Third Year : *Semester II*

Course No	Course Title	Hours/Week Theory + Lab	Credits
SWE 325	Distributed System	2 + 0	2
SWE 326	Distributed System Lab	0 + 3	1.5
SWE 331	Software Usability and Metrics	2 + 0	2
SWE 333	Software Verification and Validation	2 + 0	2
SWE 334	Software Verification and Validation Lab	0 + 3	1.5
SWE 342	Technical Writing And Presentation	0 + 4	2
SWE 343	Machine Learning	3 + 0	3
SWE 344	Machine Learning Lab	0 + 3	1.5
BUS 301W	Entrepreneurship Development	2 + 0	2
SWE 350	Project Work-III	0 + 6	3
	Total	**11 + 19 = 30**	**20.5**

SWE 325 DISTRIBUTED SYSTEMS
2 Hours/Week, 2 Credits

Distributed System Models, System Architectures & Client-Server Models, Programming Systems and Models, Processes and threads, Remote Procedure Call, High-Performance Computing, MapReduce, Many-Task Computing, Workflow Systems, Grid Computing, Cloud Computing, Virtualization, IaaS Clouds, Filesystems, Networked Filesystems, Parallel Filesystems, Distributed Filesystems, Data-Intensive Computing, Distributed Hash Tables, Consistency Models, Fault Tolerance, Many-core Computing.

Text:
1. Distributed Systems: Principles and Paradigms. Andrew S. Tanenbaum and Maarten Van Steen

Reference:
Distributed and Cloud Computing: Clusters, Grids, Clouds, and the Future Internet (DCC) by Kai Hwang, Jack Dongarra & Geoffrey C. Fox

SWE 326 DISTRIBUTED SYSTEMS LAB
3 Hours/Week, 1.5 Credit

Practical implementation of various distributed algorithms and models based on SWE 327.

SWE 331 SOFTWARE USABILITY AND MATRICS
2 Hours/Week, 2 Credits

Overview of Software Metrics, The basics of Measurement, Goal based framework for software measurement, Empirical Investigation, Measuring Internal Attributes : Size, Measuring
Internal Attributes : Structure, Measuring Cost and Effort, Measuring External product attributes :
Quality, Measuring Software Reliability, Object Oriented Metrics, For hands-on experiences: Students
will implement different software metrics calculation related algorithms, utilize existing industry related tools for measuring software metrics and compare it with their implementations to gain
concrete idea.

Text:
1. Software metrics- A Rigorous and Practical Approach, (3rd Edition) Norman Fenton, and Jones Bieman.
2. Software Measurement and Estimation: A practical Approach (1st Edition) Linda M. Laird, and M. Carol Brennan

SWE 333 SOFTWARE VALIDATION AND VERIFICATION
2 Hours/Week, 2 Credits

Demonstrate the application of verification and validation tasks and their outcomes during the software life cycle. Apply various verification and validation techniques based on various characteristics of the system/software (safety, security, risk, etc).Differentiate between the overall role of verification and validation and the specific role of software/system testing. Compare and Contrast the theoretical and practical limitations to software verification and validation analysis. Apply appropriate planning and scoping to a verification and validation effort based on the needs of the software system being developed. Develop a software verification and validation plan that reflects an understanding of verification and validation objectives, and appropriate problem/risk identification and tracking. Analyze the effectiveness of a V&V plan with respect to its objectives. Appraise various research in software verification and validation and provide critical insight as to their content with the class.

Text:
1. Software Verification and Validation – A Practioner's Guide – Steve Rakitin, 1 Feb 1997

SWE 334 SOFTWARE VALIDATION AND VERIFICATION LAB
3 Hours/Week, 1.5 Credits

Practical implementation of various techniques of Software verification and validation based on SWE 333.

SWE 342 TECHNICAL WRITING AND PRESENTATION
2 Hours/Week, 2 Credits

Issues of technical writing and effective oral presentation in Computer Science and Engineering; Writing styles of definitions, propositions, theorems and proofs; Preparation of reports, research papers, theses and books: abstract, preface, contents, bibliography and index; Writing of book reviews and referee reports; Writing tools: LATEX; Diagram drawing software; presentation tools.

SWE 343 MACHINE LEARNING
3 Hours/Week, 3 Credits

Introduction to Machine Learning Concepts: Concepts of ML. Some ML applications and examples. The main components of a ML system. Requirements to design a ML system. Induction Learning: Learning a concept and hypothesis. Generalization and overfitting. Induction and bias. Hypothesis evaluation. Entropy and information gain. Decision tree algorithm and its application. Statistical Learning: Linear Regression using LSE and estimate MSE. Classification: Linear/non-linear separation. Nearest neighbour classifier. kNN algorithm with its advantage and disadvantage. Bayesian Learning: Bayes theorem. MAP and ML hypothesis. Naïve Bayes classifier. Artificial Neural Networks: Biological neuron vs

a single artificial neuron. Transfer functions. Learning in artificial neural networks (ANNs). Single perceptron unit and the delta rule. Single layer and multi–layer perceptrons. The backpropagation learning algorithm. Using MLP-BP as a classifier. Performance measures of MLP-BP algorithm. Strength and limitations of ANN. Genetic Algorithms: GA terminology. Encoding of chromosomes. Selection operator in GA. Crossover and mutation operators in GA. Applications of GA: evolving ANN and genetic programming. Advantages and disadvantage of GA. Unsupervised Learning: Introduction to clustering. Clustering approaches: exclusive clustering using K-means algorithm, agglomerative clustering using hierarchical algorithm, overlapping clustering: using fuzzy C-means algorithm. Cluster validity problem and its quality criteria: Davies-Bouldin index.

Text:
1.Machine Learning, Tom Mitchell, McGraw Hill, 1997.

Reference:
1. Introduction to machine learning (2nd edition), Alpaydin, Ethem, MIT Press, 2010
2. An Introduction to Support Vector Machines and Other Kernel-based Learning Methods, Nello Cristianini and John Shawe-Taylor, Cambridge University Press

SWE 344 MACHINE LEARNING LAB
3 Hours/Week, 1.5 Credits

ID3 Algorithm for Decision Tree, Regression using LSE and estimating MSE, kNN Algorithm as Nearest Neighbor Classifier, Apply NB Classifier for a Classification Task, Application of the MLP-BP ANN algorithm., Aapplication of GA for solving a problem, Exclusive clustering: K-means algorithm, Agglomerative clustering: Hierarchical algorithm, Overlapping clustering: Fuzzy C-means algorithm

SWE 350 PROJECT WORK III
2 Hours/Week, 2 Credits

Projects must possess innovative ideas which reflect contemporary IT trends. Supervisor have to ensure that every accepted project contain basic level of research work.

Projects that meet the software/hardware requirements of SUST or any other IT organization are highly preferable. Students have to give a presentation on their project works. Departments should take appropriate steps to archive all the projects and keep tracks to maintain the genuineness of the projects.

BUS 301W ENTERPRENEURSHIP DEVELOPMENT
2 Hours/Week, 2 Credits

Business and Financial Environment, Financial Resource Management, Leadership and Professional Development, Managing People and Organisations, Marketing, Operations Management, Strategic Management, Information Management, MBA, Business Forecasting and Modelling, Corporate Finance, Entrepreneurial Ventures, Global Business, International Marketing, Management Consultancy, Management of Change, Managing Corporate Social Responsibility, Public Service Management, Services Marketing, Strategic Management of E-Business, Strategic Operations Management, Strategic Project Management.

Text:
1. Zimmerer, T. W. & Scarborough, N. M. (1996). Entrepreneurship and new venture formation. Upper Saddle River, NJ: Prentice Hall. Meyer and Heppard (2000)

Reference:
1. Oden, H. W. (1997). Managing corporate culture, innovation, and intrapreneurship. Westport, CT: Quorum Books.
2. Bangs, D. H., Jr. (1998). The business planning guide: Creating a plan for success in your own business. (8th Edition). Chicago: Upstart Publishing. Brenner, G., Ewan, J., & Custer, H. (1990). The complete handbook for the entrepreneur. Englewood Cliffs, NJ: Prentice Hall Stolze, W. J. (1999). Start up: An entrepreneur's guide to launching and managing a new business. 5th edition. Franklin Lakes, NJ: Career Press.