SEMESTER-V

(Scheme – 2023)

Shri Vile Parle Kelavani Mandal's
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

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

Program Name	: Diploma In Computer Engineering		
Programme Code	: CSE	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: V	Scheme	: 2023

Sr No	Course Title & Code	Course Category	IKS (Hrs)	Actual Contact Hrs./Week CL	TL	LL	Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Notional Learning Hrs /Week	Credits	Paper Duration (Hrs.)	Theory (Marks) FA-TH	SA-TH	Total	Based on LL & TL Practical (Marks) FA-PR	SA-PR	SA-OR	Based on Self Learning SLA (Marks)	Total Marks
1	#Cloud Services & Application (CSA238930)	DSC	-	04	-	02	-	06	03	03	30	70	100	50	-	25	-	175
2	#Machine Learning & Tools (MLT230811)	DSC	-	04	-	02	02	08	04	03	30	70	100	25	-	25	25	175
3	#Project (PRO230812)	INP	-	-	-	06	-	06	03	-	-	-	-	50	-	50	-	100
4	# Software Development Methodology (SDM230813)	DSC	-	04	-	02	02	08	04	03	30	70	100	25	-	25	25	175
5	#Elective – II (Any One)																	
5.1	#Full Stack Web Development (FSD230814)	DSE	-	04	-	02	-	06	03	03	30	70	100	50	25	-	-	175
5.2	#Business Analytics (BSA230815)	DSE	-	04	-	02	-	06	03	03	30	70	100	50	25	-	-	175
5.3	#Blockchain Technology (BCT230816)	DSE	-	04	-	02	-	06	03	03	30	70	100	50	-	25	-	175
6	Entrepreneurship Development & start up (EDS230817)	AEC	-	03	-	02	01	06.	03	1.5	30	70@	100	25	-	-	25	150
	Total		00	16	-	16	05	40	20	Total Papers=05	150	350	500	225	150		75	950

Abbreviations : IKS - Indian Knowledge System ,CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, SLA - Self Learning Assessment, TH-Theory, PR-Practical, OR-Oral   **Legends :** @ 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+TL+LL+SL)Hrs. x 15 Weeks
5. 1 credit is equivalent to 30 Notional Hrs.
6. ^ Self learning hours shall not be reflected in the Time Table.
7. SA-PR,SA-OR: Assessed by Internal and External Examiners Jointly   FA-PR, SLA: Assessed by Internal Examiner Only
Course Category : Discipline Specific Course Core (DSC) : 3, Discipline Specific Elective (DSE) : 1, Value Education Course (VEC) : 0, Intern./Apprenti./Project./Community (INP) : 1, Ability Enhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 0, Generic Elective (GE) : 0

Head of Department   Controller of Examination   Secretary CDC   Principal

COMPUTER ENGINEERING DEPARTMENT

1. COURSE DETAILS

Programme: IT / CSE	**Semester: IV/ V**
Course: #Cloud Services & Application	**Course Category: DSC**
Course Code: CSA238930	**Duration:16 Weeks**

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme					Assessment Scheme							
Actual Contact Hrs./Week			Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Credits	Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL		Based on Self Learning	Total Marks
									Practical (Marks)			
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR	SLA (Marks)	
04	-	02	-	03	03	30	70	100	50	-	25	-	175

3. COURSE OBJECTIVE

Cloud computing is perhaps the most flamboyant technological innovation of the 21st century. Cloud Computing is not just a technological shift; it is a strategic imperative that aligns with the core objectives of modern businesses. From optimizing costs and providing scalability to ensuring data security, accessibility, and fostering innovation, Cloud Computing is the catalyst for a transformative journey into the future.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME
- **Write Cloud Application and Deploy cloud environment**
- **Integrate various services of cloud**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Explain computing types and implement virtualization
CO2	Recognize the need of appropriate cloud model and services
CO3	Use various services to provide cloud-based solutions
CO4	Implement containerization
CO5	Describe recent trends in cloud computing

COMPUTER ENGINEERING DEPARTMENT

6. CO-PO, CO- PSO MAPPING TABLE - Information Technology

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Cloud Services & Application (CSA238930)	CO1	3	1	1	2	-	1	2	-	3
	CO2	3	1	1	2	-	1	2	-	3
	CO3	3	2	2	2	2	2	3	-	3
	CO4	3	1	2	2	1	1	1	-	3
	CO5	3	1	-	-	1	-	1	-	3
	CO Avg.	**3**	**1.2**	**1.5**	**2**	**1.33**	**1.25**	**1.8**	**-**	**3**

CO-PO, CO- PSO MAPPING TABLE - Computer Engineering

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Cloud Services & Application (CLD238930)	CO1	3	1	1	2	-	1	2	-	3
	CO2	3	1	1	2	-	1	2	-	3
	CO3	3	2	2	2	2	2	3	-	3
	CO4	3	1	2	2	1	1	1	-	3
	CO5	3	1	-	-	1	-	1	-	3
	CO Avg.	**3**	**1.2**	**1.5**	**2**	**1.33**	**1.25**	**1.8**	**-**	**3**

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic
I	**Principles of computing & Virtualization** 1.1 Eras of Computing 1.2 Parallel v/s distributed computing, Elements of Parallel Computing, Elements of distributed computing, 1.3 Technologies for distributed computing 1.4 Introduction, Characteristics of virtualized environment, Type 1, and Type 2 Hypervisors 1.5 Virtualization Technology Providers: VMware, Oracle Virtual Box, Microsoft Hyper-V, KVM, Xen 1.6 VM Migration, VM consolidation, VM Management, advantages & disadvantages of virtualization
II	**Introduction to Cloud Computing** 2.1 NIST definition of cloud Computing, Essential characteristics of cloud computing 2.2 Cloud Deployment Model: Public cloud, Private cloud, Community cloud, Hybrid cloud, Open Source & Closed clouds 2.3 Cloud Service Models: IaaS, PaaS, SaaS, architecture and anatomy of cloud computing, cloud computing infrastructure, cloud economics and benefits 2.4 Cost Metrics and Pricing Models: Business Cost Metrics, Cloud Usage Cost Metrics, Cost Management Considerations, Service Quality Metrics and SLAs Industrial Cloud Platforms: Amazon Web Services, Google App Engine, Microsoft Azure
III	**Cloud Platform** 3.1 **Infrastructure Services**: Elastic Cloud Computing (EC2), Cloud Data Network (CDN)-Cloud Front, Elastic Load Balancers (ELB) 3.2 **Storage Services:** Simple Storage Service(S3), Deploying static website on S3, Command Line tool 3.3 **Database Services:** RDS, Dynamo DB 3.4 **Network Services:** VPC components: CIDR block, public & private subnet, routing tables, security group, Network Access Control Layer (NACL), problems/case study on designing VPC 3.5 **API Services:** AWS APIs interaction with AWS service, establish connectivity between own modules in the cloud using RESTful Web Services i.e. serverless deployment, Lambda function 3.6 **Security Services:** Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO) 3.7 **Monitoring Services:** Cloud Watch, AWS CloudTrail, Cloud Zero, Data Dog, Security Hub
IV	**Containerization** 4.1 Container platform, Container Vs Virtualization, function as a service, event-based processing 4.2 Deploying Containers Docker and Kubernetes on cloud
V	**Recent trends and development** 5.1 Cloud trends in supporting Ubiquitous Computing, Enabling Technologies with the Internet of Things (RFID, Sensor Networks and ZigBee Technologies, PS) , Innovative Applications with the Internet of Things(Ex: Smart Buildings and Smart Power Grid) 5.2 Future of Cloud-Based smart Devices, Faster time to Market for Software Applications, Home Based Cloud Computing, Energy Aware Cloud

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum no of –10 Experiments/assignments/drawings.

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	CO
1	To implement virtual machine using EC2.	2	CO1
2	To install and configure AWS CLI	2	CO1
3	To host a web application using PHP on EC2	2	CO1
4	To host a web application using EC2 and ELB	2	CO3
5	To create bucket and uploading resources on S3 using AWS console and S3 command tool.	2	CO3
6	To implement Virtual Private Cloud	2	CO3
7	To create an API of random password/OTP generator using Serverless Lambda and AWS API Gateway	2	CO3
8	To create users, groups, policies, and roles using Internet Access Management (IAM)	2	CO3
9	To send an email & SMS using AWS Simple Notification Service (SNS)	2	CO3
10	To deploy a docker/Kubernetes based app on cloud	2	CO4
11	To deploy resources on Open-Source Cloud. (OpenStack/Apache Cloud Stack/Open Nebula)	4	CO2
12	To deploy Fire Store based app on Google App Engine.	2	CO2
13	To deploy resources on Microsoft Azure	2	CO2
14	To monitor and analyze real time data of various sensors on cloud	2	CO5
	TOTAL	**30**	

9. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments
3. Guest/Expert lectures
4. Industry Visit
5. Demonstrations
6. Slides
7. Self-Learning Online Resources

10. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Virtualization for Dummies, Wiley Publication	Bernard Golden	Wiley
2	Cloud Computing Principles and Paradigms	Rajkumar Buyya	Wiley
3	Programming Amazon EC2	Flavia Paganelli and Jurg van Vliet	O'reilly
4	Cloud Computing Bible	Barrie Sosinsky	Wiley

11. LEARNING WEBSITE & PORTALS
1.www.aws.amazon.com
2.http://www.nist.gov
3.https://www.ibm.com/cloud
4.https://docs.openstack.org/mitaka/install-guide-ubuntu/horizon-install.html
5.https://tutorialsdojo.com/aws-identity-and-access-management-iam/

12. ASSESMENT METHODOLOGIES/TOOLS
Formative Assessment (Assessment for Learning)
1. Test
2. Rubrics for COs Assignment
3. Self-Learning
4. Term Work
5. Seminar/Presentation

Summative Assessment (Assessment of Learning)
1. End Term Exam
2. Oral Examination

13. SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE (Specification Table)

Unit No.	Unit Title	Aligned COs	Learning Hours	R Level	U Level	A Level	Total Marks
I	Principles of computing & Virtualization	CO1	12	4	6	-	10
II	Introduction to Cloud Computing	CO2	06	6	8	-	14
III	Cloud Platform	CO3	28	4	8	14	26
IV	Containerization	CO4	06	2	-	6	8
V	Recent trends and development	CO5	08	2	4	6	12
GRAND TOTAL			60	18	26	26	70

R Remember, U Understand, A Apply and above, (Bloom's revised taxonomy levels)
NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mr. Manishkumar R Solanki
2	Internal	Mrs. Krishna Bhatt
3	External	Mr. Tejas J Shah
		Practice Manager – Talent Transformation, Wipro Limited

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

COMPUTER ENGINEERING DEPARTMENT

1. COURSE DETAILS

Programme: Computer Engineering	Semester: V
Course: #Machine Learning & Tools	Group: DSC
Course Code: MLT230811	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme					Assessment Scheme							
Actual Contact Hrs./Week			Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Credits	Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
									Practical (Marks)				
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR	SLA (Marks)	
4	-	2	02	4	3	30	70	100	25	-	25	25	175

3. COURSE OBJECTIVE

Machine learning (ML) is a branch of Artificial Intelligence (AI) that enables computers to "self-learn" from training data and improve over time, without being explicitly programmed. Machine learning algorithms are able to detect patterns in data and learn from them, in order to make their own predictions.

At the end of the course the students should be able to design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- **Design and apply various machine learning algorithms.**
- **Execute machine learning algorithms on data sets to get better insight.**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Recognize the need of machine learning in real-world problems and classify machine learning algorithms
CO2	Use machine learning libraries effectively.
CO3	Develop a model using supervised/unsupervised machine learning algorithms for regression/ classification/ clustering
CO4	Acquire an in-depth understanding of Ensemble learning methods.

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Machine Learning & Tools MLT230811	CO1	3	2	1	1	1	-	2	2	2
	CO2	1	2	3	2	1	1	2	1	1
	CO3	2	2	3	2	1	1	1	2	2
	CO4	3	2	2	2	1	1	1	1	1
	CO Avg.	2.25	2	2.25	1.75	1	1	1.5	1.5	1.5

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic
I	**Introduction to Machine Learning:** 1.1 Machine Learning, Need of Machine Learning, Issues in Machine Learning, Application of Machine Learning, steps in developing a Machine Learning Application. 1.2 Categories of Machine Learning i.e., Supervised Learning, Unsupervised Learning, Reinforcement Learning. 1.3 Split Data in Machine Learning: Training Data, Validation Data, and Testing Data 1.4 Machine Learning Basic Concepts i.e., count, mean, median, mode, standard deviation, importing data, model, training a model, testing a model 1.5 Performance Metrics: Mean Absolute Error (MAE), Root Mean Squared Error.
II	**Machine Learning Libraries** 2.1 NumPy: Arrays, ndarray, operations, Random Number Generation 2.2 SciPy: Mathematical constants and functions, Statistical functions, Linear Algebra, I/P and O/P of data 2.3 Matplotlib: Plots, Histograms, Error charts, Power spectra, Bar charts, Scatter Plots 2.4 Pandas: Reading from files with CSV, XLSX, TXT among other formats, aligning data and dealing with missing data DataFrame, Filtering data around a condition, Analysing time series 2.5 Seaborn: Importing Libraries, Importing Datasets, Color Pallet, Statistical Estimation, Categorical Plots 2.6 Scikit-Learn: Importing Data, training and testing data, algorithm functions
III	**Supervised Learning** 3.1 Introduction of regression, Introduction, correlation Coefficients, Cost function, Coefficient of Determination, Analysis of Linear Regression using dummy Data.

	Regression algorithms: Simple linear regression, Multiple linear regression, Logistic regression. 3.2 Introduction of classification, Classification model and learning steps, Classification algorithms: Naïve Bayes classifier: Bayes Theorem, Working of Naive Bayes' Classifier, Types of Naive Bayes Model, Implementation of Naive Bayes algorithm. 3.3 k-Nearest Neighbour (kNN) Working, Choosing K, algorithm and Implementation 3.4 Building Decision Trees, Deciding Feature to Split on, information gain, Gini Index 3.5 Support Vector Machines: separable case, non-separable case, Linear SVM, algorithm and implementation 3.6 Performance Metrics: Confusion Matrix, Kappa Statistics, Sensitivity, Specificity, Precision
IV	**Unsupervised Learning** 4.1 Clustering and its types 4.2 Partitioning method:k-Means and K-Medoids, Introduction, working of algorithm, Euclidean Distance, classify items, find means, find clusters, algorithm and implementation 4.3 Hierarchical clustering and its types(AHC and DHC), selecting centroids, assigning points to the nearest cluster centroids, Calculate the centroid of newly formed clusters 4.4 Density-based methods – DBSCAN
V	**Ensemble Learning** 5.1Understanding Ensembles, K-fold cross-validation Ensemble methods- Bagging, Subagging, Boosting and stacking 5.2 Bagging, Subagging, Random Forest, Comparison with Boosting, Different ways to combine classifiers. 5.3 Random forests: Introduction, Data Bagging, and Feature Selection. 5.4 Regression using decision Trees and Random Forest.

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum no of 10 Experiments/assignments

Sr. No.	Title of Assignment	Approx.Hrs required	COs
1	To perform the basic array operations with the Numpy Library	2	CO2
2	To practice data frame and file operations with the pandas library.	2	CO2
3	To visualize data using the matplotlib library and seaborn visualization commands.	2	CO2
4	To perform data cleaning and transformation operations using the Numpy and pandas libraries.	2	CO2

5	To calculate the mean, and standard deviation of statistical data using Python.	2	CO1
6	To predict Diamond on Price Prediction Dataset using linear regression.	4	CO3
7	To predict whether a customer will default or not on the credit card dataset using logistic regression.	2	CO3
8	Implement decision tree algorithm. a. Read the dataset from the CSV file. b. Provide the corresponding expression of class.	2	CO3
9	Implement the Naive Bayes algorithm. a. Read the dataset from the CSV file. b. Demonstrate intermediate calculations of algorithms.	4	CO3
10	Load breast-cancer Classification dataset, and run advanced classification algorithms using the WEKA tool.	2	CO3
11	To perform Mushroom classification into number of species, take any dataset using k-means clustering.	2	CO3
12	To perform Mushroom classification into number of species, take any dataset using k-means clustering.	2	CO3
13	To implement Ensemble learning (bagging/boosting)	2	CO4
	TOTAL	**30**	

9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING):

Assessment to be based on one of the following tools and rubrics for evaluation of SLA to be well defined by course teacher.

1. Mini project Presentation
2. Assignment
3. Quiz

10. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Guest/Expert lectures
4. Demonstrations
5. Slides
6. Self-Learning Online Resources

11. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Introduction to Machine Learning	Ethem Alpaydın, PHI,	Third Edition
2	Machine Learning An Algorithmic Perspective	Stephen Marsland	CRC Press publication
3	Introduction to Machine Learning with Python: A Guide for Data Scientists	Andreas C. Müller, Sarah Guido	O'Reilly
4	Machine Learning in Action Peter Harrington Manning	Machine Learning in Action Peter Harrington Manning	Machine Learning in Action Peter Harrington Manning
5	Python for Data Analytics	Wes McKinney	O'Reilly

12. LEARNING WEBSITE & PORTALS

1. https://python-course.eu/machine-learning
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners
4.https://data-flair.training/blogs/train-test-set-in-python-ml
5..https://www.geeksforgeeks.org/machine-learning/

13.ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Rubrics for COs Assignment
2. Self-Learning
3. Term Work
4. Seminar/Presentation

Summative Assessment (Assessment of Learning)

3. End Term Exam

14. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr.NO	Topic	Aligned COs	Teaching Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I.	Introduction to Machine Learning	CO1	5	4	4	-	8
II.	Machine Learning Libraries	CO2	10	4	4	4	12
III.	Supervised Learning	CO3	20	2	4	18	24
IV.	Unsupervised Learning	CO3	14	4	4	8	16
V.	Ensemble Learning	CO4	11	2	2	6	10
	GRAND TOTAL		60	16	18	36	70

R: Remembering   U: Understanding A: Applying (Bloom's revised Taxonomy levels) Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of CO. The actual distribution of marks at different taxonomy levels (R, U, A) in question paper may vary from above table.

15. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Pradnya Natekar
2	Internal	Mr. Siddhesh Masurkar
3	External	Mr. Manthan Desai Organization: Manager(AVP) in Accenture-Data Management CoE

1. COURSE DETAILS

Programme: Computer Engineering	**Semester: V**
Course: #Project	**Group: INP**
Course Code: PRO230812	**Duration:16 Weeks**

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme					Assessment Scheme								
Actual Contact Hrs./Week			**Self-Learning (SL^) (Term Work + Assignment) (Hrs)**	**Credits**	**Paper Duration (Hrs.)**	**Theory (Marks)**			**Based on LL & TL**			**Based on Self Learning**	**Total Marks**
									Practical (Marks)				
CL	**TL**	**LL**				**FA-TH**	**SA-TH**	**Total**	**FA-PR**	**SA-PR**	**SA-OR**	**SLA (Marks)**	
-	-	6	-	3	-	-	-	-	50	-	50	-	100

3. COURSE OBJECTIVE

To develop a project to give an in depth understanding of all the concepts learnt at the lower semesters. To expose students to the various stages of making a project and the capability to work in a team

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- **Design and develop Hardware and/or Software system**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Identify problem definitions that can be addressed by applying the acquired knowledge & skill
CO2	Plan the activities with timeline chart, work in groups/team and co-ordinate the work
CO3	Select design methodologies & its implementation.
CO4	Write the Project Report

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Project **PRO230812**	CO1	1	3	1	1	1	-	2	2	2
	CO2	-	2	3	2	1	1	2	1	1
	CO3	-	2	3	2	1	1	1	2	2
	CO4	-	-	2	2	1	1	1	1	1
	CO Avg.	1	2.33	2.25	1.75	1	1	1.5	1.5	1.5

7. COURSE CONTENTS

A) Project synopsis

Abstract

Chapter 1. Problem statement

Chapter 2. System requirement specification

Chapter 3. Proposed system/solution

Chapter 4. Estimation and planning

Chapter 5. Future scope

Chapter 6. Conclusion

Bibliography and References

B) Project Report

The report shall be presented in following sequence:

Title sheet

Project Certificate

Project approval sheet

Acknowledgement

Abstract

Table of contents

List of tables (if desired)

List of Figures (if desired)

Chapter 1: Introduction (domain)

Chapter 2: Problem statement and proposed system (input /output statement, description, feasibility)

Chapter 3: Literature Review

Chapter 4: Design and Implementation (System Architecture, Requirement: hardware software any other , flow diagrams , activity diagrams, DFD , ER diagram if desired, User Interface)

Chapter 5: Result & Conclusions (Reports, future scope and limitation)

Bibliography and References

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

i.   In the preceding semester, the Head of Department notifies and briefs the students about project development, industry sponsored project, modification or value addition in previous project, project group formation, selection criteria and project scope. Students are asked to carry out the literature survey, review the latest technologies, look for emerging trends, list software platform available, refer previous project reports to prepare project proposals considering available time, cost, feasibility, environment, safety, standards, lab facility, ethics etc.

ii.   At the beginning of the semester the project groups present their ideas in front of HOD and faculty members.

iii.   Based on above criteria and relevance to contribution towards attainment of POs, the project topics are finalized group-wise and groups are allocated to faculties based on their area of expertise.

9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING):

i.   The students are asked to prepare and submit synopsis and detail implementation plan of 16 weeks to their respective guides.

ii.   Interaction between students and project guide to discuss implementation methodology.

iii.   The project guide monitors the progress of implementation on continuous basis.

iv.   Final evaluation of project by examiners through presentation, demonstration and viva-voce.

10. IMPLEMENTATION STRATEGY (PLANNING)

1. **Methodology to assess individual/collective contribution/understanding:**
a. Internal evaluation (50 marks) by project guide.

Phase-I: 30% evaluation

At the end of first month, all the groups are asked to give presentation on progress made till date in front of committee consisting of HOD and project guides. The projects are evaluated based on project idea, knowledge, amount of work done, adherence to plan at every stage, motivation, interest shown, demonstration of skills (hardware, software, presentation), self-motivation, sincerity, punctuality, ethics etc. by the project guide and project evaluation committee.

Phase-II: 30% evaluation

The above activity is carried out at the end of second month. The students are guided for preparation of project reports.

Phase III: 40% evaluation

The above activity is carried out at the end of the semester along with demo and submission of project report.

The internal evaluation will be done on the basis of following criteria and weightage:

	Phase 1 (2-4 Week)	Phase 2 (6- 8 Weeks)	Phase 3 (14-16 Week)	Total
Marks	15	15	20	50
Evaluation Criteria	1. Project idea 2. Presentation	1. Progress made in the project 2. Presentation	1. Progress made in implementation 2 Presentation	

The student/ group will maintain the weekly report to monitor the progress of the project.

b. External evaluation (50 marks) by expert from industry/institute (external examiner)

The students demonstrate the prototype/ working projects and give power point presentation in front of External examiner. Internal and external examiners evaluate the student on the following aspects:

   a. Understanding and completeness of the Project
   b. Approach to the solution of problem
   c. Planning and implementation
   d. Design and testing procedure
   e. Project Report
   f. Students' involvement in the Project

11. SUGGESTED LEARNING RESOURCES

Sr. No.	Faculty	NAME
1	Internal	Mrs. Prachi Arora
2	Internal	Mr. J. S. kulkarni
3	Internal	Mr. Pratik Shah
4	External	Mr. Harinder Salwan Managing Director at Tricom Multimedia Pvt Ltd

1. COURSE DETAILS

Programme: Computer Engineering	Semester: V
Course: # Software Development Methodology	Course Category: DSC
Course Code: SDM230813	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme					Assessment Scheme							
Actual Contact Hrs./Week			Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Credits	Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
									Practical (Marks)				
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR	SLA (Marks)	
4	-	2	02	4	3	30	70	100	25	-	25	25	175

3. COURSE OBJECTIVE

This course will help the students to understand the essentials of software development methodologies and testing.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- **Distinguish between different software development paradigms**
- **Familiarize with system analysis and design and testing techniques**
- **Classification of   software documentation and project management tools**
- **Preparation of SQA plan**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Describe software development paradigms
CO2	Analyze and design the system
CO3	Develop and test the system
CO4	Classify software documentation and project management tools
CO5	Prepare software quality assurance plan

6. CO-PO, CO- PSO MAPPING TABLE: Computer Engineering

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
# Software Development Methodology (SDM230813)	CO1	3	1	1	1	1	1	2	2	1
	CO2	3	3	3	2	1	2	2	2	1
	CO3	3	2	3	2	1	2	2	2	1
	CO4	3	1	1	1	1	3	2	2	1
	CO5	3	2	1	1	1	1	2	2	1
	CO Avg.	3	1.8	1.8	1.4	1	1.8	2	2	1

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic
I	**Software Engineering Fundamentals** 1.1 Definition of software, Software engineering 1.2 Software Development Life Cycle (SDLC) process & Phases 1.3 Software development paradigms – Waterfall, Prototype, Incremental, Spiral 1.4 Agile Software Development Agile software development methods Agile manifesto and principles, agile framework, scrum 1.5 Strengths and weaknesses of traditional software development models 1.6 Comparison between the agile and other software development methods
II	**System Analysis and Design** **System Analysis** 2.1 Preliminary Survey, Feasibility study 2.2 SRS – characteristics, structure, case study 2.4 Formal specification methods in SRS – Structured English, Regular Expression, Decision table 2.5 **Role of System Analyst** Role of systems analyst in SDLC attributes of a systems analyst Task performed by System Analyst **System Design** 2.6 Data Flow Diagram, Structure chart 2.7 System Design Specifications 2.8 Detailed design Specifications

III	**Software Coding** 3.1 Choice of Programming Languages 3.2 Coding Standard and guidelines 3.3 Mixed language programming 3.4 COCOMO Model
IV	**Software Testing** 4.1 Software Testing Fundamentals 4.2 Testing Principles and Objectives 4.3 Types of Software Testing 4.4 Unit Testing 4.5 Integration Testing 4.6 Regression Testing 4.7 Black Box and White Box Testing 4.8 Validation testing – Alpha and Beta Testing
V	**Software Documentation and Project Management** 5.1 Introduction to software documentation 5.2 Design documentation, user documentation for Training, operations documentation, User Reference documentation 5.3 Software documentation using UML Diagram-Structural, behavioral and architectural 5.4 Significance of software project management 5.5 Different project management tools 5.6 Project Scheduling – Basic principle, Work break down structure, Activity network & critical path method 5.7 Scheduling technique – CRM, PERT
VI	**Software Quality Assurance** 6.1 Reliability Analysis 6.2 Reliability Metrics 6.3 Software Quality, Quality Control, Quality Assurance 6.4 SQA – Importance, SQA Activities – Phases of SQA 6.5 Quality evaluation standards – Six sigma, ISO for software, SEICMM- levels, KPA of Software Organization

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum no of 10 Experiments

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	CO
1	Define problem statement for the selected project & write activities for the project with relevant software development model(s)	02	CO1
2	To Prepare SRS for the selected project	02	CO2
3	To Construct DFD, Structure chart & Decision table for the selected project	04	CO2
4	To develop timeline chart/ Gantt chart/ PERT for tracking the progress of the project	02	CO2

5	To implement the modules of the selected project	04	CO3
6	Estimate cost of the project using Constructive Cost Model (COCOMO) approach for the selected project	02	CO3
7	To write test cases to validate requirements of project from SRS document	04	CO4
8	To generate bug report using bug tracking tool	02	CO4
9	Write Test Cases for any Application (e.g., Railway Reservation)	02	CO4
10	Design test cases for e-commerce website. (Login form)	04	CO4
11	To prepare SQA plan for quality of process and product	02	CO5
	TOTAL	**30**	

9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING):

Assessment to be based on one of the following tools and rubrics for evaluation of SLA to be well defined by course teacher.

1. Mini project Presentation
2. Assignment
3. Quiz

10. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Guest/Expert lectures
4. Slides
5. Self-Learning Online Resources

11. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Software Engineering: A Practitioners Approach	Pressman Roger	Tata McGraw Hill
2	An Integrated approach to Software engineering	Jalota Pankaj	Narosa Publication
3	Software Testing: Principles and Practice	Srinivasan Desikan, Gopalaswamy Rames	Pearson India
4	Fundamentals of Software Testing	Bernard Homès	Wiley Publications
5	Software Project Management	Bob Hughes And Mike Cotterell	Tata Mcgraw Hill Edition

12. LEARNING WEBSITE & PORTALS

1. http:// www.idc-online.com/resources/technical-references/information-technology-technical-references.html
2. http:// www.minigranth.com/software-engineering-tutorial/case-tools/
3. https://www.javatpoint.com/software-project-management-activities
4. https://www.toolsqa.com/
5. http:// www.rspa.com

13.ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Rubrics for COs Assignment
2. Term Work
3. Seminar/Presentation

Summative Assessment (Assessment of Learning)

1. End Term Exam

14. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Aligned COs	Teaching Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I	Software Engineering Fundamentals	CO1	10	05	05	--	10
II	System Analysis and Design	CO2	10	04	04	04	12
III	Software Coding	CO3	10	06	04	02	12
IV	Software Testing	CO3	10	04	04	04	12
V	Software Documentation and Project Management	CO4	10	06	04	02	12
VI	Software Quality Assurance	CO5	10	04	04	04	12
GRAND TOTAL			60	29	25	16	70

R Remember, U Understand, A Apply and above, (Bloom's revised taxonomy levels)
NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

COMPUTER ENGINEERING DEPARTMENT

15. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mrs. Geetha.S
2	Internal	Ms. Neha More
3	External	Mr. Milind Ugale
		Organization: Infinite IT Solutions Pvt. Ltd.

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

COMPUTER ENGINEERING DEPARTMENT

1. COURSE DETAILS

Programme: Computer Engineering	**Semester: V**
Course: # Full Stack Web Development	**Course Category: DSE**
Course Code: FSD230814	**Duration:16 Weeks**

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme						Assessment Scheme							
Actual Contact Hrs./Week			Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Credits	Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
									Practical (Marks)				
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR	SLA (Marks)	
4	-	2	-	3	3	30	70	100	50	25	-	-	175

3. COURSE OBJECTIVE

This course will equip students with the necessary skills to become proficient Full Stack developers, preparing them for industry roles and freelance opportunities.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME
- **Build dynamic and responsive user interfaces using React.js**
- **Design and manage NoSQL databases using MongoDB and Mongoose ORM.**
- **Connect front-end and back-end applications through APIs and real-time data handling and deploy them**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Use JavaScript concepts to build foundation of Full Stack Development
CO2	Build interactive front-end applications using React
CO3	Develop server-side applications using Node.js and Express.js
CO4	Manage databases using MongoDB, performing CRUD operations, schema design, aggregation, and optimization techniques
CO5	Deploy MERN applications using cloud platforms and DevOps practices

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Full Stack Web Development (FSD230814)	CO1	3	3	3	2	1	2	2	3	_
	CO2	3	3	3	3	1	2	2	3	_
	CO3	3	3	3	3	1	2	2	3	_
	CO4	3	3	3	3	1	2	2	3	_
	CO5	3	3	3	3	1	2	2	3	_
	CO Avg.	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	_

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic
I	**Introduction to Web Development** **1.1 Overview of Web Development** • Understanding Client-Server Architecture • Introduction to APIs and Databases **1.2 Core JavaScript Concepts** • JavaScript Basics: Variables, Data Types, Operators • Functions, Scope & Closures • Arrays & Objects, Destructuring, Spread Operator • ES6+ Features (Arrow Functions, Template Literals, Modules) • DOM Manipulation & Events **1.3 Advanced JavaScript** • Asynchronous JavaScript: Callbacks, Promises, Async/Await • JavaScript Modules & Import/Export
II	**Frontend Framework** **2.1 React Basics** Introduction to React.js & Virtual DOM • React Components & JSX • Props vs State • React Event Handling **2.2 React Advanced Concepts** • React Hooks (useState, useEffect, useContext)

III	• React Router (Navigation & Routing) • Fetching Data from APIs (REST & GraphQL) **2.3 State Management & UI Frameworks** • Global State Management with Redux • Context API vs Redux • UI Libraries: Material-UI, Bootstrap, Tailwind CSS
III	**Backend Development with Node.js & Express.js** **3.1 Node.js & Express.js Basics** • Introduction to Node.js & NPM • Creating a Web Server with Express.js • Middleware & Routing **3.2 REST API Development** • Building a CRUD API with Express.js • Authentication & Authorization (JWT, OAuth) • File Handling & Multer **3.3 Error Handling & Security** • Error Handling & Debugging • Web Security Best Practices (CORS, CSRF, SQL Injection, XSS)
IV	**Database Management with MongoDB** **4.1 MongoDB Basics** • NoSQL vs SQL Databases • CRUD Operations in MongoDB • Schema Design with Mongoose **4.2 Advanced MongoDB & Database Optimization** Aggregation Framework • Indexing & Performance Optimization • Relationships & Data Modelling
V	**Deployment & DevOps** 5.1 Version Control with Git & GitHub 5.2 CI/CD Basics (GitHub Actions, Docker) 5.3 Deploying Frontend (Vercel, Netlify) & Backend (Heroku, AWS, DigitalOcean) 5.4 Environment Variables & Config Management 5.5 Full Stack App Development Lifecycle 5.6 Industry Best Practices in MERN Development 5.7 Case Studies of Real-World MERN Applications

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum no of 10 Experiments

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	CO
1	Install and configure VS Code, Git, Node.js, and MongoDB to set up a development environment	2	CO1
2	Write JavaScript programs using variables, functions, and ES7+ features.	2	CO1
3	Implement DOM manipulation techniques (event handling, dynamic elements).	2	CO1
4	Implement callbacks, promises, and async/await to fetch data from a public API and display results dynamically.	2	CO2
5	Develop a React app with functional components, JSX, props, and state to display dynamic content.	2	CO2
6	Create a multi-page React app with navigation using React Router.	4	CO2
7	Use useState, useEffect to manage global and local state.	2	CO3
8	Develop a CRUD API with Express.js and test endpoints using Postman.	2	CO3
9	Implement secure user authentication and protected routes using JSON Web Tokens (JWT).	2	CO4
10	Perform CRUD Operations in MongoDB using Mongoose	2	CO4
11	Implement Git branching, pull requests, and automate deployment using GitHub Actions.	2	CO5
12	Deploy a MERN stack project on Vercel (frontend) and Heroku/AWS (backend), managing environment variables.	2	CO5
13.	*Mini Project	4	CO1-CO5
	TOTAL	30	

9. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Industry visit
4. Guest/Expert lectures
5. Demonstrations
6. Slides
7. Self-Learning Online Resources

10. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	MERN Stack Development: Build Full-Stack Applications	Shama Hoque	Packt Publishing
2	Learning React	Alex Banks, Eve Porcello	O'Reilly Media
3	Node.js Design Patterns	Mario Casciaro, Luciano Mammino	Packt Publishing
4	MongoDB: The Definitive Guide	Shannon Bradshaw, Eoin Brazil	O'Reilly Media

11 LEARNING WEBSITE & PORTALS

1. React.js Docs – https://react.dev/
2. Node.js Docs – https://nodejs.org/en/docs/
3. Express.js Docs – https://expressjs.com/
4. MongoDB Docs – https://www.mongodb.com/docs/

12. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Term Work

Summative Assessment (Assessment of Learning)

1. End Term Exam

13. SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE (Specification Table)

Unit No.	Unit Title	Aligned COs	Learning Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I	Introduction to Web Development	CO1	8	4	4	4	12
II	Frontend Framework	CO2	15	4	4	10	18
III	Backend Development with Node.js & Express.js	CO3	15	4	4	8	16
IV	Database Management with MongoDB	CO4	12	3	3	8	14
V	Deployment & DevOps	CO5	10	2	4	4	10

GRAND TOTAL	**60**	17	19	34	**70**

R Remember, U Understand, A Apply and above, (Bloom's revised taxonomy levels)
NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Priti Bokariya
2	Internal	Ms. Neha I. More
3	External	Ms. Madhuri Rokade
		Organization: System Analyst, Bitwise Global

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

COMPUTER ENGINEERING DEPARTMENT

1. COURSE DETAILS

Programme: Computer Engineering	Semester: V
Course: #Business Analytics	Course Category: DSE
Course Code: BSA230815	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme						Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Credits	Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks	
									Practical (Marks)					
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR	SLA (Marks)		
4	-	2	-	3	3	30	70	100	50	25	-	-	175	

3. COURSE OBJECTIVE

This course aims to provide students with an understanding of business analytics principles, methodologies and data-driven decision-making. Students will learn various analytics techniques used in business intelligence to support decision-making processes in different industries.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- **Develop and apply business analytics models for decision-making.**
- **Use data visualization tools for analysis and insights.**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Describe importance of Business Analytics
CO2	Apply analysis techniques to datasets in excel
CO3	Acquire basic fundamentals of R language
CO4	Perform data analytics and visualization using R
CO5	Implement data visualization techniques for better business insights
CO6	Develop a business analytics model using industry-standard tools

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Business Analytics (BSA230815)	CO1	3	2	1	1	-	1	2	1	-
	CO2	3	3	2	2	2	1	2	3	-
	CO3	3	2	2	1	-	1	2	2	-
	CO4	3	3	2	1	2	1	2	3	-
	CO5	3	2	2	1	3	1	2	3	-
	CO6	2	3	2	1	1	1	1	3	-
	CO Avg.	2.83	2.5	1.83	1.16	1.33	1	1.83	2.5	-

6. CO-PO, CO- PSO MAPPING TABLE

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic
I	**Introduction to Business Analytics** 1.1 Business Analytics: Overview and Importance 1.2 Types of Business Analytics: Descriptive, Predictive, Prescriptive 1.3 Business Intelligence vs. Business Analytics 1.4 Data-Driven Decision Making 1.5 Case Studies in Business Analytics
II	**Data Analytics with Excel** 2.1 Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs 2.2 Working with Data: Importing data, Data Entry & Manipulation, Sorting &Filtering, Data Validation, Pivot Tables & Pivot Charts 2.3 Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs 2.4 Cleaning Data with Text Functions, Date and Time values 2.5 Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis, Working with multiple sheets.

III	**Introduction to R Programming** 3.1 The R Environment 3.2 The Popularity of R by Industry 3.3 Installation, R packages, Vector in R, Data types in R 3.4 Functions in R Programming 3.5 Data Structures in R	
IV	**Data Analytics and Visualization with R** 4.1 Use Cases of Business Data Visualization 4.2 Data Cleaning and transformation using dplyr library 4.3 Basic Graphs and their Purposes 4.4 R Packages for Data Visualization 4.5 Ggplot2, Bar Graph using ggplot2 4.6 Line Plot using ggplot2 in R	
V	**Business Intelligence with Power BI** 5.1 Data Visualization Principles and types 5.2 Dashboards , Creating Dashboards in Power BI 5.2 Tools: Tableau, Power BI 5.3 BI –Importance, Advantages and Disadvantages 5.4 Environmental Factors Affecting Business Intelligence 5.5 Recent Trends in Business Intelligence and Applications	
VI	**Industry Applications of Business Analytics** 6.1 Applications in Marketing and Sales 6.2 Applications in Finance and Risk Management 6.3 Applications in Operations and Supply Chain 6.4 Ethical and Legal Considerations in Business Analytics 6.5 Future Trends in Business Analytics	

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum no of
10 experiments/assignments/drawings

Sr. No.	Title of Experiments	Approx. Hrs. required	CO
1.	To clean data using MS Excel through Text Functions, Date and Time Values	2	CO2
2.	To practice essential data analytics functions of MS Excel.	2	CO2
3.	To perform Data analytics using Look up, pivot tables and What if analysis in MS Excel.	2	CO2

4.	To implement various functions and data structures in R	2	CO3
5.	To import, clean and transform raw data using R	2	CO4
6.	To perform data manipulation using dplyr library of R	2	CO4
7.	To perform data visualization with ggplot2.	2	CO4
8.	To perform data transformation in Power BI	2	CO5
9.	To perform data Analytics by applying various filters in Power BI	2	CO5
10.	To visualize data by creating Bar Chart, Line Chart, Pie Chart, Histogram, Crosstab, Box Plot, Bubble Chart, etc. in Power BI	4	CO5
11.	To generate and publish dashboards and reports using Power BI	4	CO5
12.	Case study: Applications on Business Analytics	2	CO6
13	Comparative Study of Descriptive, Predictive & Prescriptive Analytics	2	CO1
	Total	**30**	

9. IMPLEMENTATION STRATEGY (PLANNING)
1. Teaching Plan
2. Minimum no of practical/assignments
3. Guest/Expert lectures
4. Slides
5. Self-Learning Online Resources

10. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1.	Business Analytics	Dr. Mohmd Imran Khan	Lovely Professional
2.	Power BI Data Analysis and Visualization	Suren Machiraju, Suraj Gaurav	DEG PRESS
3.	Introducing Microsoft Power BI	Alberto ferari and Macro Russo	Microsoft Press
4.	Data Analysis with Excel	Manisha Nigam	BPB
5.	Data Analysis with R	Anthony Fischetti	Packt

11. LEARNING WEBSITE & PORTALS

1. https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel
2. https://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science scratch/
3. https://www.geeksforgeeks.org/power-bi-tutorial/?ref=lbp
4. https://www.techtarget.com/searchcontentmanagement/definition/Microsoft-Power-BI
5. https://www.projectpro.io/article/power-bi-microsoft-projects-examples-and-ideas-forpractice/

12. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Self-Learning
4. Term Work
5. Seminar/Presentation

Summative Assessment (Assessment of Learning)

1. End Term Exam
2. Tutorial Performance

13. SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE (Specification Table)

Unit No.	Unit Title	Aligned COs	Learning Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I	Introduction to Business Analytics	CO1	4	4	2	-	6
II	Data Analytics with Excel	CO2	10	2	2	8	12
III	Introduction to R Programming	CO3	14	4	6	8	18
IV	Data Analytics and Visualization with R	CO4	14	4	6	6	16
V	Business Intelligence with Power BI	CO5	12	4	4	4	12
VI	Industry Applications of Business Analytics	CO6	6	2	2	2	6
GRAND TOTAL			**60**	**20**	**22**	**28**	**70**

R Remember, U Understand, A Apply and above, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mr. Akhilesh R Gupta
2	Internal	Mrs. Rupali Pawar
3	External	Mr. Vishal Sharma
		Data Scientist, Software Engineer, Esports Analyst

1. COURSE DETAILS

Programme: CSE	**Semester: V**
Course: #Blockchain Technology	**Course Category: DSE**
Course Code: BCT230816	**Duration:16 Weeks**

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme						Assessment Scheme							
Actual Contact Hrs./Week			Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Credits	Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
									Practical (Marks)				
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR	SLA (Marks)	
04	-	02	-	03	03	30	70	100	50	-	25	-	175

3. COURSE OBJECTIVE

After completion of this course the student will be able to describe the fundamentals of Block Chain Technology, explore the working of cryptocurrencies, analyze different blockchain consensus mechanisms and smart contracts to apply them in real world blockchain based applications.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- Understand cryptographic principles and implement consensus algorithms for decentralized applications.
- Create and deploy blockchain-based solutions using smart contracts.

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Acquire basic knowledge of Blockchain technology
CO2	Identify various block chain technologies and apply consensus mechanisms
CO3	Analyze the role of cryptographic principles in blockchain and evaluate the characteristics of cryptocurrency.
CO4	Describe security issues and challenges in Blockchain
CO5	Evaluate real-world applications of blockchain across various industries

6. CO-PO, CO- PSO MAPPING TABLE: Computer Engineering

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Blockchain Technology (BCT230816)	CO1	3	1	1	1	-	1	2	1	3
	CO2	3	3	2	2	-	1	2	1	3
	CO3	3	3	2	2	1	1	1	1	3
	CO4	3	3	2	1	1	1	1	1	2
	CO5	2	2	2	1	-	2	2	1	1
	CO Avg.	2.8	2.4	1.8	1.4	1	1.2	1.6	1	2.4

7. COURSE CONTENTS

Unit No.	TOPIC/Sub-Topic
I	**Introduction to Blockchain** 1.1 History and Evolution of Blockchain 1.2 Features of Blockchain 1.3 Life Cycle of Blockchain 1.4 Difference between Blockchain and Databases 1.5 Centralized, De-Centralized, and Distributed Systems 1.6 Types of Blockchain 1.7 Distributed Ledger Technology 1.8 Blockchain Ecosystem and Structure
II	**Blockchain Technology & Consensus Mechanisms** 2.1 Types of Blockchain Technology 2.2 Difference between public, private and federated blockchain, 2.3 Comparison of Blockchain characteristics 2.4 Blockchain requirement flowchart 2.5 Consensus Algorithm: introduction and objective, Types of Consensus Algorithm 2.6 Proof of Work and Proof of Stake, Proof of Burn, Proof of Authority 2.7 Blockchain Wallets: Introduction, Types, and Security

III	**Cryptographic Fundamentals and Cryptocurrency**
	3.1 Basics of Cryptography
	3.2 Hash Functions and Digital Signatures
	3.3 Public and Private Keys (Asymmetric Cryptography)
	3.4 Introduction to Cryptographic Algorithms (SHA-256, RSA, AES)
	3.5 Role of Cryptography in Blockchain
	3.6 Definition and Characteristics of Cryptocurrency
	3.7 Types of Cryptocurrencies (Bitcoin, Ethereum, Altcoins, Stablecoins)
	3.8 Cryptocurrency Exchanges and Trading
	3.9 Risks and Challenges of Cryptocurrency Adoption
IV	**Security Issues in Blockchain**
	4.1 Attacks on Blockchains such as Sybil attacks, selfish mining,
	4.2 51% attacks advent of algorand,
	4.3 Sharding based consensus algorithms to prevent these attacks.
	4.4 Ethereum and Smart Contracts: comparing Bitcoin scripting vs. Ethereum Smart Contracts
	4.5 Challenges and Scalability Issues in Blockchain
V	**Blockchain Applications and Challenges**
	5.1 Real-World Applications of Blockchain (Finance, Supply Chain, Healthcare, etc.)
	5.2 Future Trends and Advancements in Blockchain
	5.3. Use Cases of Blockchain Technology (Any 2)
	• Blockchain in Supply Chain
	• Blockchain in Manufacturing
	• Blockchain in Healthcare
	• Blockchain in Cyber security
	• Blockchain in Financial Industry
	• Blockchain in Higher Education Institutions

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum 10 no of experiments

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	CO
1.	Examine and document each stage in the lifecycle of a blockchain transaction from initiation to confirmation.	2	CO1
2.	To create account on test blockchain networks and mine blocks.	2	CO2
3.	To implement PoW algorithm for simulating mining in python	2	CO2
4.	To implement secret key/ public key cryptography techniques	2	CO 3
5.	To implement SHA-256.Hashing Techniques.	4	CO3
6.	To implement MD5 Hashing Techniques.	2	CO3
7.	To create and broadcast a transaction using web3.js in python	2	CO3
8.	To Create and deploy a smart contract using Solidity programming and Remix IDE.	4	CO4
9.	To Create a contract demonstrating Solidity data types and functions	2	CO4

10.	To Implement a contract to send and receive Ether	4	CO4
11.	Case study on bitcoin (Cryptocurrency).	2	CO5
12.	Case study on Blockchain enabled Website.	2	CO5
	TOTAL	**30**	

9. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Tutorials
2. Guest/Expert lectures
3. Slides
4. Case Study
5. Self-learning resources

10. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Blockchain For Dummies	Tiana Laurence	John Wiley & Sons
2	Blockchain :Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money	Mark Gates	Wise Fox Publishing and Mark Gates, 2017.
3	Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming	Josh Thompson	Create Space Independent Publishing Platform
4	Blockchain Technology: Cryptocurrency and Applications	S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan	Oxford University Press

11. LEARNING WEBSITE & PORTALS

1. https://ethereum.org/en/
2. https://web3js.readthedocs.io/en/v1.2.9/
3. https://studio.ethereum.org/
4. Centre of Excellence, IIT Bombay (https://isrdc.iitb.ac.in/blockchain/coe/areas.html).
5. Course Link by IIT Kanpur (https://www.cse.iitk.ac.in/pages/CS731.html

12. ASSESMENT METHODOLOGIES/TOOLS
Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Self-Learning
4. Term Work
5. Seminar/Presentation

Summative Assessment (Assessment of Learning)

1. End Term Exam

13. SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE
(Specification Table)

Unit No.	Unit Title	Aligned COs	Learning Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I	Introduction to Blockchain	CO1	10	8	4	-	**12**
II	Blockchain Technology & Consensus Mechanisms	CO2	14	4	4	8	**16**
III	Cryptographic Fundamentals and Cryptocurrency	CO3	18	6	6	8	**20**
IV	Security Issues in Blockchain	CO4	10	4	4	4	**12**
V	Blockchain Applications and Challenges	CO5	08	2	2	6	**10**
GRAND TOTAL			**60**	**24**	**20**	**26**	**70**

R Remember, U Understand, A Apply and above, (Bloom's revised taxonomy levels)
NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

14. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Sharyu Kadam
2	Internal	Ms. Priti Bokariya
3	External	Dr. Sagar Rane,
		Associate professor, Army Institute of Technology, Pune

1. COURSE DETAILS

Programme: Computer Engineering	Semester: V
Course: Entrepreneurship Development & Start Up	Course Category: AEC
Course Code: EDS230817	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme						Assessment Scheme							
Actual Contact Hrs./Week			Self-Learning (SL^) (Term Work + Assignment) (Hrs)	Credits	Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
									Practical (Marks)				
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR	SLA (Marks)	
03	-	02	01	03	03	30	70@	100	25	-	-	25	150

3. COURSE OBJECTIVE

Student will able to developed entrepreneurial abilities by providing background information about support systems, skill sets, financial and risk covering institutions and other for building an enterprise.

4. SKILL COMPETENCY

- **Develop project proposal for start-ups.**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Recognize the qualities of an entrepreneur.
CO2	Identify the business opportunity
CO3	Analyze the financial aspects for the Start-up
CO4	Develop marketing strategy.

6. CO-PO, CO- PSO MAPPING TABLE – Computer Engineering

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Entrepreneurship Development & Start Up (EDS230817)	CO1	3	2	2	-	1	1	2	1	1
	CO2	3	2	2	-	1	1	2	1	1
	CO3	2	3	1	2	1	2	2	1	1
	CO4	1	2	3	2	1	2	2	1	1
	CO Avg.	2.25	2.25	2	2	1	1.5	1	1	1

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic

I	**Introduction to Entrepreneurship and Start-up:**
	
	1.1 Definition of Entrepreneurship and Start-up
	1.2 Qualities of an entrepreneur.
	1.3 Functions of an entrepreneur
	1.4 Intrapreneurship
	1.5 Motivation: Understanding Motivation through Maslow's Need Hierarchy
	1.6 Roles of entrepreneurs and managers.
	1.7 Problems and Barriers faced by Entrepreneurs and Start-ups.
	1.8 Types of Business Structures for start-ups:
	    1.8.1 Sole Proprietorship
	    1.8.2 Partnership firm
	    1.8.3 One-person Company
	    1.8.4 Limited Liability Partnership
	    1.8.5 Private Limited Company
	    1.8.6 Public Limited Company

II	**Business/Start-up ideas: Generation and Evaluation**
	
	2.1 Business Idea Generation:
	    2.1.1 Creativity Process
	    2.1.2 Innovation
	    2.1.3 Value creation
	    2.1.4 Concept of Business Opportunity
	    2.1.5 Search for Business Opportunity
	2.2 Idea Evaluation:
	    2.2.1 Dynamics of Project Identification
	    2.2.2 Design thinking for finding solutions
	    2.2.3 SWOT analysis for business idea
	    2.2.4 Prototyping
	    2.2.5 Value proposition
	    2.2.6 Test marketing & Customer validation.

III	**Business Plan**
	3.1 Project Report and its contents
	    3.1.1 Information about entrepreneur
	    3.1.2 Information about project / business
	    3.1.3 Technical details of proposed project
	    3.1.4 Financial details of proposed project
	    3.1.5 CPM, PERT analysis & application
	    3.1.6 Analysis on profitability and return on investments
	    3.1.7 Supplementary information
	3.2 Project appraisal/feasibility
	    3.2.1 Steps in project appraisal
	    3.2.2 Aspects of project appraisal
	3.3 Business Location
	    3.3.1 Primary factors for deciding business location
	    3.3.2 Secondary factors for deciding business location
	3.4 Authorities to contact for Various Clearance Certificates.
	3.5 Study of balance sheet
	3.6 Taxation
	    3.6.1 GST
	    3.6.2 Income Tax

IV	**Institutional Support System for Micro, Small and Medium Enterprises:** 4.1 Small Industries Development Organization (SIDO) 4.2 National small Industries Corporation Limited (NSIC) 4.3 Small Scale Industries Board (SSIB) 4.4 India Investment Centre (IIC) 4.5 Micro, Small and Medium Enterprises – Development Institute (MSME- DI) 4.6 District Industries Centers (DIC) 4.7 Industrial Estates

V	**Startup Funding Stages and Institutional Finance to Entrepreneurs:**
	
	5.1 Startup Funding Stages:
	    5.1.1 Pre-Seed Funding: The bootstrapping stage
	    5.1.2 Seed Funding: Product development stage
	    5.1.3 Series A Funding: First round of VC
	    5.1.4 Series B Funding: Second round of VC
	    5.1.5 Series C Funding: Third round of VC
	    5.1.6 Series D Funding: Special round of funding
	    5.1.7 IPO: Stock market launch
	5.2 Institutional Finance to Entrepreneurs:
	    5.2.1 Industrial Development Bank of India (IDBI)
	    5.2.2 Life Insurance Corporation (LIC)
	    5.2.3 Small Industries Development Bank of India (SIDBI)
	    5.2.4 Khadi and Village Industries Commission (KVIC)

VI	**Marketing strategies for Enterprises and Start-ups**
	6.1 Market - Concept, Types
	6.2 Micro and Macro Market Environment
	6.3 Market Research - Concept, Importance and Process
	6.4 Marketing Mix
	6.5 Market segmentation
	6.6 Digital Marketing:
	    6.6.1 Search engine optimization
	    6.6.2 Online advertising
	    6.6.3 Social media marketing
	    6.6.4 Web analytics
	    6.6.5 Email marketing
	    6.6.6 Social media marketing

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS
Term Work consists of Journal containing minimum no of –10 Experiments/assignments/drawings.

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	CO
1.	Gather information on Entrepreneurship and Start-up	04	CO1
2.	Develop Business/Start-up ideas: Generation and Evaluation	02	CO2
3.	Prepare Business Plan: Case Study	04	CO2
4.	Classify Institutional Support System for Micro, Small and Medium Enterprises	02	CO3
5.	Identify Startup Funding Stages and Institutional Finance to Entrepreneurs	04	CO3
6.	Select Marketing strategies for Enterprises and Start-ups: Case Studies	02	CO4
7.	Prepare a report on Loan procedure proprietorship	02	CO3

8.	Prepare Balance Sheet: Case Study	04	CO3
9.	To select software product and Services: Case Study	04	CO2
10.	To prepare Project Report on software and services/ Technology hardware and equipment.	02	CO1, CO2 CO3, CO4
	Total	**30**	

9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING):

Assessment to be based on one of the following tools and rubrics for evaluation of SLA to be well defined by course teacher.

Assignment:

Identify a Problem & Propose a Business Idea

- Observe daily problems and list 5 common pain points.
- Brainstorm innovative solutions and create a problem-solution fit table.
- Validate the idea by conducting a mini-survey (10–20 people).

AI & Automation in Entrepreneurship

- Find 5 AI-powered tools that can automate tasks (e.g., marketing, sales, customer support).
- Test at least one tool and write a 200-word review on how it can help entrepreneurs.

10. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Guest/Expert lectures
4. Demonstrations
5. Slides
6. Self-Learning Online Resources
7. Industry Visit

11. SUGGESTED LEARNING RESOURCES

Sr. No.	Title Of Book	Author	Publication
1.	Entrepreneurship Development	Sangita Sharma	PHI Learning Publication ISBN-978-81-203-5270-4
2.	Entrepreneurship and Small Business Management	Khanna S. S	S. Chand and Sons, Delhi. ISBN -978-93-5161-094-6
3.	Entrepreneurship Development	S, Anil Kumar	New Age International, New Delhi.ISBN: 978-81-2241-434-9
4.	Product Design and Manufacturing	Chitale A.K	PHI Learning Publication ISBN-978-81-203-4873-8
5.	Entrepreneurship Development	Sangita Sharma	PHI Learning Publication ISBN-978-81-203-5270-4

12. LEARNING WEBSITE & PORTALS
1. http://www.startupindia.gov.in/
2. https://www.nstedb.com/index.htm
3. NSIC : National Small Industries Corporation
4. https://www.startupindia.gov.in

13. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)
1. Test
2. Rubrics for COs Assignment
3. Term Work
4. Seminar/Presentation

Summative Assessment (Assessment of Learning)
1. End Term Exam

14. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Aligned COs	Learning Hours	Distribution of Theory Marks			
				R Level	**U Level**	**A Level**	**Total Marks**
I	Introduction to Entrepreneurship and Start-up:	CO1	06	06	04	-	10
II	Business/Start-up ideas: Generation and Evaluation	CO2	08	04	04	04	12
III	Business Plan	CO2	07	02	06	04	12
IV	Institutional Support System for Micro, Small and Medium Enterprises:	CO3	08	-	04	06	10
V	Startup Funding Stages and Institutional Finance to Entrepreneurs:	CO3	06	02	04	06	12
VI	Marketing strategies for Enterprises and Start-ups	CO4	10	02	04	08	14
	GRAND TOTAL		**45**	**16**	**26**	**28**	**70**

R Remember, U Understand, A Apply and above, (Bloom's revised taxonomy levels)
NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

15. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Pradnya Natekar
2	Internal	Mr. Siddhesh Masurkar
3	External	Mr. Devang Parekh
		Organization: Accenture India, Mumbai