VI SEMESTER

Semester: VI		
DATA SCIENCE (Theory)		
Course Code: MVJ21CG61		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand the competitive advantages of data science.	
2	Understand the big data framework.	
3	Learn data analysis methods.	
4	Learn stream computing.	

UNIT-I	
INTRODUCTION: WhatisDataScience?BigDataandDataSciencehype–andgettingpastthehype, Whynow?— Datafication,Currentlandscapeofperspectives,Skillsets.NeededStatisticalInference:Populationsandsamples,Statisticalmodeling,probabilitydistributions,fittingamodel, -IntroductiontoR Videolink:https://www.digimat.in/nptel/courses/video/106106179/L01.html	**8 Hrs**
UNIT-II	
ExploratoryDataAnalysisandtheDataScienceProcess:Basictools(plots,graphsandsummary statistics)ofEDA,PhilosophyofEDA,TheDataScienceProcess,CaseStudy:RealDirect(onlinerealestatefirm).ThreeBasicMachineLearningAlgorithms:LinearRegression,kNearestNeighbors(k-NN),k-means LaboratorySessions/Experimentallearning:VariousProgramsusingKNNAlgorithm Videolink :https://nptel.ac.in/courses/106/107/106107220/	**8 Hrs**
UNIT-III	
OneMoreMachineLearningAlgorithmandUsageinApplications:Motivatingapplication: FilteringSpam,WhyLinearRegressionandk- NNarepoorchoicesforFilteringSpam,NaiveBayes and why itworks forFilteringSpam, Data Wrangling: APIs and othertools for scrappingtheWeb	**8 Hrs**

Laboratory Sessions/ Experimental learning: Experiment to analyze structured data andunstructureddata. Videolink:https://www.digimat.in/nptel/courses/video/111104098/L01.html	
UNIT-IV	
FeatureGenerationandFeatureSelection(ExtractingMeaningFromData):Motivatingapplication: user(customer) retention.Feature Generation (brainstorming,role of domainexpertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; DecisionTrees;RandomForests.RecommendationSystems:BuildingaUser-FacingDataProduct,AlgorithmicingredientsofaRecommendationEngine,DimensionalityReduction,SingularValueDecomposition,PrincipalComponentAnalysis,Exercise:build yourownrecommendationsystem LaboratorySessions/Experimentallearning:Implementationofvariouscasestudies. Videolink:https://www.youtube.com/watch?v=KTzXVnRlnw4	**8 Hrs**
UNIT-V	
MiningSocial-NetworkGraphs:Socialnetworksasgraphs,Clusteringofgraphs,Directdiscoveryofcommunitiesingraphs,Partitioningofgraphs,Neighborhoodpropertiesingraphs,DataVisualization:Basicprinciples,ideasandtoolsfordatavisualization.DataScienceand Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientistsLaboratory Sessions/Experimentallearning:VariouscasestudiestodifferentiateSQL andNOSQLDatabases Videolink:https://www.digimat.in/nptel/courses/video/106106169/L01.html	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Definedata scienceanditsfundamentals
CO2	Demonstrate theprocessindatascience
CO3	Explainmachinelearningalgorithms necessaryfordatasciences
CO4	Illustratetheprocessoffeatureselectionandanalysisofdataanalysisalgorithms
CO5	Visualizethedataandfollowofethics

Reference Books	
1.	CathyO'NeilandRachelSchutt,"DoingDataScience",StraightTalkFromThe

	Frontline.O'Reilly,2014
2.	Jure Leskovek,AnandRajaramanandJeffreyUllman,"MiningofMassive Datasets. v2.1",CambridgeUniversityPress,2014
3.	KevinP.Murphy,"MachineLearning:AProbabilisticPerspective",2013.
4.	JiaweiHan,MichelineKamberandJianPei,"DataMining:Conceptsand Techniques",ThirdEdition,2012.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

High-3, Medium-2, Low-1

Semester: VI		
WEB DEVELOPMENT &LAB (Theory and Practice)		
Course Code: MVJ21CG62		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	To understand different Internet Technologies.	
2	To learn java-specific web services architecture	
3	To understand the SQL and JDBC	
4	To learn the AJAX and JSON	

UNIT-I	
Website Basics, HTML5, CSS 3, Web 2.0: Web Essentials: Clients, Servers and Communication ,The Internet, Basic Internet protocols, World wide web, HTTP Request Message , HTTP Response Message, Web Clients, Web Servers, HTML5 : Tables, Lists, Image, HTML5 control elements , Semantic elements , Drag and Drop, Audio, Video controls, CSS3: Inline, embedded and external style sheets, Rule cascading, Inheritance, Backgrounds, Border Images, Colours, Shadows, Text, Transformations **Video link / Additional online information:** https://www.youtube.com/watch?v=QEtWL4lWlL4	**8 Hrs**
UNIT-II	
Client side Programming: An Introduction to java Script, JavaScript DOM Model, Date and Object, Regular Expression, Exception Handling, Validation, Built-in Objects, Event Handling, DHTML with JavaScript, JSON introduction, Syntax, Function Files, Http Request, SQL. **Video link / Additional online information:** • https://www.youtube.com/watch?v=uDwSnnhl1Ng&list=PLsyeobzWxl7qtP8Lo9TReqUMkiOp446cV	**8 Hrs**
UNIT-III	
Server Side Programming: Java Servlet Architecture, Servlet Life Cycle, Form GET and POST actions, Session handling, Installing and Configuring Apache Tomcat Web Server, Database Connectivity: JDBC perspectives, JDBC Program Example, JSP: Understanding	**8 Hrs**

Java server page, JSP Standard Tag Library (JSTL), Creating HTML form using JSP Code. **Video link / Additional online information:** • https://www.youtube.com/watch?v=7TOmdDJc14s&list=PLsyeobzWxl7pUPF2xjjJiG4BKC9x_GY46	
UNIT-IV	
PHP: Introduction to PHP, PHP using PHP, Variables, Program Control, Built-in Functions, Form Validation, Basic command with PHP examples, Connection to server, creating Database, Selecting Database, Listing Database, listing table names Creating a table, Inserting data, deleting data and tables, altering tables. **Video link / Additional online information :** • https://www.youtube.com/watch?v=itRkLa2kq6w	**8Hrs**
UNIT-V	
AJAX: Ajax client server architecture, Xml HTTP request object, Call back methods. Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, Web Services: Introduction, Java web services Basics, Creating, Publishing, Testing and Describing a web services, Database driven web service from an application. **Video link / Additional online information** • https://www.youtube.com/watch?v=qk9MWbyRlhE	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information(Department of CSE) for the web pages. 2. Design HTML form for keeping student record and validate it using Java script. 3. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access. 4. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-	

SHRINKING" in BLUE color. Then the font size decreases to 5pt.

5. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. 1.Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
6. Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database.
7. Validate the form using PHP regular expression. PHP stores a form data in to database
8. Write a PHP program to display a digital clock which displays the current time of the server.
9. Creating simple application to access data base using JDBC Formatting HTML with CSS.
10. Write a Program for manipulating Databases and SQL with real time application

Any 10 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Construct a basic website using HTML and Cascading Style Sheets.
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanism
CO3	Develop server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and to represent data in XML format.
CO5	Use AJAX and web services to develop interactive web applications.

Reference Books	
1.	Deitel and Deitel and Nieto,Internet and World Wide Web, How to Program, Prentice Hall, 5th Edition, 2011.
2.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1stEdition, Pearson Education India. (ISBN:978-9332575271)
3.	Stephen Wynkoop and John Burke —Running a Perfect Website‖, QUE, 2nd Edition,1999

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level

Semester: VI		
MACHINE LEARNING &LAB (Theory and Practice)		
Course Code: MVJ21CG63		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Define machine learning and problems relevant to machine learning
2	Differentiate supervised, unsupervised and reinforcement learning.
3	Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear inmachine learning.
4	Perform statistical analysis of machine learning techniques.

UNIT-I	
Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=rQ3oi9g8alY	**8 Hrs**
UNIT-II	
Decision Tree Learning Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=qDcl-FRnwSU	**8Hrs**
UNIT-III	
Bayesian Learning and Evaluating Hypotheses **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.	**8 Hrs**

Evaluating Hypotheses: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis **Video link / Additional online information (related to module if any):** • https://www.youtube.com/watch?v=480a_2jRdK0	
UNIT-IV	
Artificial Neural Networks and Instance based Learning **Artificial Neural Networks:** Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. Instanced Based Learning:Introduction, k-nearest neighbor learning, locally weighted regression. **Video link:** • https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056.	**8Hrs**
UNIT-V	
Reinforcement Learning and Deep Learning **Reinforcement Learning:**Introduction, Learning Task, Q Learning. **Deep Learning**: Introduction to Deep Learning-Reasons to go Deep Learning, Introduction to Convolutional Networks ,Restricted Boltzmann Machines,Deep Belief Nets, Recurrent Nets. **Video link:** https://www.youtube.com/watch?v=TIlDzLZPyhY&list=PLyqSpQzTE6M_FwzHF	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. 2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. 3. Develop a program to demonstrate the prediction of values of a given dataset using Linear regression 4. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. 5. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.	

6. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
8. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
9. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using ***k*-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
10. Write a program to implement ***k*-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
11. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Any 11 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the issues in machine learning and Algorithms for solving it.
CO2	Explain theory of probability and statistics related to machine learning.
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, Learning.
CO4	Identify the difference between Machine Learning and Deep Learning and using scenario
CO5	Explain the concepts of Q learning and deep learning

Reference Books	
1.	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
3.	EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10

marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**
CO3	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**3**
CO4	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

High-3, Medium-2, Low-1

Semester: VI		
BRAIN COMPUTER INTERFACE (Theory)		
Course Code: MVJ21CG641		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Discuss different types of BCI signals from instruments	
2	Discuss and compare different types of brain signals used for feature extraction	
3	Discuss the major components of BCI which makes up the system	
4	Explain the applications based on BCI	
5	Use the toolbox BCILAB	

UNIT-I	
What is BCI? How do BCI works, Brain computer interface types-Invasive, Partially invasive, Non-invasive, Brain signal for BCI signal-EEG, MEG, fNIRS, fMRI , Non brain signals for BCI **Video link / Additional online information :** https://nptel.ac.in/courses/108/108/108108167/	**8Hrs**
UNIT-II	
EEG Process, Temporal characteristics, Spatial Characteristics, Oscillatory EEG activity, eventrelated potentials (ERP), slow cortical potentials (SCP), and neuronal potentials. Motor Imagery BCI **Video link / Additional online information :** https://www.youtube.com/watch?v=PWRGe3uyS4c	**8Hrs**
UNIT-III	
Signal Processing-Spatial, temporal, spectral, spatio-temporal filters, Feature extraction, Machine Learning **Video link / Additional online information :** https://www.youtube.com/watch?v=PWRGe3uyS4c&t=214	**8Hrs**
UNIT-IV	
BCI monitoring hardware and hardware, BCI application-P300 speller, neuro prosthetic devices **Video link / Additional online information :** https://www.youtube.com/watch?v=KfaGvb9YfVM	**8Hrs**
UNIT-V	
Toolbox Architecture, Plug-in concepts, Implementing ERP Based BCI, ERP	**8Hrs**

Analysis in BCI Lab **Video link / Additional online information :** https://www.youtube.com/watch?v=PWRGe3uyS4c&t=322	

Course Outcomes: After completing the course, the students will be able to	
CO1	Acquire the brain signal in the format required for the specific application
CO2	Preprocessing the signal for signal enhancement
CO3	Extract the dominant and required features
CO4	Classify and derive the control signals for BCI applications
CO5	Apply the BCI knowledge for medical applications

Reference Books	
1.	R. Wolpaw and Elizabeth Winter Wolpaw, "Review of "Brain- Computer Interfaces, principles and practice", Biomed Engineering online
2.	Brain Computer Principles and Practices",JonathanWolpaw ,Elizabeth Winter Wolpaw, Oxford University Press

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**1**	**-**	**1**	**1**	**2**	**--**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**1**	**-**	**-**	**1**	**1**	**-**	**2**	**3**	**3**	**3**	**3**	**-**
CO4	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**--**	**-**	**-**	**-**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**3**	**3**	**3**	**3**

High-3, Medium-2, Low-1

Semester: VI		
VISUAL DESIGN & COMMUNICATION (Theory)		
Course Code: MVJ21CG642		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Apply appropriate communication skills across settings, purposes, and audiences.	
2	Demonstrate knowledge of communication theory and application.	

UNIT-I	
Need for and the Importance of Human and Visual Communication. Communication a expression, skill and process, Understanding Communication: SMRC-Model	**8Hrs**
UNIT-II	
Communication as a process. Message, Meaning, Connotation, Denotation Culture/Codes etc Levels of communication: Technical, Semantic, and Pragmatic. The semiotic landscape: language and visual communication, narrative representation	**8Hrs**
UNIT-III	
Fundamentals of Design: Definition. Approaches to Design, Centrality of Design, Elements of Design: Line, Shape, Space, Colour, Texture. Form Etc. Principles of Design: Symmetry. Rhythm, Contrast, Balance Mass/Scale etc. Design and Designers (Need, role, process, methodologies etc.)	**8Hrs**
UNIT-IV	
Principles of Visual and other Sensory Perceptions. Colour psychology and theory (some aspects) Definition, Optical / Visual Illusions Etc Various stages of design process- problem identification, search for solution refinement, analysis, decision making, and implementation	**8Hrs**
UNIT-V	
Basics of Graphic Design. Definition, Elements of GD, Design process-research, a source of concept, the process of developing ideas-verbal, visual, combination & thematic, visual thinking, associative techniques, materials, tools (precision	**8Hrs**

instruments etc.) design execution, and presentation.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate critical and innovative thinking
CO2	Display competence in oral, written, and visual communication
CO3	Apply communication theories.

Reference Books	
1.	Communication between cultures - Larry A. Samovar, Richard E. Porter, Edwin R. McDaniel & Carolyn Sexton Roy, Monica Eckman, USA, 2012
2.	Introduction to Communication studies - John Fiske & Henry Jenkins 3rd edition, Routledge, Oxon 2011
3.	An Introduction to communication studies - Sheila Steinberg, Juta & Co., Cape Town, 2007
4.	One World Many Voices: Our Cultures - Marilyn Marquis & Sarah Nielsen, Wingspan Press, California, 2010

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3, Medium-2, Low-1

Semester: VI		
INFORMATION RETRIEVAL (Theory)		
Course Code: MVJ21CG643		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To understand the basics of Information Retrieval.	
2	To understand machine learning techniques for text classification and clustering.	
3	To understand various search engine system operations.	
4	To learn different techniques of recommender system.	

UNIT-I	
Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=fFxpSmyICwI	**8 Hrs**
UNIT-II	
Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=m0oiAOgSQFw	**8 Hrs**
UNIT-III	
A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing. **Video link / Additional online information (related to module if any):**	**8 Hrs**

https://www.youtube.com/watch?v=vuc93jbO2Dw	
UNIT-IV	
The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=JjywDlY1OJk	**8Hrs**
UNIT-V	
Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=1JRrCEgiyHM	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use an open source search engine framework and explore its capabilities
CO2	Evaluate Boolean Model
CO3	Apply appropriate method of classification or clustering.
CO4	Design and implement innovative features in a search engine.
CO5	Design and implement a recommender system.

Reference Books	
1.	Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2.	Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbook, First Edition, 2011.
3.	C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
4.	Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**-**	**-**
CO2	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**
CO3	**2**	**3**	**1**	**3**	**-**	**1**	**1**	**1**	**-**	**1**	**-**	**2**
CO4	**3**	**2**	**2**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**1**
CO5	**2**	**2**	**3**	**3**	**-**	**1**	**2**	**1**	**2**	**-**	**1**	**2**

High-3, Medium-2, Low-1

Semester: VI		
GPU COMPUTING (Theory)		
Course Code: MVJ21CG644		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To learn parallel programming with graphics processing units (GPUs).	
2	To introduce different GPU programming models.	

UNIT-I	
Evolution of GPU architectures – Understanding Parallelism with GPU –Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory. **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/105/106105220/	**8Hrs**
UNIT-II	
Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions. **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/105/106105220/	**8Hrs**
UNIT-III	
Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors. **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/105/106105220/	**8 Hrs**
UNIT-IV	
OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples. **Video link / Additional online information (related to module if any):** • http://www.nvidia.com/object/cuda_home_new.html	**8Hrs**
UNIT-V	
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication	**8Hrs**

– Programming Heterogeneous Cluster. **Video link / Additional online information (related to module if any):** http://www.openCL.org	

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe GPU Architecture
CO2	Write programs using CUDA, identify issues and debug them
CO3	Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
CO4	Write simple programs using OpenCL
CO5	Identify efficient parallel programming patterns to solve problems

Reference Books	
1.	Shane Cook, CUDA Programming: A Developers Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2.	David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.
3.	Nicholas Wilt, CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison -Wesley, 2013.
4.	Jason Sanders, Edward Kandrot, CUDA by Example: An Introduction to General Purpose GPU Programming^, Addison – Wesley, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may

have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
CO2	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
CO3	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**
CO4	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**3**
CO5	**3**	**3**	**3**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**-**	**3**

High-3, Medium-2, Low-1

Semester: VI		
VISUALIZATION TECHNIQUES (Theory)		
Course Code: MVJ21CG645		**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	learn the value of visualization, specific techniques in information visualization and scientific visualization, and how understand how to best leverage visualization methods.	

UNIT-I	
Introduction –Visualization Stages –Computational Support –Issues –Different Types of Tasks –Data representation –Limitation: Display Space, Rendering Time, Navigation Link.	**8Hrs**
UNIT-II	
Human Factors –Foundation for a Science of Data Visualization –Environment-Optics – Optimal Display –Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual Attention that Pops Out –Types of Data –Data Complexity –The Encoding of Values – Encoding of Relation –Relation and Connection –Alternative Canvass	**8Hrs**
UNIT-III	
Human Vision –Space Limitation –Time Limitations –Design –Exploration of Complex Information Space –Figure Caption in Visual Interface –Visual Objects and Data Objects – Space Perception and Data in Space –Images, Narrative and Gestures for Explanation	**8Hrs**
UNIT-IV	
Norman‟s Action Cycle –Interacting with Visualization –Interaction for Information Visualization –Interaction for Navigation –Interaction with Models – Interacting with Visualization –Interactive 3D Illustrations with Images and Text – Personal View –Attitude – user perspective –Convergence –Sketching – Evaluation.	**8Hrs**
UNIT-V	
Design –Virtual Reality: Interactive Medical Application –Tactile Maps for visually challenged People –Animation Design for Simulation –Integrating Spatial and Nonspatial Data –Innovating the Interaction –Small Interactive Calendars – Selecting One from Many– Web Browsing Through a Key Hole –Communication Analysis –Archival Galaxies	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamentals of data visualization
CO2	Acquire knowledge about the issues in data representation
CO3	Visualize the complex engineering design.
CO4	Design real time interactive information visualization system

CO5	Apply the visualization techniques in practical applications

Reference Books	
1.	Robert Spence, "Information Visualization:An Introduction", Third Edition, Pearson Education, 2014
2.	Colin Ware, "Information Visualization Perception for Design", ThirdEdition, Morgan Kaufmann, 2012.
3.	Robert Spence, "Information Visualization Design for Interaction", Second Edition, Pearson Education, 2006
4.	Benjamin B. Bederson, Ben shneiderman, "The Craft of Information Visualization", Morgan Kaufmann, 2003.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**
CO3	**2**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**3**
CO4	**3**	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

High-3, Medium-2, Low-1

Semester: VI		
ANGULAR JS AND NODE JS (Theory&Lab)		
Course Code: MVJ21AEC66		**CIE Marks:100**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To learn the basics of Angular JS.
2	To understand the Angular JS Modules
3	To implement Forms, inputs and Services
4	To implement Directives and Databases
5	To understand basics of Node JS.

UNIT-I	
Introduction To Angular JS: Introduction – Features – Angular JSModel-View-Controller – Expression -Directives and Controllers.	**6Hrs**
UNIT-II	
Angular JS Modules: Arrays –Working with ng-model – Working with Forms – Form Validation – Error Handling with Forms – Nested Forms with ng-form – Other Form Controls.	**6Hrs**
UNIT-III	
Directives& Building Databases: Part I- Filters – Using Filters in Controllers and Services – Angular JS Services – Internal Angular JS Services – Custom Angular JS Services	**6Hrs**
UNIT-IV	
Directives& Building Databases: Part-II- Directives – Alternatives to Custom Directives – Understanding the Basic options – Interacting with Server –HTTP Services – Building Database, Front End and BackEnd	**6Hrs**
UNIT-V	
Introduction to NODE .JS: Introduction –Using the Terminals – Editors –Building a Webserver with Node – The HTTPModule – Views and Layouts.	**6Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the features of Angular JS.
CO2	Recognize the form validations and controls.
CO3	Implement Directives and Controllers
CO4	Evaluate and create database for simple application.
CO5	Plan and build webservers with node using Node .JS.

Reference Books

1	Adam Freeman - ProAngular JS, Apress, First Edition, 2014.
2	ShyamSeshadri, Brad Green –"AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps", Apress, O'Reilly Media, Inc.
3.	AgusKurniawan–"AngularJS Programming by Example", First Edition, PE Press, 2014.
4.	Brad Dayley, "Learning Angular JS", Addison-Wesley Professional, First Edition, 2014.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**
CO3	**2**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**3**
CO4	**3**	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

High-3, Medium-2, Low-1