Curriculum Structure for Multi-Disciplinary Minor (MDM) Degree in

MACHINE LEARNING

(In light of NEP 2020)

(NEP_Version II)

Offered By

Information Technology Department

For students admitted in 2023-24 onwards

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Near Kathora Naka, Amravati, Maharashtra

PIN 444604

www.gcoea.ac.in

A. Preamble:

This multidisciplinary minor program covers specialized subjects pertaining to SE/ML domains. Those have lots of potential to cater to solution process of many complex problems. The MDM provides considerable leverage to students to develop a modern outlook for student's by getting an opportunity to experience the latest subjects of IT field.

B. Program-Specific Outcomes for Minor in **Software Engineering and Machine Learning**

On completion of a Minor in SE/ML, a student will be able to

PSO1 To inculcate a technically proficient outlook to application part of various different domains of information Technology

PSO2 To develop understanding of real-life and real-world problems that can be solved using specialized domains of software engineering & machine learning

PSO3 To exhibit the knowledge of SE/ME to formulate solution process of complex technical and societal problems

C. Intake: Minimum 15 and maximum 60 students (to be discuss)

D. Eligibility criteria:

a. Students enrolled in Electronics and Telecommunication Engg., Civil Engg,, Mechanical Engg, Electrical Engg, Instrumentation Engg are eligible. The allotment of minor degree programme will be as per the policy of the Institute

E. Structure of the MDM course: Track-1

IT Department offer Multi-disciplinary Minor Basket, Track-1 (Machine Learning)														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	**TU**	**PR**	**Total**	**CT1**	**CT2**	**TA**	**ESE**	**ICA**	**ESE**		
MM1	IT1315	Essential Math for Machine Learning	3	-	-	3	15	15	10	60	-	-	100	3
MM2	IT1415	Artificial Intelligence	3	-	-	3	15	15	10	60	-	-	100	3
MM3	IT1515	Machine Learning Foundation	3	-	-	3	15	15	10	60	-	-	100	3
MM4	IT1615	Fundamentals of Deep Learning	3	-	-	3	15	15	10	60	-	-	100	3
MM5	IT1715	Minor Project	-	-	4	4	-	-	-	-	50	50	100	2
Total			**12**	**0**	**4**	**16**	**60**	**60**	**40**	**240**	**50**	**50**	**500**	**14**

Multi-disciplinary Minor Basket, Track-1 (Machine Learning)

Course Code	IT1315							Course category		MM
Course Name	ESSENTIAL MATHEMATICS FOR MACHINE LEARNING									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	02 hrs 30 min	--	--	100	03

Course Objectives

1. Introduce students to the vectors in machine learning ,vector space , Eigen values and Eigenvectors, Special Matrices .
2. Introduce students to Singular Value Decomposition, PCA, LDA.
3. Understand the Linear and Multiple Regression, Logistic Regression..
4. Understand the Gradient Descent and other optimization algorithms in machine
5. Apply and understand the concept of joint probability and covariance, SVM

Vectors in Machine Learning: Basics of Matrix Algebra, Vector Space, Subspace, Basis and Dimension,. Linear Transformations, Norms and Spaces, Orthogonal Complement and Projection Mapping, Eigen values and Eigenvectors, Special Matrices and Properties.

Spectral Decomposition: Singular Value Decomposition, Low Rank Approximations, Python Implementation of SVD and Low-rank Approximation., Principal Component Analysis, Python Implementation of PCA, Linear Discriminant Analysis, Python Implementation of LDA.

Least Square Approximation and Minimum Normed Solution: Linear and Multiple Regression, Logistic Regression., Classification Metrics, Gram Schmidt Process, Polar Decomposition, Minimal Polynomial and Jordan Canonical Form, Some more Matrices Applications in Machine Leaning.

Numerical Optimization in Machine Learning: Gradient Descent and other optimization algorithms in machine learning., Optimization using Python, Review of Probability, Bayes theorem and random variable, Expectation and variance.

Discrete and continuous distribution functions: joint probability and covariance, Introduction to SVM, Error minimizing LPP., Lagrangian Multiplier method, concepts of duality, hard and soft margin classifier, SVM in Python.

Text Books

1. W. Cheney, Analysis for Applied Mathematics. New York: Springer Science + Business Medias, 2001.
2. S. Axler, Linear Algebra Done Right (Third Edition). Springer International Publishing, 2015.
3. J. Nocedal and S. J. Wright, Numerical Optimization. New York: Springer Science + Business Media, 2006.
4. J. S. Rosenthal, A First Look at Rigorous Probability Theory (Second Edition). Singapore: World Scientific Publishing, 2006.

Course Outcomes

Students will be able to:

IT1315.1 Use of vectors, Eigen values and Eigenvectors in machine learning

IT1315.2 Use of SVD, PCA and LDA to solve problems in machine learning

IT1315.3 Prepare the classification using Linear and Multiple Regression, Logistic Regression,

IT1315.4 Solve problems based on Gradient Descent, Bayes theorem

IT1315.5 Apply the concepts of SVM to various applications in machine learning

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1315.1	1	2	2	0	0	0	0	0	0	3	0	2	1	3	1
IT1315.2	2	2	3	0	0	0	0	0	0	0	0	1	2	3	1
IT1315.3	3	2	1	0	0	3	0	2	0	0	0	3	0	2	3
IT1315.4	1	3	3	0	0	0	1	0	0	1	0	2	2	0	2
IT1315.5	2	1	2	0	0	0	0	0	0	0	0	2	1	1	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	IT1415							Course category			MM
Course Name	ARTIFICIAL INTELLIGENCE										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	02 hrs 30 min	--	--	100	03

Course Objectives:

1. To gain a historical perspective of AI and its foundations
2. To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. To investigate applications of AI techniques in intelligent agents, expert systems and other machine learning models.

Introduction: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents, Natural Language Possessing.

Knowledge Representation & Reasoning : Syntax and semantics for propositional logic, Syntax and semantics for first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

Knowledge organization and manipulation: Preliminary concept, Examples of search problems, Uniformed and blind search. Informed search, Indexing and retrieval technique, integrating knowledge in memory.

Knowledge Acquisition: General concept in knowledge acquisition, learning by induction. Analogical and explanation-based learning: Analogical learning and reasoning, Explanation and learning.

Expert system: Expert system architectures: Introduction, Rules based system architecture, Knowledge acquisition and validation, Knowledge system building tools.

Text Books:

1. Artificial Intelligence, P.H. Winston, 2nd Edition Addison- Wesley Publication Company, 1984.
2. Introduction to Artificial Intelligence E. Charniac and D. McDermott, 2nd Edition, Addison Wesley Publishing Company, 2002.

Reference Book:

1 Introduction to expert systems, Peter Jackson, 3rd Edition, Addison-Wesley Publishing Company, 1986.

2 Artificial Intelligence, E. Rich, K.K. Knight,2nd Edition, Tata McGraw Hill, New Delhi, 1991.

3 LISP-The language of Artificial Intelligence, F. Holtz, TAB Books Inc. 1985.

4 Principles of Artificial Intelligence & Expert Systems Development, D.W. Rolston, McGraw Hill, 1988.

Useful link:

https://nptel.ac.in/courses/106/105/106105077/

https://nptel.ac.in/courses/106/105/106105078/

Course Outcomes:

On completion of the course, students will be able to:

IT1415.1 Student will be able to demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

IT1415.2 Student will apply basic principles of AI in solutions that require problem solving, inference, perception.

IT1415.3 Student will apply basic principles of AI in knowledge representation, and learning.

IT1415.4 Students will able to demonstrate proficiency in applying scientific method to models of machine learning.

IT1415.5 Students will apply AI techniques to real-world problems to develop intelligent systems.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1415.1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IT1415.2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	2
IT1415.3	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0
IT1415.4	0	0	3	3	0	0	0	0	0	0	0	0	0	0	1
IT1415.5	0	0	0	0	2	0	0	0	0	0	0	0	2	0	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	IT1515							Course category			MM
Course Name	MACHINE LEARNING FOUNDATION										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	02 hrs 30 min	--	--	100	03

Course Objectives:

1 To understand the basic theory underlying machine learning

2 To be able to formulate machine learning problem corresponding to different applications.

3 To understand a range of machine learning algorithms along with their strength and weaknesses

4 To understand linear model methods

5 To Understand different types of learning methods.

Introduction to Machine Learning: Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models.

Features: Feature types, Feature Construction and Transformation, Feature Selection.

Classification and Regression Classification: Binary Classification- Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification.

Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.

Linear Models: Least Squares method, Multivariate Linear Regression, Regularized Regression, UsingLeast Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM.

Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm.

Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees. Probabilistic Models Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian

Mixtures, and Compression based Models.

Trends in Machine Learning: Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text Books:

1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press, Edition 2012.
2. Introduction to Statistical Machine Learning with Applications in R, Hastie, Tibshirani, Friedman,Springer, 2nd Edition-2012.

Reference Books:

1. Pattern Recognition and Machine Learning, C. M. Bishop, Springer 1st Edition-2013.
2. Introduction to Machine Learning, Ethem Alpaydin, PHI 2nd Edition-2013.
3. Reinforcement and Systematic Machine Learning for Decision Making, Parag Kulkarni ,Wiley IEEE Press, Edition July 2012.

Course Outcomes:

On completion of the course students will be able to

IT1515.1 Model the learning primitives.

IT1515.2 Build the learning model.

IT1515.3 Implement the technique of classification methods.

IT1515.4 Implement the technique of tree based models.

IT1515.5 Tackle real world problems in the domain of Data Mining, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1515.1	2	2	0	0	3	0	0	0	0	0	0	0	2	3	3
IT1515.2	2	2	1	0	3	0	0	0	0	0	0	0	2	3	2
IT1515.3	2	3	3	2	3	2	0	0	0	0	0	0	2	3	3
IT1515.4	2	3	3	2	3	2	0	0	0	0	0	0	2	3	3
IT1515.5	2	3	3	2	3	2	0	0	0	0	0	0	2	3	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	IT1615							Course category		MM
Course Name	FUNDAMENTALS OF DEEP LEARNING									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	02 hrs 30 min	--	--	100	03

Course Objectives

1. To understand the basics of neural networks
2. Comparing different deep learning models
3. To understand the Recurrent and Recursive nets in Deep Learning
4. To understand the basics of deep reinforcement learning models
5. To analyze Types of Networks

Foundations of Deep learning: What is machine learning and deep learning? History of deep learning, Advantage and challenges of deep learning. Learning representations from data , Understanding how deep learning works in three figures(input, hidden layer, output), Common Architectural Principles of Deep Network, Architecture Design, Applications of Deep learning, Hyperparameters : Learning Rate, Regularization, Momentum, Sparsity, Hidden Units, cost functions, error back propagation, Gradient-Based Learning, Implementing Gradient Descent, vanishing and Exploding gradient descent, Optimization algorithm(SGD, AdaGrad, RMSProp, adam).

Deep Neural Networks (DNNs): Introduction to Neural Networks :The Biological Neuron, The Perceptron(AND,OR,NOT,XOR), Deep forward network, Multilayer Feed-Forward Networks , Training Neural Networks :Backpropagation and Forward propagation Activation Functions :Linear ,Sigmoid, Tannh, Hard Tanh, Softmax, Rectified Linear, Loss Functions :Loss Function Notation , Loss Functions for Regression , Loss Functions for Classification, Loss Functions for Reconstruction.

Convolution Neural Network (CNN): Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Local Response Normalization, Training a Convolutional Network

Recurrent Neural Network (RNN): Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks,

The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory

Deep Generative Models: Introduction to deep generative model, Boltzmann Machine, Deep Belief Networks, Generative adversarial network (GAN), discriminator network, generator network, types of GAN, Applications of GAN networks

Text Books

1. Goodfellow, I., Bengio, Y., Courville, A, "Deep Learning", MIT Press, 2016
2. Josh Patterson & Adam Gibson, "Deep Learning"
3. Charu Agarwal, "Neural Networks and deep learning"
4. Nikhil Buduma, "Fundamentals of Deep Learning", SPD
5. Francois chollet, "Deep Learning with Python"

e-Resources:

1. http://csis.pace.edu/ctappert/cs855-18fall/DeepLearningPractitionersApproach.pdf
2. https://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-1col-dkrieselcom.pdf

MOOC Courses:

1. Deep Learning- Part 1, IIT Madras: https://nptel.ac.in/courses/106106184
2. Deep Learning Specialization: https://www.coursera.org/specializations/deep-learning

Course Outcomes

Students will be able to:

IT1615.1 Understand the basics of Deep Learning and apply the tools to implement deep learning applications

IT1615.2 Evaluate the performance of deep learning models

IT1615.3 Implement the technique of Convolution neural network (CNN)

IT1615.4 Solve the language translation problem by Recurrent neural network (RNN)

IT1615.5 Construct new data by deep generative models

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1615.1	2	3	1	0	0	0	0	0	0	0	0	1	2	3	1
IT1615.2	3	3	3	0	0	0	0	0	0	0	0	1	3	3	1
IT1615.3	3	3	3	0	0	0	0	0	0	0	0	1	3	3	1
IT1615.4	3	3	3	0	0	0	0	0	0	0	0	1	3	3	1
IT1615.5	1	3	2	0	0	0	0	0	0	0	0	1	3	3	1

0-Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	IT1715							Course category			MM
Course Name	MINOR PROJECT										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	CT-2	TA	ESE	ESE Duration	ICA	ESE		
--	--	04	04	--	--	--	--	--	50	50	100	02

Course Objectives

1. To offer students a glimpse into real world problems and challenges that need IT based solutions
2. To enable students to create very precise specifications of the IT solution to be designed and use all concepts of IT in creating a solution for a problem.
3. To introduce students to the vast array of literature available of the various research challenges in the field of IT and create awareness among the students of the characteristics of several domain areas where IT can be effectively used.
4. To enable students to and improve the team building, communication and management skills of the students.

Minor Project Each batch consists of maximum 2-3 students.

Students can refer following domain list for developing minor project.

1. Web server, DNS Server, Proxy Server, Mail Server.
2. Database connectivity.
3. Cyber Security
4. Client-server Architecture.
5. Networking.
6. Data Mining and Data Ware housing.
7. Data Science.
8. Machine Learning, Deep Learning.
9. Internet of Things.
10. Cloud Computing.
11. Artificial Intelligence.
12. Block chain.
13. Network Security.
14. Cryptocurrency
15. Big Data Analytics.

Course Outcomes:-

Students will be able to:

IT1715.1 Discover potential research areas in the field of IT

IT1715.2 Conduct a survey of several available literature in the preferred field of study and formulate and propose a plan for creating a solution for the research plan identified

IT1715.3 Compare and contrast the several existing solutions for research challenge and demonstrate an ability to work in teams and manage the conduct of the research study.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1715.1	2	3	1	0	0	0	0	0	0	0	0	1	2	3	1
IT1715.2	3	3	3	0	0	0	0	0	0	0	0	1	3	3	1
IT1715.3	3	3	3	0	0	0	0	0	0	0	0	1	3	3	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Curriculum Structure for Multi-Disciplinary Minor (MDM) Degree in

SOFTWARE ENGINEERING

(In light of NEP 2020)

(NEP_Version II)

Offered By

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For students admitted in 2023-24 onwards

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A. Structure of the MDM course: Track-2

IT Department offer Multi-disciplinary Minor Basket, Track- 2 (Software Engineering)														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	**TU**	**PR**	**Total**	**CT1**	**CT2**	**TA**	**ESE**	**ICA**	**ESE**		
MM1	IT1316	Data Structure & Algorithms	**3**			**3**	**15**	**15**	**10**	**60**	**-**	**-**	**100**	**3**
MM2	IT1416	Software Engineering	**3**			**3**	**15**	**15**	**10**	**60**	**-**	**-**	**100**	**3**
MM3	IT1516	Object Oriented Design & Programming	**3**			**3**	**15**	**15**	**10**	**60**	**--**	**-**	**100**	**3**
MM4	IT1616	Software Testing	**3**			**3**	**15**	**15**	**10**	**60**	**-**	**-**	**100**	**3**
MM5	IT1716	Minor Project	**-**	**-**	**4**	**4**	**-**	**-**	**-**		**50**	**50**	**100**	**2**
Total			**12**	**0**	**4**	**16**	**60**	**60**	**40**	**240**	**50**	**50**	**500**	**14**

F.Multi-disciplinary Minor Basket, Track- 2 (Software Engineering)

Course Code	IT1316						Course category			MM
Course Name	DATA STRUCTURES AND ALGORITHMS									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	02 hrs 30 min	--	--	100	03

Course Objectives

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly , Circular linked list: operations on it.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree,Tree operations on each of the trees .Applications of Binary Trees.

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text books

1. Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. Richard Gilberg and Behrouz Forouzan, "Data structures A Pseudo code Approach with C", 2nd edition, 2005,Cengage Learning.

Reference books

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.
3. "Data structures with C", Seymour Lipschutz, 1st Edition, 2017, SchaumSeries,TataMacGraw Hill

Useful link:

http://nptel.ac.in/courses/106106130/, IIT Madras

http://nptel.ac.in/courses/106103069/, IIT Guwahati

http://nptel.ac.in/courses/106106127/, Prof. Shankar Balachandran, IIT Madras

Course outcomes

Student will be able to

IT1316.1 Analyse the time and computation complexity and justify the correctness of an algorithm. Implement, use and analyse various searching techniques. (Linear Search and Binary Search)

IT1316.2 Design and analyse the algorithm for given problem using of Stacks, Queues

IT1316.3 Learn various types of linked list and related algorithms, complexity analysis and choose appropriate linked list for given application.

IT1316.4 Apply Non-Linear Data Structures Graph, Trees -search and traversal algorithms and determine the time and computation complexity

IT1316.5 Discuss and Use different Sorting and Hashing Algorithms and compare their performances in term of Space and Time complexity.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1316.1	3	1	2	0	1	0	0	0	0	1	1	1	1	3	2
IT1316.2	3	1	1	0	2	0	0	0	0	1	1	1	1	3	2
IT1316.3	3	1	1	0	2	0	0	0	0	1	1	1	1	3	2
IT1316.4	3	1	1	0	2	0	0	0	0	1	1	1	1	3	2
IT1316.5	3	1	1	0	1	0	0	0	0	1	1	1	1	3	2

0-Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code				IT1416				Course category			MM
Course Name				SOFTWARE ENGINEERING							
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	02 hrs 30 min	--	--	100	03

COURSE OBJECTIVES

1 To familiarize students with the principles of software engineering (SE) in general.
2 Understand efficient techniques for managing systems development lifecycle.
3 To imbibe a correct sense of SE principles and role during development processes.
4 To inculcate a sense of team-work and team-leadership in a software development team.
5 To gain a better understanding of software development processes in general and to learn different techniques and methodologies for developing large software systems

Introduction: Software Characteristics, Software Engineering: A Layered Technology, Software Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Agile Process Model

Software Engineering Principles and Practice: Communication Practices, Planning Practices, Requirements Engineering

Software Quality Management and Software Testing: Quality concepts, Evolution of Quality Management, Quality assurance, Software Reviews, Testing Fundamentals

Software Project Management: Introduction to Software Project Management, Project Planning, Project Scheduling, Software Teams and Role of Leadership

Agile Software Development: Introduction to Agile development, Agile Processes, Extreme Programming, Dynamic Software Development Method

Text Books:

1. Software Engineering: A Practitioner's Approach by Roger Pressman (Tata Mc. Hill)
2. Software Engineering (Ninth Edition) by Ian Summerville (Pearson Education)
3. An Integrated Approach to Software Engineering, by Pankaj Jalote (Springer/Narosa)
4. Fundamentals of Software Engineering, by Rajib Mall, (Prentice Hall India)

Reference Books:

1. Schaum's Outline of Software Engineering by David Gustafson (Tata Mc. Hill)
2. Software Project Management by Sanjay Mohapatra (Cengage Learning India Pvt. Ltd.)

Course Outcomes

IT1416.1 Able to interpret a general understanding of software engineering from a professional and wider viewpoint.

IT1416.2 Apply methodically the skills learned during the course to actual circumstances of problem understanding and software development.

IT1416.3 Understand the processes of software development as an effective role player.

IT1416.4 Able to practice good communication in software development activities.

IT1416.5 Understand the technical and ethical obligation of developing contemporary software and engaging in lifelong learning.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1416.1	3	2	0	0	2	0	0	0	0	0	0	0	0	2	1
IT1416.2	0	2	3	0	0	0	0	0	0	0	0	0	1	2	1
IT1416.3	0	1	1	2	2	0	0	0	0	0	0	0	0	2	2
IT1416.4	1	0	0	2	0	0	0	0	0	0	0	0	2	2	3
IT1416.5	2	0	0	0	0	3	--	1	2	--	2	3	2	2	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	IT1516							Course category			MM
Course Name	OBJECT ORIENTED ANALYSIS AND DESIGN										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	02 hrs 30 min	--	--	100	03

COURSE OBJECTIVES

1. To describe the activities in the different phases of the object-oriented development life cycle.
2. To State the advantages of object-oriented modeling v
3. Model a real-world application by using a UML class diagram.
4. Recognize when to use generalization, aggregation, and composition relationships.

Object Oriented concepts: Objects and classes, abstraction, encapsulation, generalization, polymorphism and inheritance, polymorphism, link and association, Need for object oriented approach.

Object Modeling Technique : System design life cycle, object oriented S/W development process model, Object Oriented Analysis, object model, function model, relationship among models, object diagrams, state diagrams, data flow diagrams.

Unified Modeling Language : Class diagram, sequence diagram, Use case diagram, Collaboration diagram, state chart diagram, Activity diagram, component diagram, deployment diagram.

Translation of Object Oriented design into implementation: Programming style, Documentation, characterization of object oriented languages, Comparison of object oriented language like C++, JAVA.

Introduction to Design Pattern: Designing objects with responsibilities, Creator, Information expert, Low Coupling, High Cohesion, Controller Design Patterns ,creational, factory method , structural, Bridge, Adapter ,behavioral, Strategy, observer, Applying GoF design patterns.

TEXT BOOKS

1 Michael Blaha and James Rumbaugh, “Object-Oriented Modeling and Design with UML”, 2nd Edition, Pearson Education,2005

REFERENCE BOOK

1 Grady Booch, Michael W. Engel, Kelli A. Houston, Robert A. Maksimchuk, Bobbi J.

Young, Jim Conallen, “Object-Oriented Analysis and Design with Applications”, 3rd Edition, Pearson Education, 2009

2 Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides, “Design Patterns: Elements of Reusable Object-oriented Software”, Pearson Education India, 2004.

COURSE OUTCOMES

At the end of the course, the students will be able to

IT1516.1 Define the fundamentals of OO approach.
IT1516.2 Design OO Application using design patterns.
IT1516.3 Solve real world problems by applying OOAD principle.
IT1516.4 Acquire expertise in Java Programming
IT1516.5 Understand Design Patterns

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1516.1	3	2	0	0	3	0	0	0	0	0	0	0	0	2	1
IT1516. 2	2	2	0	0	3	0	0	0	0	0	0	0	1	2	1
IT1516.3	2	2	0	2	3	0	0	0	0	0	0	0	0	2	2
IT1516.4	2	2	2	2	3	0	0	0	0	0	0	0	2	2	3
IT1516.5	1	1	1	1	2	0	0	0	0	0	0	0	1	1	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	IT1616							Course category			MM
Course Name	SOFTWARE TESTING										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	02 hrs 30 min	--	--	100	03

Course Objective:

1. Study fundamental concepts of software testing.
2. To understand application in various scenarios with the help different testing strategies, methods and tool
3. To identify and eliminate defects or bugs within the application.
4. To identify defects that can range from minor glitches to critical errors that may lead to system crashes or incorrect data processing.

Introduction: Software Testing, Importance of testing, Roles and Responsibilities, Testing Principles, Attributes of Good Test, V-Model, Test Case Generation , SDLC Vs STLC, Software Testing Life Cycle-in detail.

Types of Testing: Testing Strategies: Unit Testing, Integration Testing, System Testing, Smoke, Regression Testing, Acceptance Testing. Clean Room Software Engineering. Functional/Non- Functional Testing. Testing Tools, Categorization of testing methods: Manual Testing, Automation Testing and Automated Testing Vs. Manual Testing.

Non Functional Testing: Performance Test, Memory Test , Scalability Test, Compatibility Test, Security Test, Cookies Test, Session Test, Recovery Test, Installation Test, Ad-hoc Test, Risk Based Test,
Compliance Test. McCall's Quality Factors, FURPS.

Software Testing Methodologies: Validation & Verification, White/Glass Box Testing, Black Box Testing, Grey Box Testing, Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Boundary Value Analysis, Equivalence Class Partition, State Based Testing, Cause Effective Graph, Decision Table, Use Case Testing, Exploratory testing
and Testing Metrics, Testing GUI

Software Testing Life Cycle: Requirements Analysis/Design, Traceability Matrix, Test Planning, Objective, Scope of Testing, Schedule, Approach, Roles & Responsibilities, Assumptions, Risks & Mitigations,

Entry & Exit Criteria, Test Automation, Deliverables.

Test Cases Design: Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Environment setup, Understand the SRS, Hardware and software requirements, Test Data.

Test Execution: Execute test cases, Error/Defect Detecting and Reporting, DRE(Defect Removal Efficiency), Object ,Types of Bugs , Art of Debugging,. Debugging Approaches, Reporting the Bugs, Severity and

priority, Test Closure, Criteria for test closure, Test summary report.

Test Metrics: Test Measurements, Test Metrics, Metric Life Cycle, Types of Manual Test Metrics.

Course Outcomes: After completion of this course, student will be able to

IT1616.1 Understand importance of testing techniques in software quality management and assurance

IT1616.2 Identify various types of software risks and its impact on different software application.

IT1616.3 Create test case scenarios for different application softwares using various testing techniques.

IT1616.4 Apply different testing methodologies used in industries for software testing.

IT1616.5 Understand different Test Metrics

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1616.1	1	2	0	0	3	0	0	0	0	0	0	0	0	2	1
IT1616.2	2	3	0	0	2	0	3	0	0	0	0	1	1	2	1
IT1616.3	3	2	0	2	3	0	0	0	2	0	0	0	0	2	2
IT1616.4	2	2	2	2	3	0	0	0	0	0	0	0	2	2	3
IT1616.5	1	2	0	0	3	0	0	0	0	0	0	0	0	2	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	IT1716							Course category		MM
Course Name	MINOR PROJECT									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
--	--	04	04	--	--	--	--	--	50	50	100	02

Course Objectives

1 To offer students a glimpse into real world problems and challenges that need IT based solutions

2 To enable students to create very precise specifications of the IT solution to be designed and use all concepts of IT in creating a solution for a problem.

3 To introduce students to the vast array of literature available of the various research challenges in the field of IT and create awareness among the students of the characteristics of several domain areas where IT can be effectively used.

4 To enable students to and improve the team building, communication and management skills of the students.

Minor Project Each batch consists of maximum 2-3 students.

Students can refer following domain list for developing minor project.

1. Web server, DNS Server, Proxy Server, Mail Server.
2. Database connectivity.
3. Cyber Security
4. Client-server Architecture.
5. Software testing
6. Data Mining and Data Ware housing.
7. Data Science.
8. Machine Learning, Deep Learning.
9. Internet of Things.
10. Cloud Computing.
11. Artificial Intelligence.
12. Block chain.
13. Network Security.
14. Cryptocurrency

15. Big Data Analytics.

Course Outcomes:-

Students will be able to:

IT1716.1 Discover potential research areas in the field of IT

IT1716.2 Conduct a survey of several available literature in the preferred field of study and formulate and propose a plan for creating a solution for the research plan identified

IT1716.3 Compare and contrast the several existing solutions for research challenge and demonstrate an ability to work in teams and manage the conduct of the research study.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT1716.1	2	3	1	0	0	0	0	0	0	0	0	1	2	3	1
IT1716.2	3	3	3	0	0	0	0	0	0	0	0	1	3	3	1
IT1716.3	3	3	3	0	0	0	0	0	0	0	0	1	3	3	1

0-Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated