VII SEMESTER

Semester: VII		
FOUNDATION OF DATA SCIENCE		
Course Code: MVJ21AI71		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science	

UNIT-I	
INTRODUCTION TO DATA SCIENCE: Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation. **Video Links :** https://www.youtube.com/watch?v=KMj49syT8JM&list=PLyqSpQzTE6M-sBjDcT21Gpnj8grR2fDgc	**10 Hrs**
UNIT-II	
BIG DATA: Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study. **Video Links:** https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-III	
MACHINE LEARNING: Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms. **Video Links:**https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-IV	
DEEP LEARNING: Introduction – Deep Feed forward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning. **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	**10 Hrs**
UNIT-V	
DATA VISUALIZATION : Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive	**10 Hrs**

dashboard with dc.js-summary. **Video Links**: https://nptel.ac.in/courses/106/101/106101163/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamental concepts of data science.
CO2	Understand data analysis techniques for applications handling large data
CO3	Understand various machine learning algorithms used in data science process
CO4	Visualize and present the inference using various tools
CO5	Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

Reference Books	
1.	Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016
2.	An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013
3.	Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016
4.	Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

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 marks is 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/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	3	1	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	1	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: VII		
COMPUTER VISION **Professional Elective II**		
Course Code: MVJ21AI721		**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	This course will enable students to Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.	

UNIT-I	
Digital Image Formation and low-level processing Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing	**8Hrs**
UNIT-II	
Depth estimation and Multi-camera views Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.	**8Hrs**
UNIT-III	
Feature Extraction Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.	**8Hrs**
UNIT-IV	
Image Segmentation Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.	**8Hrs**
UNIT-V	
Pattern Analysis Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant	**8Hrs**

Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the concepts of Digital Image Processing.
CO2	Analyse Homography and stereopsis.
CO3	Analyse Edges and Hough Transforms.
CO4	Demonstrate the ideas of image Segmentation.
CO5	Implement the concepts of Pattern Analysis.

Reference Books	
1.	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
3.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4.	K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

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 marks is 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**	**-**	**-**
CO4	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**3**	**3**	**3**	**3**

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
INFORMATION RETRIEVAL		
Course Code:MVJ21AI722		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**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	
INTRODUCTION: 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	
MODELING AND RETRIEVAL EVALUATION: 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	
TEXT CLASSIFICATION AND CLUSTERING: 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.	**8 Hrs**

Video link / Additional online information (related to module if any): https://www.youtube.com/watch?v=vuc93jbO2Dw	
UNIT-IV	
WEB RETRIEVAL AND WEB CRAWLING: 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**	**8 Hrs**
UNIT-V	
RECOMMENDER SYSTEM: 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**	**8 Hrs**

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

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is 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/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	1	-	2	-	-	2	3
CO2	3	2	2	1	-	-	-	-	-	2	-	1	2	2
CO3	2	3	1	3	-	1	1	1	-	1	-	2	2	1
CO4	3	2	2	1	-	2	-	-	-	-	2	1	2	2
CO5	2	2	3	3	-	1	2	1	2	-	1	2	2	2

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
HIGH PERFORMANCE COMPUTING		
Course Code:MVJ21AI723		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Improve the system performance
2	Learn various distributed and parallel computing architecture
3	Learn different computing technologies

UNIT-I	
Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm). **Video link** : https://www.youtube.com/watch?v=GlobK-eWDSo	**8 Hrs**
UNIT-II	
Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O. **Video link** : https://www.youtube.com/watch?v=9J4uXnSDias	**8 Hrs**
UNIT-III	
Example Cluster System – Beowlf; Cluster Operating Systems: Compas And Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface. **Video link** : https://www.youtube.com/watch?v=GlobK-eWDSo	**8 Hrs**
UNIT-IV	
Device Connectivity; Java for Pervasive Devices; Application Examples **Video link** : https://www.youtube.com/watch?v=bS6XqjBO99Q	**8 Hrs**
UNIT-V	
Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms. Videolink**:https://nptel.ac.in/courses/115/101/115101092/**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understanding the concepts in grid computing

CO2	Ability to set up cluster and run parallel applications
CO3	Ability to understand the cluster projects and cluster OS
CO4	Understanding the concepts of pervasive computing
CO5	Understanding the concepts of quantum computing

Reference Books	
1.	"Selected Topics In Advanced Computing" Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, 2005 Pearson Education.
2.	J. Burkhardt et.al: 'pervasive computing' Pearson Education
3.	Marivesar:' Approaching quantum computing', Pearson Education
4.	Raj kumar Buyya:'High performance cluster computing', Pearson Education

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
BIG DATA ANALYTICS		
Course Code:MVJ21AI724		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	The scope and essentiality of Big Data and Business Analytics.
2	The technologies used to store, manage, and analyze big data in a Hadoop ecosystem.
3	The techniques and principles in big data analytics with scalability and streaming capability.
4	The hypothesis on the optimized business decisions in solving complex real-world problems

UNIT-I	
INTRODUCTION TO BIG DATA: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Traditional Business Intelligence (BI) versus Big Data. Big data analytics: Classification of Analytics, Importance and challenges facing big data, Terminologies Used in Big Data Environments, The Big Data Technology Landscape. **Video link** : https://www.digimat.in/nptel/courses/video/106104189/L01.html	**8 Hrs**
UNIT-II	
INTRODUCTION TO HADOOP: Introducing Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, History and overview of Hadoop, Use Case of Hadoop, Hadoop Distributors, Processing Data with Hadoop, Interacting with Hadoop Ecosystem Video link **: https://www.digimat.in/nptel/courses/video/106104189/L04.html**	**8 Hrs**
UNIT-III	
THE HADOOP DISTRIBUTED FILESYSTEM: Hadoop Distributed File System(HDFS):The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, Hadoop Filesystems. The Java Interface- Reading Data from a Hadoop URL, Reading Data Using the Filesystem API, Writing Data. Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations. **Video link** : https://www.digimat.in/nptel/courses/video/106104189/L04.html	**8 Hrs**
UNIT-IV	
UNDERSTANDING MAP REDUCE FUNDAMENTALS :Map Reduce Framework: Exploring the features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions, Techniques to optimize Map Reduce jobs, Uses of Map Reduce. Controlling MapReduce Execution with Input Format, Reading Data with custom Record Reader,-Reader, Writer,	**8 Hrs**

Combiner, Partitioners, Map Reduce Phases, Developing simple MapReduce Application. Video link **:https://www.digimat.in/nptel/courses/video/106104189/L06.html**	
UNIT-V	
INTRODUCTION TO PIG : Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, Working with operators in Pig, Working with functions in Pig. **Videolink: https://www.youtube.com/watch?v=qr_awo5vz0g**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the evolution of big data with its characteristics and challenges with traditional business intelligence.
CO2	Explain the big data technologies used to process and querying the bigdata in Hadoop, MapReduce and Pig.
CO3	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes in distributed Hadoop Ecosystem
CO4	Develop a Map Reduce application for optimizing the jobs.
CO5	Develop applications for handling huge volume of data using Pig Latin

Reference Books	
1.	Seema Acharya, Subhashini Chellappan,—BigData and Analytics, Wiley Publications,2nd Edition, 2014 DT Editorial Services,—BigData, DreamTechPress, 2nd Edition, 2015.
2.	TomWhite, —Hadoop: The Definitive Guide, O'Reilly, 3rd Edition, 2012.
3.	Big Data Black Book, Dreamtech publications , 1st Edition, 2017.
4.	Michael Minelli, Michele Chambers, Ambiga Dhiraj, —BigData, BigAnalytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1st Edition, 2013.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

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CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective II		
PERVASIVE COMPUTING		
Course Code:MVJ21AI725		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand an insight into future developments in the field of pervasive computing.
2	Provide an in-depth knowledge on pervasive computing and wireless networking.
3	Describe the variety of pervasive services and applications.

UNIT-I	
Pervasive Computing : Evolution of Pervasive Computing - Decentralization continues - Applied Pervasive computing - Pervasive computing principles - Pervasive Information Technology - Smart Cards - Smart Labels. **Video link** : https://www.youtube.com/watch?v=bS6XqjBO99Q	**8 Hrs**
UNIT-II	
Embedded Controls: Smart sensors and Actuators - Smart Appliances - Appliances and Home Networking -Automotive Computing. Operating Systems: Windows CE -Palm OS - Symbian EPOC - Java Card - Windows for Smart Cards. Video link **: http://digimat.in/nptel/courses/video/108108147/L01.html**	**8 Hrs**
UNIT-III	
Middleware Components: Programming Consumer Devices - Smart Card Programming - Messaging Components - Database Components. Security: The importance of security - Cryptographic patterns and methods Cryptographic Tools-Secure socket layer **Video link** : https://www.digimat.in/nptel/courses/video/117108048/L01.html	**8 Hrs**
UNIT-IV	
Gateways, Device Management and Synchronization :Connectivity Gateway - Wireless Gateway - Transcoding - Residential Gateway - Architecture and components of Web Application Servers - Web Sphere Application Server Web Sphere Everyplace Suite - Oracle Portal-to-Go - Tasks of Device Management Systems - Tivoli Device Support Infrastructure - User Profiles and Directory Services - Synchronization - The Challenge of Synchronizing Data - Industry Data Synchronization Standards -Today's Synchronization Solution Video link **:https://www.digimat.in/nptel/courses/video/106105183/L40.html**	**8 Hrs**

UNIT-V	
Portals and Access Services: Internet Portals-Wireless Portal - Broadcasting Portal - Home Services - Communication Services - Home Automation - Energy Services - Security Services - Remote Home Healthcare Services - Travel and Business Services - Consumer Services Video link: https://www.youtube.com/watch?v=oxMdDsud5vg	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the principles of pervasive technology.
CO2	Identify the functionalities of operating systems and middleware
CO3	Analyze the device management and synchronization techniques.
CO4	Explain the various gateways
CO5	Choose the appropriate techniques to develop various pervasive applications.

Reference Books	
1.	Asoke K Talukder, Roopa R Yavagal, "Mobile computing: Technology, Applications and Service Creation", Second Edition, Tata McGraw-Hill Publishing Company Limited, 2017, ISBN 978-0070144576
2.	UweHansmann, LotharMerk, Martin S. Nicklous, Thomas Stober, "Pervasive Computing Handbook",Second edition, Springer, 2003, ISBN 978-3-642-05525-6.
3.	MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, "Pervasive Computing: Concepts, Technologies and Applications", CRC Press,2016, ISBN 9781466596276.

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 marks is 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/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		-	-	-	-	-	-	-	-	-	2	-
CO2	2	2		-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
NATURAL LANGUAGE PROCESSING		
Course Code:MVJ21AI731		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Learn the fundamentals of natural language processing
2	Understand the use of CFG and PCFG in NLP
3	Understand the role of semantics of sentences and pragmatics
4	Gain knowledge in automated Natural Language Generation and Machine Translation

UNIT-I	
INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM –Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance values of real symmetric matrices: Jacobi and Givens method. **Laboratory Session**: Word Analysis **Applications:** Text to Speech conversion **Video link** :https://nptel.ac.in/courses/106/105/106105158/	**8 Hrs**
UNIT-II	
WORD LEVEL AND SYNTACTIC ANALYSIS: N grams Models of Syntax - Counting Words - Unsmoothed N grams-Smoothing-Back off Deleted Interpolation – Entropy – English Word Classes - Tag sets for English-Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -Issues in PoS tagging – Hidden Markov and Maximum Entropy models. **Laboratory Session**: Morphological Analyzer for a given word **Applications**: Speech to text conversion Video link **:https://nptel.ac.in/courses/106/105/106105158/**	**8 Hrs**
UNIT-III	
CONTEXT FREE GRAMMARS**:** Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures	**8 Hrs**

Laboratory Sessions: Chunking for a given sentence **Applications**: Compiler **Video link** :https://www.youtube.com/watch?v=6b40kKe2SFg	
UNIT-IV	
SEMANTICS AND PRAGMATICS: Representing Meaning - Meaning Structure of Language, - First Order Predicate Calculus-Representing Linguistically Relevant Concepts –SyntaxDriven Semantic Analysis - Semantic Attachments –Syntax Driven Analyzer- Robust Analysis – Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval. **Laboratory Session**: Pragmatic Analysis of a given sentence **Applications**: Sentiment Analysis Video link **:https://www.coursera.org/lecture/human-language/pragmatics-E8VXH**	**8 Hrs**
UNIT-V	
LANGUAGE GENERATION AND DISCOURSEANALYSIS: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatize, Penn Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, and British National Corpus (BNC). **Laboratory Session**: Sentiment analysis on movie database **Applications**: Sentiment analysis Videolink**:https://www.coursera.org/lecture/text-mining-analytics/5-6-how-to-do-sentiment-analysis-with-sentiwordnet-5RwtX**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	To tag a given text with basic Language features.
CO2	To design an innovative application using NLP components
CO3	To implement a rule-based system to tackle morphology/syntax of a language
CO4	To design a tag set to be used for statistical processing for real-time applications
CO5	To compare the use of different statistical approaches for different types of NLP applications

Reference Books	
1.	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2.	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MITPress.

	Cambridge, MA:1999
3.	Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.

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 marks is 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/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
HEALTHCARE ANALYTICS		
Course Code:MVJ21AI732		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the health data formats, health care policy and standards
2	Learn the significance and need of data analysis and data visualization
3	Understand the health data management frameworks
4	Learn the use of machine learning and deep learning algorithms in healthcare
5	Apply healthcare analytics for critical care applications

UNIT-I	
INTRODUCTION TO HEALTHCARE ANALYSIS :Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach. **Video link** :https://www.digimat.in/nptel/courses/video/110104095/L01.html	**8 Hrs**
UNIT-II	
ANALYTICS ON MACHINE LEARNING : Machine Learning Pipeline – Pre-processing – Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection. Video link **:https://www.digimat.in/nptel/courses/video/106105152/L01.html**	**8 Hrs**
UNIT-III	
HEALTH CARE MANAGEMENT: IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare. **Video link** : https://www.digimat.in/nptel/courses/video/110104095/L41.html	**8 Hrs**
UNIT-IV	
HEALTHCARE AND DEEP LEARNING: Introduction on Deep Learning – DFF network	**8 Hrs**

CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System. Video link **:https://www.youtube.com/watch?v=W3_yaf3HvHU**	
UNIT-V	
CASE STUDIES: Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis. Videolink: **https://www.youtube.com/watch?v=UvQFH5RGOnU**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use machine learning and deep learning algorithms for health data analysis
CO2	Apply the data management techniques for healthcare data
CO3	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
CO4	Design health data analytics for real time applications
CO5	Design emergency care system using health data analysis

Reference Books	
1.	Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2.	Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3.	Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.

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 marks is 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/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		-	-	-	-	-	-	-	-	-	2	-
CO2	2	2		-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
PATTERN RECOGNITION		
Course Code:MVJ21AI733		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Identify areas where Pattern Recognition and Machine Learning can offer a solution.
2	Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
3	Describe genetic algorithms, validation methods and sampling techniques
4	Describe and model data to solve problems in regression and classification
5	Implement learning algorithms for supervised tasks.

UNIT-I	
Introduction: Importance of pattern recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-supervised learning, Introduction to Bayes Decision Theory, Discriminant Functions and Decision Surfaces, Gaussian PDF and Bayesian Classification for Normal Distributions. L1, L2	**8 Hrs**
UNIT-II	
Data Transformation and Dimensionality Reduction: Introduction, Basis Vectors, The Karhunen Loeve (KL) Transformation, Singular Value Decomposition, Independent Component Analysis (Introduction only). Nonlinear Dimensionality Reduction, Kernel PCA. L1, L2	**8 Hrs**
UNIT-III	
Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability estimation, Bayesian Interference, Maximum Entropy Estimation, Mixture Models, Naive-Bayes Classifier, The Nearest Neighbor Rule. L1, L2, L3	**8 Hrs**
UNIT-IV	
Linear Classifiers: Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error Estimate. L1, L2, L3	**8 Hrs**

UNIT-V	
Nonlinear Classifiers: The XOR Problem, The two Layer Perceptron, Three Layer Perceptron, Back propagation Algorithm, Basic Concepts of Clustering, Introduction to Clustering , Proximity Measures. L1, L2, L3	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify areas where Pattern Recognition and Machine Learning can offer a solution.
CO2	Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
CO3	Describe genetic algorithms, validation methods and sampling techniques
CO4	Describe and model data to solve problems in regression and classification
CO5	Implement learning algorithms for supervised tasks.

Reference Books	
1.	Pattern Recognition: Sergios Theodoridis, Konstantinos Koutroumbas, Elsevier India Pvt. Ltd (Pap Back), 4th edition
2.	The Elements of Statistical Learning: Trevor Hastie
3.	Pattern Classification: Richard O. Duda
4.	Pattern Recognition and Image Analysis Earl Gose: Richard Johnsonbaugh

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 marks is 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/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		-	-	-	-	-	-	-	-	-	2	-
CO2	2	2		-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
VISION SYSTEMS AND ROBOTICS		
Course Code:MVJ21AI734		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Learn the basics of robotics.
2	Understand the robot end effectors.
3	Learn the techniques used in robot mechanics.
4	Learn the fundamentals of machine vision systems and robot programming.
5	Learn the basics of robotics.

UNIT-I	
BASICS OF ROBOTICS: Introduction- Basic components of robot-Laws of robotics-classification of robot-work space – accuracy resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives.	**8 Hrs**
UNIT-II	
ROBOT END EFFECTORS : Robot End effectors: Introduction- types of End effectors- Tools as end effectors - Drive system for grippers - Mechanical gripper- types of gripper mechanism-gripper force analysis and gripper design - other types of gripper- special purpose grippers.	**8 Hrs**
UNIT-III	
ROBOT MECHANICS : Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation.	**8 Hrs**
UNIT-IV	
MACHINE VISION FUNDAMENTALS : Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique-segmentation- Thresholding- edge detection- binary morphology - grey morphology - Camera calibration – Stereo Reconstruction.	**8 Hrs**
UNIT-V	
V ROBOT PROGRAMMING: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- VAL language commands- motion control, hand control, program control, pick and place applications - palletizing applications	**8 Hrs**

using VAL, Robot welding application using VAL program- Rapid Language - basic commands Virtual robotics - VAL-II and AML – applications of robots	

Course Outcomes: After completing the course, the students will be able to	
CO1	Able to know the basics of robotics.
CO2	Able to understand the concepts of robot end effectors.
CO3	Obtain forward, reverse kinematics and dynamics model of the industrial robot arm
CO4	Develop the vision algorithms.
CO5	Understand the robot programming and applications of robots.

Reference Books	
1.	Carsten Steger, Markus Ulrich, Christian Wiedemann, Machine Vision Algorithms and Applications, Second edition, Weinheim, WILEY-VCH, 2018
2.	John J. Craig, Introduction to Robotics - Mechanics and Control, 3 rd Edition, Pearson Education Inc, 2013.
3.	S.K. Saha, Introduction to Robotics, 4 th Edition, Tata McGraw Hill Education, 2011.
4.	Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford University Press, Sixth impression, 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 marks is 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/PSO Mapping														
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CO3	2	3	3	2	-	-	-	-	-	-	-	-	1	3
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO5	3	1	2	2	-	-	-	-	-	-	-	1	2	-

High-3, Medium-2, Low-1

Semester: VII Professional Elective III		
DEEP LEARNING TECHNIQUES		
Course Code:MVJ21AI735		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Learn feed forward deep networks
2	Understand convolutional networks and sequence modelling
3	Study probabilistic models and auto encoders
4	Expose the students to various deep generative models
5	Study the various applications of deep learning

UNIT-I	
DEEP NETWORKS: Machine Learning Basics: Learning Algorithms – Supervised and Unsupervised learning – Feed forward Deep networks – regularization – Optimization for training Deep models. **Video link** :http://www.deeplearning.net	**8 Hrs**
UNIT-II	
CONVOLUTIONAL NETWORKS AND SEQUENCE MODELLING : Convolutional Networks – Convolution operation – Motivation Pooling – Basic Convolution function – Algorithms – Recurrent and recursive nets : Recurrent neural networks – Bidirectional RNN – Recursive Neural networks – Auto regressive networks – Long term dependencies – Temporal dependencies – Approximate search **Video link** :www.cs.toronto.edu/~fritz/absps/imagenet.pdf	**8 Hrs**
UNIT-III	
PROBABILISTIC MODELS AND AUTO ENCODERS : Structured Probabilistic models : Challenges of unstructured modelling – using graphs to describe model structure – Learning about dependencies – inference – Deep learning approach – Monte carlo models – Linear Factor models and Auto encoders **Video link** :https://www.youtube.com/watch?v=wPz3MPl5jvY	**8 Hrs**
UNIT-IV	
DEEP GENERATIVE MODELS : Restricted Boltzmann Machines – Deep Belief networks – Deep Boltzmann machine – Convolutional Boltzmann machine **Video link :**https://www.youtube.com/watch?v=W3_yaf3HvHU	**8 Hrs**

UNIT-V	
APPLICATIONS: Speech, Audio and Music processing – Language modelling and Natural language processing – information retrieval – object recognition and computer vision – Multi modal and multi task learning Videolink: http://www.deeplearning.net	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use feed forward deep networks
CO2	Apply convolutional networks and sequence modelling for problem solving
CO3	Use probabilistic models and auto encoders
CO4	Use deep generative models for problem solving
CO5	Apply the deep learning techniques

Reference Books	
1.	Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015
2.	Li Deng, Dong Yu, "Deep Learning: Methods and Applications", now publishers, 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 marks is 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/PSO Mapping														
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CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
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CO3	2	3	3	2	-	-	-	-	-	-	-	-	1	3
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO5	3	1	2	2	-	-	-	-	-	-	-	1	2	-

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
GAME DESIGN & DEVELOPMENT		
Course Code: MVJ21AI741		**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 concepts of Game design and development.
2	Learn the processes, mechanics and issues in Game Design.
3	Be exposed to the Core architectures of Game Programming.
4	Know about Game programming platforms, frame works and engines. Learn to develop games.

UNIT-I	
3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.	**8 Hrs**
UNIT-II	
Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.	**8 Hrs**
UNIT-III	
Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management	**8Hrs**
UNIT-IV	
2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity. DX Studio.	**8Hrs**
UNIT-V	
Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Discuss the concepts of Game design and development.
CO2	Design the processes, and use mechanics for game development.
CO3	Explain the Core architectures of Game Programming

CO4	Use Game programming platforms, frame works and engines.
CO5	Create interactive Games

Reference Books	
1.	Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012
2.	Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009
3.	David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2 nd Editions, Morgan Kaufmann, 2006.
4.	Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2 nd Edition Prentice Hall / New Riders, 2009.

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 marks is 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**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
C05	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
COMPUTER GRAPHICS		
Course Code: MVJ21AI742		**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 two dimensional graphics and their transformations
2	Gain knowledge about graphics hardware devices and software used.
3	Appreciate illumination and color models.
4	Understand the three dimensional graphics and their transformations.
5	Be familiar with understand clipping techniques.

UNIT-I	
Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.	**8 Hrs**
UNIT-II	
Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.	**8 Hrs**
UNIT-III	
Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces - B-Spline curves and surfaces. **TRANSFORMATION AND VIEWING:** Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods	**8 Hrs**
UNIT-IV	

Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.	**8Hrs**
UNIT-V	
Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening. **COMPUTER GRAPHICS REALISM:** Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Design two dimensional graphics
CO2	Apply two dimensional transformations.
CO3	Design three dimensional graphics.
CO4	Apply three dimensional transformations.
CO5	Design animation sequences.

Reference Books	
1.	John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", , 3rd Edition, Addison- Wesley Professional,2013. (UNIT I, II, III, IV)
2.	Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007 (UNIT V).
3.	Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4th Edition, Pearson Education, 2010.
4.	Hill F S Jr., "Computer Graphics", Maxwell Macmillan" , 1990.

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 marks is 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	**1**											
CO2	**1**		**2**	**2**			**1**			**2**	**2**	
CO3	**1**							**2**	**2**	**2**	**1**	
CO4	**1**	**2**				**2**						**2**

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
INTRODUCTION TO HUMAN COMPUTER INTERACTION		
Course Code:MVJ21AI743		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Learn the foundations of Human Computer Interaction.
2	Be familiar with the design technologies for individuals and persons with disabilities.
3	Be aware of mobile HCI.
4	Learn the guidelines for user interface.
5	Learn the foundations of Human Computer Interaction.

UNIT-I	
FOUNDATIONS OF HCI : The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=WW1g3UT2zww	**8 Hrs**
UNIT-II	
DESIGN & SOFTWARE PROCESS : Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=dNgK8CXzMSw	**8 Hrs**
UNIT-III	
MODELS& THEORIES: HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW. **Video link / Additional online information (related to module if any):**	**8 Hrs**

https://www.youtube.com/watch?v=axKhU701LxU	
UNIT-IV	
MOBILE HCI: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. – Case Studies **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=o5bPWsfYkQo	**8 Hrs**
UNIT-V	
WEB INTERFACE DESIGN: Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Case Studies. **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=QJ9ygdD2sIY	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Design effective dialog for HCI.
CO2	Design effective HCI for individuals and persons with disabilities.
CO3	Assess the importance of user feedback.
CO4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO5	Develop meaningful user interface.

Reference Books	
1.	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2.	Brian Fling, ―Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)
3.	Bill Scott and Theresa Neil, ―Designing Web Interfaces, First Edition, O'Reilly, 2009. (UNIT-V)

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 marks is 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/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	3	2	-	-	-	-	-	-	-	-	1	3
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO5	3	1	2	2	-	-	-	-	-	-	-	1	2	-

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
MOBILE APPLICATION DEVELOPMENT		
Course Code:MVJ21AI744		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Demonstrate their understanding of the fundamentals of Android operating systems
2	Demonstrate their skills of using Android software development tools
3	Demonstrate their ability to develop software with reasonable complexity on mobile platform
4	Demonstrate their understanding of the fundamentals of Android operating systems

UNIT-I	
Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools. Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=deq8mkt_cxQ	**8 Hrs**
UNIT-II	
Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities **Applications:** Design a Simple Calculator App **Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=PJ3RdfJ4Np8	**8 Hrs**
UNIT-III	

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toast. **Video link / Additional online information (related to module if any):** https://nptel.ac.in/courses/106/106/106106147/	**8 Hrs**
UNIT-IV	
Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update) **Video link / Additional online information (related to module if any):** http://developer.android.com/develop/index.htm	**8 Hrs**
UNIT-V	
Advanced Topics: Alarms – Creating and using alarms Using Internet Resources – Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location **Video link / Additional online information (related to module if any):** https://www.codeschool.com/learn/ios	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamentals of Android operating systems
CO2	Understand various layouts and designing UI.
CO3	Understand major Android components intents, broadcasting and notifications.
CO4	Understand basic concepts of SQLite database.
CO5	Understand how to utilize Location based services.

Reference Books	
1.	Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012
2.	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.
3.	Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.

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 marks is 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/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	1	-
CO4	3	3	3	3	-	-	-	2	2	2	-	3	2	2
CO5	3	3	3	3	-	-	2	2	3	2	-	3	1	-

High-3, Medium-2, Low-1

Semester: VII Open Elective III		
QUANTUM COMPUTING		
Course Code:MVJ21AI745		**CIE Marks:100**
Credits: L:T:P:S:3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To understand the building blocks of a quantum computer.
2	To understand the principles, quantum information and limitation of quantum operations formalizing
3	To understand the quantum error and its correction.

UNIT-I	
FUNDAMENTAL CONCEPTS: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms. **Video Links :** https://www.youtube.com/watch?v=3yoyVCAQH4M	**8 Hrs**
UNIT-II	
QUANTUM COMPUTATION : Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database. **Video Links:** https://www.youtube.com/watch?v=OlatlIaqPj8	**8 Hrs**
UNIT-III	
QUANTUM COMPUTERS : Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance. **Video Links:** https://www.youtube.com/watch?v=Nq4YZtINNAQ	**8 Hrs**
UNIT-IV	
QUANTUM INFORMATIONS: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. **Video Links**: https://nptel.ac.in/courses/115/101/115101092/	**8 Hrs**
UNIT-V	
QUANTUM ERROR CORRECTION :Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource. Video Links**:https://www.digimat.in/nptel/courses/video/115101092/L23.html**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Define and explain basic concepts in Quantum computing.
CO2	Demonstrate applications of Quantum computing.
CO3	Explain principles in the design of Quantum Computers

CO4	Discuss applications and limitations of Quantum operations
CO5	Explain theory and concepts in Quantum error correction.

Reference Books	
1.	Micheal A. Nielsen and Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian Edition, 2002
2.	Bennett C.H., Bernstein E., Brassard G., Vazirani U., The strengths and weaknesses of quantum computation. SIAM Journal on Computing.
3.	Mika Hiravensalo, "Quantum computing" II edition, ACM computing classification, Springer-2004

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is 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/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	-	-	-	-	-	-	2	2	-
CO2	3	3	2	3	3	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	3	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Semester: VII		
PROJECT PHASE – 1 (Theory)		
Course Code: MVJ21AIPR75		**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 support independent learning.
2	To develop interactive, communication, organization, time management, and presentation skills.
3	To impart flexibility and adaptability
4	To expand intellectual capacity, credibility, judgment, intuition.
5	To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas

Project Work Phase - I
Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the project and be able to defend it.
CO2	Learn to use modern tools and techniques
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO4	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO5	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation
Internal Marks: The Internal marks (50 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.

CIE Marks Breakup for Major Project during VII Semester :

Relevance of the Topic	10 Marks
Report	20 Marks
Evaluation by Guide	25 Marks
Presentation	30 Marks
Viva- Voce	15 Marks
Total	100 Marks

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

High-3, Medium-2, Low-1