/nltk.ipynb	Text Segmentation, Stop Words & Word Segmentation, Stemming ,Parsing (Speech Tagging & Chunking),programs
3	https://github.com/samiramunir/Simple-Sentiment-Analysis-usi ng-NLTK/blob/master/live_classifier.py	sentiment Analysis Program
4	https://www.youtube.com/watch? v=yLDRHyNJSXA&list=PLPIwNooIb9 vimsumdWeKF3BRzs9tJ-_gy&index=38	Sentiment Analysis theory content

NATURAL LANGUAGE PROCESSING **Course Code : 315329**

Sr.No	Link / Portal	Description
5	https://www.youtube.com/watch?v=fM4qTMfCoak&list=PLZoTAELRMXVMdJ5sqbCK2LiM0HhQVWNzm	NLP concept playlist

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students