UNIVERSITY OF MUMBAI

Bachelor of Engineering

Information Technology (Second Year – Sem.VII)

Revised course (REV- 2012)

From Academic Year 2015 -16

Under

FACULTY OF TECHNOLOGY

(As per Semester Based Credit and Grading System)

B.E. Engineering (Semester VII)
Revised course for Information Technology
Academic Year 2015 -16 (REV- 2012)

Course Code	Course Name	Teaching Scheme (hrs/week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	TW/Prac	Tut.	Total
BEITC701	Software Project Management	4			4			4
BEITC702	Cloud Computing	3			3			3
BEITC703	Intelligent System	4			4			4
BEITC704	Wireless Technology	4			4			4
BEITC705	Elective - I	4			4			4
BEITL701	Software Project Management		2			1		1
BEITL702	Cloud Computing		2			1		1
BEITL703	Intelligent System		2			1		1
BEITL704	Wireless Technology		2			1		1
BEITT705	Elective - I		2			1		1
BEITP706	Project-I		*			3		3
	Total	19	10		19	08		27

*Work load of the teacher in semester VII is equivalent to 6 hrs/week.

Elective –I (Semester VII)	
BEITC7051	Image Processing
BEITC7052	Software Architecture
BEITC7053	E-Commerce & E-Business
BEITC7054	Multimedia Systems
BEITC7055	Usability Engineering
BEITC7056	Ubiquitous Computing

Examination Scheme

Course Code	Course Name	Theory					Term work	Pract/ Oral	Total
		Internal Assessment			End sem exam	Exam duration (in Hrs)			
		TEST 1	TEST 2	AVG.					
BEITC701	Software Project Management	20	20	20	80	3	25	25	150
BEITC702	Cloud Computing	20	20	20	80	3	25	25	150
BEITC703	Intelligent System	20	20	20	80	3	25	25	150
BEITC704	Wireless Technology	20	20	20	80	3	25	25	150
BEITC705	Elective - I	20	20	20	80	3	25	25	150
BEITP706	Project-I						25	25	050
	Total	100	100	100	400	15	150	150	800

Course Code	Course Name	Teaching Scheme (hrs/week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC701	Software Project Management	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
BEITC701	Software Project Management	20	20	20	80	25	---	25	150

Course Objectives:

This course will help students to identify key areas of concern over Project Life Cycle (PLC) and use of project management principles across all the phases of PLC. The course will also help student to make them understand the importance and necessity of project plan and how it is helpful to project manager in monitoring and controlling the various aspects of the project such as schedule, budget, etc. The course will make them understand the importance of team and how to work as a team member, share best project management practices.

Course Outcomes:

Upon completion of the course, students should be able to:
- Articulate similarities and differences between IT projects and other types of projects.
- Justify an IT project by establishing a business case
- Develop a project charter
- Develop a work breakdown structure for an IT project

- Estimate resources (time, cost, human being, etc.)
- Establish task inter-dependencies
- Construct and analyze a network diagram
- Identify IT project risks and develop risk mitigation strategies
- Ensure the quality of the project using various standards
- Demonstrate Team work and team spirit and how to overcome the conflicts

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	**An overview of IT Project Management**	Introduction, the state of IT project management, context of project management, need of project management, project goals, project life cycle and IT development, information technology project methodology (ITPM), project feasibility, request for proposal (RFP), the business case, project selection and approval, project contracting, PMBOK.	4
2	**Project Integration Management**	Introduction, project management process, project integration management, the project charter, project planning framework, the contents of a project plan, the planning process.	4
3	**Project Scope Management**	Introduction, scope planning, project scope definition, project scope verification, scope change control, the Work Breakdown Structure (WBS), the linear responsibility chart.	4
4	**Project Time Management**	Introduction, developing the project schedule, Scheduling Charts, logic diagrams and network (AOA, AON), critical path, calendar scheduling and time based network, management schedule reserve, PDM network, PERT, CPM, Resource loading, resource leveling, allocating scarce resources to projects and several projects, Goldratt's critical chain.	10
5	**Project Cost Management**	Cost estimating, Cost escalation, Cost estimating and system development cycle, Cost estimating process, Elements of budgets and estimates, Project cost accounting and MIS, Budgeting using cost accounts, Cost schedules and forecasts.	4

6	**Project Quality Management**	Introduction, Quality tools and philosophies, quality systems, the IT project quality plan.	3
7	**Project Human Resource Management**	Introduction, organization and project planning, the project team, multidisciplinary teams, the project environment, project leadership, ethics in projects, multicultural projects, Role of project manager, IT governance and the project office. Introduction to change, the nature of change, the change management plan, dealing with resistance and conflicts.	5
8	**Project Communication Management**	Introduction, monitoring and controlling the project, the project communications plan, project metric, project control, designing the control system, the plan-monitor-control cycle, data collection and reporting, reporting performance and progress, information distribution.	4
9	**Project Risk Management**	Basic concepts, Identification, Assessment, Response planning, Management.	4
10	**Project Procurement Management**	Introduction, project procurement management, outsourcing.	3
11	**The Implementation Plan and Project Closure**	Introduction, project implementation, administrative closure, project evaluation, project audit.	3

Text Books:

1. Jack T. Marchewka, Information Technology Project Management, 4th edition, Wiley India, 2009.
2. John M. Nicholas, Project Management for Business and Technology, 3rd edition, Pearson Education.

References:

1. E-Book - Project Management Body of Knowledge (PMBOK).
2. Claudia M. Baca, Patti M. Jansen, PMP: Project Management Professional Workbook, Sybex Publication.
3. S. J. Mantel, J. R. Meredith and etal., Project Management 1st edition, Wiley India, 2009.
4. Joel Henry, Software Project Management, A real-world guide to success, Pearson Education, 2008.
5. Gido and Clements, Successful Project Management, 2nd edition, Thomson Learning

6. Hughes and Cornell, Software Project Management, 3rd edition, Tata McGraw Hill
7. Joseph Phillips, IT Project Management, end edition, Tata McGraw Hill
8. Robert K. Wyzocki, Effective Project Management, 5th edition, Wiley
9. Brown, K.A. Project Management, McGraw Hill, 2002.
10. Dinsmore, P. C. (Ed.), The AMA Handbook of Project Management. AMACOM, 1993.

Term work:

Term work shall consist of at least 10 experiments covering all topics of the syllabus. Distribution of marks for term work shall be as follows:
1. Attendance (Theory and Practical): 05 Marks
2. Laboratory work (Experiments and Journal): 15 Marks
3. Assignments: 5 Marks
The final certification and acceptance of TW ensures the satisfactory performance of laboratory Work and Minimum Passing in the term work.

Suggested Practical List:

In practical, a group of maximum **three** students should be formed. Each group is supposed to complete all lab experiments (given below) on the case study given by the subject teacher. In lab experiments, students can used the tools like MsWord to prepare document whereas MsProject for preparing WBS, N/w diagram, PERT, CPM, performance analysis of the project, etc.

1. Project and System's Management
2. Feasibility study
3. Project Proposal
4. Project Planning
5. Activity Planning
6. Analyzing the project network diagram
7. Cost estimation and budgeting
8. Risk management
9. Performance analysis of project
10. Project evaluation and closure

Theory Examination:

- Question paper will comprise of 6 questions, each carrying 20 marks.
- Total 4 questions need to be solved.
- Q.1 will be compulsory, based on entire syllabus.
- Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (hrs/week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC702	Cloud Computing	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEIT C702	Cloud Computing	20	20	20	80	25	---	25	150

Course Objectives:

This course will help the students to get familiar with cloud computing fundamentals, architecture, services, implementation and deployment techniques etc.

Course Outcomes:

After completion of the course the learner should be able to:

1. Differentiate different computing techniques.

2. Compare various cloud computing providers/ Software.

3. Handle Open Source Cloud Implementation and Administration.

4. Understand risks involved in cloud computing.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	Introduction to Cloud Computing	- Introduction – Component of CC – Comparing CC with Virtualization, Grids, Utility Computing, client-server model, P-to-P Computing – Impact of CC on Business – Key Drivers for Cloud Computing - Cloud computing Service delivery model - Cloud Types – Private, Public and Hybrid, when to avoid public cloud, Cloud API	**2**
2.	Virtualization	- Introduction & benefit of Virtualization – Implementation Levels of Virtualization- VMM Deisgn Requirements and Providers – Virtualization at OS level – Middleware support for Virtualization – Virtualization structure/tools and mechanisms: Hypervisor and Xen Architecture, Binary Translation with full Virtualization, Para Virtualization with Compiler Support – - Virtualization fo CPU, Memory and I/O Devices, Hardware support for Virtualization in intel x86 processor – CPU Virtualization – Memory Virtualization and I/O Virtualization – Virtualization in Multicore processors	**4**
3.	Cloud computing Services	XaaS, IaaS, PaaS- Leveraging PaaS for Productivity-Languages for PaaS- DBaaS(Database as a services) – SaaS (Software as a service) – Comparison of various cloud computing providers/ Softwares.	**4**
4.	Cloud Computing and Business Value	Key Business Drivers for CC- Cloud computing and out sourcing – Types of Scalability – Security issues in Cloud Computing- time to Market Benefits- Distribution over Internet – Three levels of Business value from Cloud computing.	**4**
5.	Open Source Cloud Implementation and Administration	Eucalyptus and Open Stack Architecture Features – Components – Various mode of operations – Installation and configuration process of both open source – Cloud Administration and Management Task – Creating User Interface (Web Interface) of Private cloud.	**6**

6.	Cloud Deployment Techniques	Factors for Successful Cloud Deployment – Network Requirements – Potential Problem areas in a cloud Network and their Mitigation – Cloud Network Topologies – Automation and Self-service feature in a cloud –cloud performance.	**4**
7.	Security	Security for Virtualization Platform – Host security for SaaS, PaaS and IaaS – Data Security – Data Security Concerns – Data Confidentiality and Encryption – Data Availability – Data Integrity – Cloud Storage Gateways – Cloud Firewall	**4**
8.	Architecture for Cloud Application	Cloud Application requirements- Architecture for traditional Vs Cloud Applications- Multi-ties Application Architecture- SOA for Cloud applications – Resource oriented SOA – Method –oriented SOA and Event Driven SOA – Parallelization within Cloud Applications – Leveraging In-memory Operations for Cloud Application	**4**
9	Cloud Programming	Programming Support for Google Apps engine: GFS, Big Tables, Googles NO SQL System, Chubby, Google Distibuted Lock Service, Programming Support for Amazon EC2: Amazon S3, EBS and Simple DB etc.	**4**
10	Adoption and Use of Cloud	Adoption of Public cloud by SMBs- Public Cloud Adoption phase for SMBs- Vendor liability and Management Adoption process of Public clouds by Enterprises – Managed Private clouds Migrating Application to the cloud – Impact of Shared Resources and Multi-Tenancy on cloud Applications – Phases during Migration an Application to An IaaS Cloud	**4**
11	Risks of Cloud Computing and Related Costs	Risk Assessment and Management – Rosk of Vendor Lock-in – Risk of Loss of control over IT services- Risk of Poor Provisioning – Risk of Multi-tenant environment – Risk failure of cloud provider – SLA risk –security, malware and Internet Attacks – Risk with Application Licensing.	**2**
12	AAA Administration for Clouds	AAA model – SSO for Clouds – Authentication management and Authorization management in clouds – Accounting for Resource utilization.	**2**

13	Security as a service	What can security as service offer- Benefits for Security as a service – Issues with Security as a Service- Identity Management as a Service	2
14	Mobile Cloud Computing	Introduction, Defination, Architecture, Benefits, challenges in mobile and at cloud shield	2

Text Books:

1. Cloud Computing Principles and Paradigms, Rajkumar Buyya Wiley

2. Distributed and Cloud Computing, Kai Hwang, Mk Publication

3. Cloud computing Black Book Dreamtech Publication

References:

1. Using Goolgle Apps engine O'reilly Publication

2. Programming Amazon EC2, O'reilly Publication

3. Cloud security, Ronald L. Wiley Publication

4. Cloud computing Dr. Kumar Saurabh, wily Publication

5. Virtualization for Dummies, Wiley Publication

Term work:

Suggested Practical List (If Any):

1. Implementation of Private cloud using Eucalyptus or Open stake

      - Working with KVM to create VM

      - Installation and configuration of Private cloud

      - Bundling and uploading images on a cloud

      - Creating web based UI to launch VM

      - Working with Volumes – Attached to the VM

2. Programming using Google Apps engine and Pythone

Theory Examination:

- Question paper will comprise of 6 questions, each carrying 20 marks.

- Total 4 questions need to be solved.

- Q.1 will be compulsory, based on entire syllabus.

- Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (hrs/week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC703	Intelligent System	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC703	Intelligent System	20	20	20	80	25	---	25	150

Course Objectives:

1. To introduce the students' with different issues involved in trying to define and simulate intelligence.
2. To familiarize the students' with specific, well known Artificial Intelligence methods, algorithms and knowledge representation schemes.
3. To introduce students' different techniques which will help them build simple intelligent systems based on AI/IA concepts.

Course Outcomes:

1. Students will develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
2. Students will be able to choose an appropriate problem-solving method and knowledge-representation scheme.
3. Students will develop an ability to analyze and formalize the problem (as a state space, graph, etc.) and select the appropriate search method.
4. Students will be able to develop/demonstrate/ build simple intelligent systems or classical toy problems using different AI techniques.

DETAILED SYLLABUS

Module	Detailed Content	Hours
1	**Introduction:** Introduction to AI, AI Problems and AI techniques, Solving problems by searching, Problem Formulation.	04
2	**Intelligent Agents:** Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent.	03
3	**Uninformed Search Techniques:** DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search, Comparing Different Techniques.	04
4	**Informed Search Methods**: Heuristic functions, Hill Climbing, Simulated Annealing, Best First Search, A*, IDA*, SMA*, Crypto-Arithmetic Problem, Backtracking for CSP, Performance Evaluation.	08
6	**Adversarial Search:** Game Playing, Min-Max Search, Alpha Beta Pruning.	03
7	**Knowledge and Reasoning:** A Knowledge Based Agent, WUMPUS WORLD Environment, Propositional Logic, First Order Predicate Logic, Forward and Backward Chaining, Resolution. , Introduction to PROLOG.	08
8	**Planning**: Introduction to Planning, Planning with State Space Search, Partial Ordered planning, Hierarchical Planning, Conditional Planning, Planning with Operators.	04
9	**Uncertain Knowledge and Reasoning:** Uncertainly, Representing Knowledge in an Uncertain Domain, Conditional Probability, Joint Probability, Bays theorem, Belief Networks, Simple Inference in Belief Networks.	06
10	**Learning:** Learning from Observation, General Model of Learning Agents, Inductive Learning, Learning Decision Trees, Rote Learning, Learning by Advice, Learning in Problem Solving, Explanation based Learning	05
11	**Expert Systems:** Representing and using Domain Knowledge, Expert System-shell, Explanation, Knowledge Acquisition	03

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Education.
2. Elaine Rich, Kevin Knight, Shivshankar B Nair, Artificial Intelligence, McGraw Hill, 3rd Edition.
3. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 2nd Edition.

Reference Books:

1. George Lugar, .AI-Structures and Strategies for Complex Problem Solving., 4/e, 2002, Pearson Education.

2. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.

3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.

4. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication

Term work:

Term Work shall consist of at least 8 practical and 2 assignments based on the list given below:

Suggested Practical:

1. Implementing Water jug problem using 1. BFS. , 2. DFS (Un-Informed Search)
2. Implementing 8 puzzle problem with Heuristic function using Hill Climbing. (Informed Search)
3. Implementing 8 puzzle problem with Heuristic function – Best First Search (Informed Search)
4. Implementing 8 Queen Problem with Heuristic function (Informed Search)
5. Implementing Tic-Tac-Toe problem to demonstrate Min – Max and Alpha Beta Pruning. (Adversarial Search)
6. Implementing WUMPUS world problem. (Knowledge and Reasoning)
7. Introduction to PROLOG – solving Basic problems like Factorial, Fibonacci series, Implementing User Defined String functions etc. (PROLOG)
8. Implementing Family Information System (PROLOG)
9. Implementing Mini Expert system. (PROLOG)

(Note: List of experiments is not limited with the above list , teacher can choose different set of experiments but care should be taken to explore variety of topics.)

Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 5 Marks (Assignment) + 5Marks (Attendance (theory + practical))

 Oral examination is to be conducted based on the complete syllabus.

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
4. Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (hrs/week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BE ITC704	Wireless Technology	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC 704	Wireless Technology	20	20	20	80	25	---	25	150

Course Objectives:

Get acquainted with modern wireless communication networks. Evolution of cellular networks, to understand basic framework of various protocols and standards used to develop wireless personal and wide area networks

Course Outcomes:

1. Understand the new trends in mobile/wireless communications networks
2. Understand the characteristics of mobile/wireless communication channels
3. Understand the multiple radio access techniques
4. Understand the multiuser detection techniques
5. Understand various wireless networks and their technologies
6. Understand need of securities and economies in wireless systems

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	Fundamentals of wireless Communication	• Fundamentals of Wireless Communication Advantages, Limitations and Applications • Wireless Media • Infrared Modulation Techniques • DSSS And FHSS • Multiple access technique: TDMA,CDMA, FDMA, CSMA,OFDMA [fundamentals] • Frequency Spectrum • Radio and Infrared Frequency Spectrum	**08**
2	Wireless technology	• The cellular concepts: Frequency Reuse, Channel assignment strategies, Handoff strategies Interference and System Capacity [Design problems] • Evolution of cellular networks 1G, 2G,3G,4G •GSM: System Architecture, Radio Subsystem, Channel Types, GSM frame structure • CDMA: Architecture, Frequency and channel specifications, forward and Reverse CDMA Channels.	**10**
3	Wire less in local loop (WLL)	User requirements of WLL systems, WLL system architecture, MMDS, LMDS, WLL subscriber terminal, WLL interface to the PSTN	**04**
4	Wire less local area networks (WLAN)	Introduction, WLAN Equipment, WLAN topologies and Technologies, IEEE 802.11 WLAN : Architecture, Physical Layer, Data Link Layer , MAC Layer, Security Latest developments of IEEE 802.11 standards	**08**
5	Wireless personal area netwoks (WPAN)	Introduction ,WPAN technologies and Protocols, Bluetooth (802.15.1)[Protocol stack and network connection establishment, security aspects] HR –WPAN (UWB) (IEEE 802.15.3) LR-WPAN (IEEE 802.15.4) Zigbee [Stack architecture, components , Network Topologies , Applications] Wireless Sensor networks [Network model and protocol stack ,	**08**

		routing algorithms, Applications]	
6	Wireless metropolitan area networks	IEEE 802.16 [Protocol Architecture], IEEE 802.16a [Wimax] Wimax and LTE /3GPP comparison	**04**
7	Security issues in Wireless Systems	The need, attacks , security services, wired equivalent privacy protocol(WEP), Mobile IP, VPN [PPTP, L2TP, IPSec]	**03**
8	Economies of Wireless Network	Economic Benefits, Economics of Wireless industry Wireless data forecast, charging issues	**03**

Text Books:

1. Modern wireless communication systems: by Simon Haykin, Michael Moher, adapted by David Koilpillai ; Pearson (Indian edition 2011)

2. Wireless Networks: by Nicopolitidia, M S Obaidat, GI Papadimitriou; Wiley India (student edition 2010)

3. Wireless communications: by T L Singal; Tata McGraw Hill Education private Ltd.(edition 2011)

References:

1. Wireless and Mobile Networks: Dr. Sunilkumar S. Manvi & Mahabaleshwar S. Kakkasageri

2. Wireless Communications and Networking: by Vijay K. Garg

3. Wireless Communications: by Theodore S. Rappaport

Term work: Students are asked to perform lab sessions using Ns-2 Simulator and Matlab platform.

Assignments should be given based on syllabus.

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
4. Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (hrs/week)	Credits Assigned

		Theory	Pract.	Tut.	Theory	TW/Pract	Tut.	Total
BEITC7051	Image Processing	04	02	---	04	01	---	05

Course Code	CourseName	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
BEITC7051	Image Processing	Test 1	Test 2	Average of Test1 & Test2					
		20	20	20	80	25	---	25	150

Course Pre-requisite: As images are two dimensional signals, the single dimensional Digital Signal Processing fundamentals are part of the prerequisite study.

Objective: One picture is worth thousand words. A course in digital image processing teaches how such visual information can be used in various applications. This course will introduce the basic ideas and techniques used for processing images and their popular applications.
The objectives of this course are:
- To cover the basic theory and algorithms that are widely used in digital image processing,
- To expose students to current technologies and issues that are specific to image processing systems
- To develop skills in using computers to process images.

Outcome: Students should demonstrate the ability:
- To understand the fundamental concepts of a digital image processing system,
- To make extensive use of these concepts in implementing processing techniques such as noise removal, enhancement, compression for efficient storage and transmission, object extraction, representation and description for recognition or building computer vision, etc.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	Weightage of marks
0	Introductions to Signal Processing Only as a prerequisite for Image Processing. Hence not part of theory exam.	Analog, discrete and digital signals, 1D, 2-D signals with examples. Discrete time signals: sequences, Discrete time systems LTI systems and their properties. Convolution and Correlation- need, methods and examples	04	0%
1	Introduction to digital image processing	Introduction: Definition of digital image, generation of digital image, steps in digital image processing, 2D sampling, spatial and tonal resolutions, pixel connectivity, elements of digital image processing systems	05	10%
2	Image enhancement in the spatial domain	Point operations, histogram processing, spatial filtering: smoothing, sharpening, median, highboost	07	20%
3	Two Dimensional Discrete Fourier Transform	Introduction to image in frequency domain, Concept of basis images, two dimensional D.F.T. and its properties, two dimensional F.F.T. Filtering in the frequency domain: smoothening, sharpening and homomorphic filtering.	06	15%
4	Image segmentation	Detection of discontinuities, edge linking and boundary detection, Hough transform, thresholding, region oriented segmentation.	06	10%
5	Image representation and description	Boundary descriptors: shape number, Fourier descriptor, statistical moments; regional descriptors	06	10%
6	Image data compression	Image data redundancies: coding, inter-pixel, psychovisual; Fundamentals of lossless compression : Arithmetic coding, Huffman coding, LZW coding, RLE, Bit plane coding, predictive coding Lossy compression : JPEG, Subband coding, Vector quantization, Image compression standard, Fidelity criteria	06	15%
7	Image morphology	Morphological operation : Dilation erosion, Opening & Closing, Hit or Miss Transform, Basic Morphological Algorithms	04	10%

8	Applications of image processing	Case Study on the following applications: Digital watermarking, Biometric authentication (face, finger print, signature recognition), Vehicle number plate detection and recognition, Content Based Image Retrieval, Text Compression.	04	10%

Text Books:
1. Gonzalez & Woods, Digital Image Processing, Pearson Education, Third Edition.
2. W. Pratt, Digital Image Processing, Wiley Publication, Fourth Edition, 2013.

Reference Books:
1. J. G. Proakis and D. G. Manolakis, Digital Signal processing Principals,Algorithms and Applications,PHI publications, Third edition,
2. Milan Sonka , Digital Image Processing and Computer Vision, Thomson publication, Second Edition.2007.
3. A.K. Jain, Fundamentals of Image processing, Prentice Hall of India Publication, 1995
4. Gonzalez & Woods, Digital Image Processing using MATLAB, Pearson Education
5. S.Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Processing ,McGraw Hill Education (India) Private Limited, New Delhi, 2009.
6. S.Sridhar, Digital Image Processing ,Oxford University Press, New Delhi, 2011.

Term work:

At least 08 experiments covering entire syllabus must be performed during the semester and it should be presented in the practical record. Term work assessment must be based on the overall performance of the student with every practical graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. Due weightage should be given for the student's attendance.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests shall be considered as final IA marks

Suggested Practical List:

A minimum of 8 experiments from the suggested list must be performed. The DSP experiments (experiment 1 and 2) are the prerequisites.

1. Write a MATLAB program or C++ program for generating the following discrete time signals:
    a. Exponential signal
    b. Unit step and unit ramp signals
    c. Sinusoidal signal
    d. Composite signal with minimum 3 sinusoids added
2. Write a MATLAB program to demonstrate convolution and correlation operations with different examples of discrete time sequences.
3. Write a program for the following point processing operations and compare the results with MATLAB built in functions
    a. Image negative
    b. Gray level slicing with or without background
    c. Power law transformations
    d. Bit plane slicing
    e. Histogram equalization
4. Write a program for image enhancement and compare the results with MATLAB built in functions.
    a. Smoothing
    b. Sharpening
    c. High boost filtering
5. Write a program for image noise removal and analyze the results using,
    a. Averaging
    b. Median filter
6. Write a MATLAB program for 2D Discrete Fourier Transform and Inverse transform using built in functions.
7. Write a MATLAB PROGRAM for Transform domain processing using low pass and high pass filters and analyze the results for the following (any one):
    a. Ideal filter
    b. Butterworth filter
    c. Gaussian filter
8. Write a MATLAB PROGRAM for edge detection in 2 directions and compare the results with built in functions for the following operators (any one):
    a. Robert operator
    b. Prewitt operator
    c. Sobel operator
9. Write a MATLAB PROGRAM to compress the image using any one of the following lossless image compression techniques:
    a. Huffman
    b. RLE
    c. LZW
10. Write a MATLAB PROGRAM to compress the image using any one of the following

lossy image compression techniques:
  a. JPEG
  b. IGS
  c. Predictive coding
11. Write a MATLAB PROGRAM to perform the following basic and derived morphological operations:
  a. Dilation
  b. Erosion
  c. Opening
  d. Closing
  e. Boundary Detection
12. Write a MATLAB PROGRAM to represent / describe the image using any one of the following:
  a. Chain code / shape number
  b. Moments
  c. Fourier descriptors
  d. Euler number

Theory Examination:
  1. Question paper will comprise of 6 questions, each carrying 20 marks.
  2. Total 4 questions need to be solved.
  3. Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
  4. Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (hrs/week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical /Oral	Tutorial	Total
BEITC7052	Software Architecture	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC7052	Software Architecture	20	20	20	80	25	---	25	150

Course Objectives:

- To provide students with a strong foundation in developing large, practical software-intensive applications.
- To train students with sound technical exposure to the concepts, principles, methods and best practices in software architecture.
- To develop the ability among students to learn the details of modeling techniques, design, implementation, deployment, and system adaptation.
- To enable students to choose the right tool for the job at hand and document design rationale.
- To prepare students to gain experiences with examples in design pattern application and case studies in software architecture.

Course Outcomes:

At the end of the course, students should be able to:
1. Argue the importance and role of software architecture.
2. Recognize major software architectural styles, design patterns, and frameworks.
3. Design software architecture for large scale software systems.
4. Describe various documentation approaches and architectural description languages.
5. Apply architectural patterns to quickly generate architectural alternatives and choose between them.

Prerequisites:

This course builds on the study of Object Oriented Software Engineering. We assume fluency with Object Oriented Languages and UML

DETAILED SYLLABUS:

Sr. No	Module	Detailed Content	Hours
1	1	**Basic Concepts** 1.1 Concepts of Software Architecture 1.2 Models. 1.3 Processes. 1.4 Stakeholders.	03
2	2	**Designing Architectures** 2.1 The Design Process. 2.2 Architectural Conception. 2.3 Refined Experience in Action: Styles and Architectural Patterns. 2.4 Architectural Conception in Absence of Experience. 2.5 Putting it all Together: Design Processes Revisited	05
3	3	**Connectors** 3.1 Connectors in Action: A Motivating Example. 3.2 Connector Foundations. 3.3 Connector Roles. 3.4 Connector Types and Their Variation Dimensions. 3.5 Example Connectors. 3.6 Using the connector Framework	06
4	4	**Modeling** 4.1 Modeling Concepts. 4.2 Ambiguity, Accuracy, and Precision. 4.3 Complex Modeling: Mixed Content and Multiple Views. 4.4 Evaluating Modeling Techniques. 4.5 Specific Modeling Techniques: Generic Techniques, Domain and Style specific ADLs, Extendable ADLs.	04
5	5	**Visualization** 5.1 Visualization Concepts. 5.2 Common issues in Visualization. 5.3 Visualization Techniques: Textual Visualization, UML, xADL.	04
6	6	**Analysis** 6.1 Analysis Goals. 6.2 Scope of Analysis.	06

		6.3 Architectural Concern being Analyzed. 6.4 Level of Formality of Architectural Models. 6.5 Type of Analysis. 6.6 Analysis Techniques.	
7	7	**Implementation and Deployment** 6.1 Concepts. 6.2 Existing Frameworks. 6.3 Software Architecture and Deployment. 6.4 Software Architecture and Mobility.	**04**
8	8	**Applied Architectures and Styles** 8.1 Distributed and Networked Architectures. 8.2 Architectures for Network-Based Applications. 8.3 Decentralized Architectures. 8.4 Service-Oriented Architectures and Web Services.	**08**
9	9	**Designing for Non-Functional Properties** 9.1 Efficiency. 9.2 Complexity. 9.3 Scalability and Heterogeneity. 9.4 Adaptability. 9.5 Dependability.	**04**
10	10	**Documentation** 10.1 Uses of Architectural Documentation. 10.2 Views 10.3 Choosing the Relevant Views 10.4 Documenting a View 10.5 Documentation across Views	**04**

Text Books:

1. Richard N. Taylor, Nenad Medvidovic, Eric M. Dashofy, "Software Architecture: Foundations, Theory, and Practice", Wiley Publications.
2. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Pearson

References:

1. M. Shaw, "Software Architecture Perspectives on an Emerging Discipline", Prentice Hall.

Term work: Term work should be based on the Lab experiments and assignments.

Suggested Practical List:
1. Modeling using xADL
2. Analysis – Case study
3. Visualization using xADL
4. Integrate software components using a middleware
5. Use middleware to implement connectors
6. Wrapper to connect two applications with different architectures
7. Creating web service
8. Architecture for any specific domain

Theory Examination:

- Question paper will comprise of 6 questions, each carrying 20 marks.

- Total 4 questions need to be solved.

- Q.1 will be compulsory, based on entire syllabus.

- Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
BEITC7053	E-Commerce and E-Business	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC7053	E-Commerce and E-Business	20	20	20	80	25	---	25	150

Course Objectives:

➢ To understand technical aspect of E-commerce and E-Business

➢ To describe the process of E-commerce and E-business

➢ To understand Infrastructure design issues of E-commerce

Course Outcomes:

Graduates will be able to design and conduct experiments, as well as analyze and interpret the technological, user, network requirements for developing the various modules of e commerce/business site, will be able to apply the knowledge gained and modern engineering tools in their application domain.

Pre requisites:

Internet Technologies, Database concepts, Internet Security, Middleware technologies, web services

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	**E – commerce :- Introduction to E commerce**	Definition of e com , different types of e com , Examples of e com E commerce trade cycle , Advantages and disadvantages of ecom , Traditional commerce Vs E commerce	**2**
2	**Overview of Hardware and software technologies for E com**	Client side programming (Dream weaver , Front page) , Server side programming (PHP) , Database connectivity , session tracking , middleware technologies from e com perspective and security aspects wrt to e commerce, integration of web services	**8**
3	**Payment System for e commerce**	Traditional payment model , Characteristics of payment system, SET Protocol for credit card payment, E-cash, E-check, smart cards	**8**
4	**E – Marketing Strategies**	Value chain , Working of e – market , Transactions at e – market , Strategies for marketing for selling on the web – Advertising supported , advertising subscription mixed model , fee for transaction model Sales and Promotions Strategies for Purchasing and support activities	**8**
5	**E business :- Introduction to e business**	Definition of e business , Characteristics , elements of e business , e business roles , Impact of e business , challenges of e business , difference between e business , e commerce	**4**
6	**Developing e business models**	E- business structure , Evolution of e –business and its stages , E – business models , Characteristics of Internet based software and e business solutions	**3**
7	**E-business strategies**	Strategic planning process, SCM , CRM , ERP , procurement	**7**
8	**Design and development of**	a) Building an e commerce website. :- SDLC , system design , Issues involved in designing a	**8**

| an business website | website , Prerequisites required for designing in – house website, steps involved in web site development , e-business and web site development solutions , security issues involved and analysing website traffic --- Case study | |
| | b) Analysis and design – (Workflow management, process modelling , data modelling) , UI design , use case design , information architecture , security concerns | |

Text Books:

1. E-Commerce Fundamentals and application (Henry Chan) Wiley publication
2. Electronics Commerce (Gary Schneider) Thomson Course technology
3. E – Business , Parag Kulkarni , Sunita Jahirabadkar, Pradip Chande , Oxford Higher Education , Oxford University Press
4. E –business and E – commerce Management , Dave Chaffey , Pearson , 3rd edition
5. E commerce by Laudon

References:

1. E- Commerce Strategies, Technology and applications (David Whitley) Tata McGrawHill
2. Introduction to E-commerce Elias Awad

Term work:

Term work should include at least 8 experiments.

Journal must include at least 2 assignments.

Term work: - 25 marks (total) = 15 marks (experiments) + 5 marks (Assignments) + 5 marks (attendance – theory + Practical).

Oral exam will be based on the above syllabus.

Suggested Practical List (If Any):

Exp 1: All experiments should be part of final e-commerce / e business portal development
1. Home page design
2. Form validation (Ajax enabled)
3. Catalog design and Search techniques (Web mining , and Ajax enabled)
4. Access control mechanism (session management)
5. Payment systems
6. Security features
7. Creating Web Site to integrate web Services
8. Server side using Web Services

Exp 2: Case study of M commerce, bit coins, Google app engine, and other current e com / e business technologies

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
4. Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme Hrs./Week			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
BEITC7054	Multimedia Systems	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC7054	Multimedia Systems	20	20	20	80	25	---	25	150

Course Objectives:

➢
   To understand technical aspect of Multimedia Systems
➢
   To understand and evaluate the process of development of Multimedia Systems
➢
   To understand the framework and standards available for different Multimedia applications

Course Outcomes:

Students will be able to understand the relevance and underlying infrastructure of multimedia systems. The purpose of this course is to make the students capable to apply their multimedia knowledge to understand the current requirements of multimedia products. The standards and frameworks introduced will help the students develop the multimedia systems as per industry standards

Pre requisites:

Interactive I/O devices, Networking, basic concepts communication devices, Standards & frameworks

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	Introduction to Multimedia	What is multimedia, Hypermedia, Multimedia tools, Multimedia Authoring & its Tools, VERML, File Formats.	**2**
2	Color in Images & Video	Colour Models for Images & Videos, Video Signals, Digital Video, MIDI, Quantization, Transmission of Audio	**4**
3	Compression Algorithms	Lossless Compression , Introduction, Basics, RLC ,VLC, lossless Image Compression, Lossy Compression, introduction, Distortion, Rate Distortion Theory, Quantization	**4**
4	Image Compression Standards	JPEG standards, JPEG 2000 standards, JPEG –LS standards, Bi-Level Image Compression Standards	**4**
5	Video Compression Techniques	Introduction, Motion Compensation ,Motion vectors, H.261& H.263,MPEG-1&MEPEG-2MPEG_4,MPEG-7,MPEG21	**5**
6	Audio Compression	ADPCM, Vocoders, Psychoacoustics, MPEG audio.	**3**
7	Multimedia Network Applications	Quality of Multimedia Data transmission, Multimedia over IP, Multimedia over ATM, Media on Demand, Multimedia over Wireless Network	**6**
8	Multimedia Data bases	Design and Architecture of Multimedia Data base, Types, Organization, Medias Abstraction, Query Language.	**7**
9	Frame Work for Multimedia Standards	Introduction, Standard Activates, Standard to built a news Global Information Infrastructure, Standardization process on Multimedia Communication, ITU-I Mediacom 2004 Framework, ISO/MPEG -21 Framework, IETF Multimedia Internet Standards.	**6**

10	Application layer:	Introduction, ITU applications, MPEG Application , Digital Broadcasting Applications, Universal multimedia access.	**7**

Text Books:

1) Fundamentals of Multimedia by Ze-Nian Li& Mark.S.Drew

2) Introduction to Multimedia Communication, Application, Middleware, Networking by K.R.Roa, Zoran S,Bojkovic & Dragorad A. Milovanovic.

References:

Multimedia systems by Thakker

Term work:

Term work should include at least 8 experiments.

Journal must include at least 2 assignments.

Term work :- 25 marks (total) = 15 marks (experiments) + 5 marks (Assignments) + 5 marks (attendance – theory + Practical).

Oral exam will be based on the above syllabus.

Suggested Practical List (if any):

1) Creating sample movies/ animations in flash.

2) Designing a multimedia application / multimedia authoring system.

3) Design a web application using dream viewer &fireworks

4) Construction of website using pictures, video, audio

5) Design a game application in flash

 6) Record speech & perform compression & decompression

7) Case study on all file formats related to multimedia system

8) Case study on different authoring tools

9) Different levels of control in slide show presentation

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
4. Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC7055	Usability Engineering	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC7055	Usability Engineering	20	20	20	80	25	---	25	150

Course Objectives:

Is to provide concrete advice and methods that can be systematically employed to ensure a high degree of usability in the final user interface.

Course Outcomes:

Students will be able to create useful usable and used interface.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	1	**Introduction** Cost Savings, Usability Now, Usability Slogans, Discount Usability Engineering, Recipe For Action, Usability and Other Considerations, Definition of Usability, Example: Measuring the Usability of Icons, Usability Trade-Offs, Categories of Users and Individual User Differences	**06**
2	2	**Generations of User Interfaces** Batch Systems, Line-Oriented Interfaces, Full-Screen Interfaces, Graphical User Interfaces, Next-Generation Interfaces, Long-Term Trends in Usability	**02**
3	3	**The Usability Engineering Lifecycle** Know the User, Competitive Analysis, Goal Setting, Parallel Design, Participatory Design, Coordinating the Total Interface, Guidelines and Heuristic Evaluation, Prototyping, Interface Evaluation, Iterative Design, Follow-Up Studies of Installed Systems, Meta-Methods, Prioritizing, Usability Activities.	**08**
4	4	**Usability Heuristics** Simple and Natural Dialogue, Speak the Users' Language, Minimize User Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Good Error Messages, Prevent Errors, Help and Documentation, Heuristic Evaluation.	**08**
5	5	**Usability Testing** Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects of Tests with Human, Subjects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories,	**08**
6	6	**Usability Assessment Methods beyond Testing** Observation, Questionnaires and Interviews, Focus Groups, Logging, Actual Use, User Feedback, Choosing Usability Methods.	**04**
7	7	**Interface Standards** National, International and Vendor Standards, Producing Usable In-House Standards. **International User Interfaces** International Graphical Interfaces, International Usability Engineering, Guidelines for	**08**

		Internationalization, Resource Separation, Multilocale Interfaces.	
8	8	**Future Developments** Theoretical Solutions, Technological Solutions, CAUSE Tools: Computer-Aided Usability Engineering, Technology Transfer	**04**

Text Books:
➢ Usability Engineering by Jacob Nielson, Morgan Kaufmann, Academic Press.
* **eBook available**

References:
Developing User Interfaces - Ensuring Usability through Product & Process by Deborah Hix, Rex Hartson, Wiley

Suggested Practical List (If Any): Refer appendix A of the text book for Practical Exercise.

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC7056	Ubiquitous Computing	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC7056	Ubiquitous Computing	20	20	20	80	25	---	25	150

Course Objectives:

- To introduce the ideas of ubiquitous computing techniques based on human experience.
- To generate an ability to design, analyze and perform experiments on real life problems using various smart devices, smart interaction and smart environment.
- To integrate computation into the environment, rather than having computers as distinct objects.
- To enable people to move around and interact with computers more naturally than they currently do.

Course Outcomes:

On successful completion of this course the student has: Knowledge and understanding regarding:
- The objectives and the historical development of the field of ubiquitous computing
- Fundamentals of sensor technology and sensor networks
- Apply middleware techniques to implement ubiquitous computing systems
- Design of new (often embedded) interactive artifacts
- Context aware and adaptive systems
- Compare the usability of alternative design of interactions for specific ubiquitous computing systems

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	Introduction to Ubiquitous Computing	Definition, Advantage, Application and Scope. Properties of Ubiquitous Computing, Ubiquitous System Environment Interaction. Architectural Design for UbiCom Systems: Smart DEI Model.	**4**
2	Smart Devices and Services	Introduction to Smart Devices: Users, Mobiles, Cards and Device Networks. Service Architecture Models. Service Provision Life-Cycle. Virtual Machines and Operating Systems Mobile Computers and Communicator Devices.	**8**
3	Sensing and Controlling	Tagging the Physical World. Sensors and Sensor Networks. Micro Actuation and Sensing: Micro-Electro-Mechanical Systems (MEMS). Embedded Systems and Real-Time Systems. Control Systems for Physical World Tasks. Robots	**8**
4	Context-Aware Systems	Introduction to Context-Aware Computing, Context-Aware Systems, Context-Aware Applications, Designing and Implementing Context-Aware Applications, Issues for building Context-Aware Applications.	**8**
5	Human–Computer Interaction	User Interfaces and Interaction for Four Widely Used Devices. Hidden UI Via Basic Smart Devices. Hidden UI Via Wearable and Implanted Devices. Human-Centered Design (HCD). User Models: Acquisition and Representation. iHCI Desi	**10**
6	Ubiquitous Communication	Data Networks. Audio Networks. Wireless Data Networks. Universal and Transparent Audio, Video and Alphanumeric Data. Ubiquitous Networks. Network Design Issues. Human Intelligence Versus Machine Intelligence. Challenges in Ubiquitous System, Social Issues: Promise Versus Peril.	**10**

Text Books:

[1] Stefan Poslad. Ubiquitous Computing: Smart Devices, Environments and Interactions, Wiley Publication.

[2] John Krumm. Ubiquitous Computing Fundamentals. CRC Press.

References:

[1] Yin-Leng Theng and Henry B. L. Duh. Ubiquitous Computing: Design, Implementation, and Usability. IGI Global.

[2] Adam Greenfield. Everyware the Drawing age of Ubiquitous Computing, Published in Association with AIGA.

[3] Mobile and Ubiquitous Computing", Georgia Tech, 2003.

Term work:

Term work will be based on Practical and Assignments covering the topics of the syllabus.

Suggested Practical List (If Any):
1. Applications for location-based messages
2. Global Positioning system
3. Context-Aware system
4. Human Computer Interaction
5. Ubiquitous Communication
6. Case study of Class Room 2020
7. Case study of Super Market
8. Case study of Hospital Management

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITP706	Project I	---	*	---	---	03	---	03

*Work load of the teacher in semester VII is equivalent to 6 hrs/week.

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITP706	Project I	---	---	---	---	25	---	25	50

Objective: To help the learner to develop some of the following:

1. Relate theory with real time applications.

2. Experiencing the issues involved with creation and design of simple products and processes.

Outcomes: The learner should be able to prepare a synopsis of the work selected.

Guidelines for Project

o Students should do literature survey/visit industry/analyze current trends and identify the problem for Project and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by experimental/simulation methods. The solution to be validated with proper justification and compile the report in standard format.

Guidelines for Assessment of Project I
- o Project I should be assessed based on following points
  - Quality of problem selected
  - Clarity of Problem definition and Feasibility of problem solution
  - Relevance to the specialization
  - Clarity of objective and scope
- o Project I should be assessed through a presentation by a panel of Internal and External examiners appointed by the University of Mumbai.

UNIVERSITY OF MUMBAI

Bachelor of Engineering

Information Technology (Second Year – Sem.VIII)

Revised course (REV- 2012)

From Academic Year 2015 -16

Under

FACULTY OF TECHNOLOGY

(As per Semester Based Credit and Grading System)

B.E. Engineering (Semester VIII)
Revised course for Information Technology from
Academic Year 2015 -16, (REV- 2012)

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut.	Theory	TW/Pract	Tut.	Total
BEITC801	Storage Network Management and Retrieval	4			4			4
BEITC802	Big Data Analytics	4			4			4
BEITC803	Computer Simulation and Modeling	4			4			4
BEITC804	Elective -II	4			4			4
BEITL801	Storage Network Management and Retrieval		2			1		1
BEITL802	Big Data Analytics		2			1		1
BEITL803	Computer Simulation and Modeling		2			1		1
BEITL804	Elective -II		2			1		1
BEITP805	Project - II		**			6		6
	Total	16	08		16	10		26

**Workload of the teacher in semester VIII is equivalent to 12 hrs/week.

Elective –I I (Semester VIII)	
BEITC8041	Enterprise Resource Planning
BEITC8042	Wireless Sensor Networks
BEITC8043	Geographical Information Systems
BEITC8044	Robotics
BEITC8045	Soft Computing
BEITC8046	Software Testing & Quality Assurance

Examination Scheme

Course Code	Course Name	Theory					Term work	Pract/ Oral	Total
		Internal Assessment			End sem exam	Exam duration (in Hrs)			
		TEST 1	TEST 2	AVG.					
BEITC801	Storage Network Management and Retrieval	20	20	20	80	3	25	25	150
BEITC802	Big Data Analytics	20	20	20	80	3	25	25	150
BEITC803	Computer Simulation and Modeling	20	20	20	80	3	25	25	150
BEITC804	Elective -II	20	20	20	80	3	25	25	150
BEITP805	Project - II						50	50	100
	Total	80	80	80	320	12	150	150	700

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC801	Storage Network Management and Retrieval	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
BEITC801	Storage Network Management and Retrieval	20	20	20	80	25	---	25	150

Course Objectives:

a. Study and evaluate the need for Storage networking, current storage technologies: SAN, NAS, IP storage etc., which will bridge the gap between the emerging trends in industry and academics.

b. Understanding and building Storage networks and its backup and recovery techniques.

c. Study the information retrieval system as per different application in storage networks.

Course Outcomes:

1) Students will be able to evaluate storage architectures, including storage subsystems, SAN, NAS, and IP-SAN, also define backup, recovery.
2) Examine emerging technologies including IP-SAN.
3) Define information retrieval in storage network and identify different storage virtualization technologies.

Prerequisite: Computer Networks, Database Management Systems and Operating Systems

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
I	NEED FOR STORAGE NETWORK	INTRODUCTION:- Limitations of traditional server centric architecture,. Storage centric architecture and its advantages. BASICS OF STORAGE NETWORK:- Intelligent Storage Systems (ISS), Data protection (RAID implementation methods).RAID arrays ,Components, RAID technologies, RAID levels, RAID impact on disk, performance & RAID comparison.	10
II	STORAGE NETWORK ARCHITECTURE	SCSI, SAN: FC SAN FC Protocol Stack, IP Storage, Infiniband, Virtual Interfaces	08
III	ADVANCED STORAGE TECHNOLOGY	NETWORK ATTACHED STORAGE (NAS):- Local File systems, Network File systems and file servers, Shared Disk File systems: Case study, Comparison: NAS, FC SAN and iSCSI SAN. STORAGE VIRTUALIZATION:- Virtualization in I/O path, Limitations and requirements, Definition of Storage Virtualization, Storage virtualization on Block and file level, Storage virtualization on various levels of Storage network, Symmetric and Asymmetric Virtualization.	14
IV	STORGAE NETWORK BACKUP AND RECOVERY	BC Terminology, BC Planning Lifecycle, General Conditions for Backup, Recovery Considerations, Network Backup Services Performance Bottlenecks of Network Backup, Backup Clients, Back up file systems, Backup Databases, Next Generation Backup.	06

V	INFORMATION RETRIEVAL IN STORAGE NETWORK	Overview, Abstraction , Information System, Measures, from Data to Wisdom, Document and Query Form, Query structures, The matching process, Text analysis: Indexing, Matrix representation, Term extraction, Term association, , Stemming , Multilingual retrieval systems	**10**

Text Books:

1. ULF Troppen, Rainer Erkens and Wolfgang Muller , " Storage Networks Explained: Basic and Applications of Fibre Channel SAN, NAS and ISCSI and Infifniband " , Wiley
2. EMC Educational Services, "Information Storage and Management", wiley India
3. R. R. Korfhage, "Information Storage and Retrieval", Wiley

References:

1. Richard Barker and Paul Massiglia, " Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs" , Wiley.
2. Robert Spalding, " Storage Networks: The Complete Reference", Tata McGraw Hill
3. W. Curtis Preston, "Using SANs and NAS", O'Reilly

Term work: based on Laboratory Practical's/ Case studies and assignment

1. Term work shall consist of 10 practical implementation, case studies and study of simulators or tools available.
2. Study and implementation of simulation tool Navishpere and Unisphere related to storage network management.
3. Case study on Building and implementing SAN.
4. Study and implementation of any information retrieval tool.

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme Hrs./Week			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC802	Big Data Analytics	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC802	Big Data Analytics	20	20	20	80	25	---	25	150

Course Objectives:

1. To provide an overview of an exciting growing field of big data analytics.

2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce.

3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.

4. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Course Outcomes: At the end of this course a student will be able to:

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.

3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Book	Hours
1	Introduction to Big Data	Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.	**From Ref. Books**	**03**
2	Introduction to Hadoop	What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Physical Architecture; Hadoop limitations.	Hadoop in Practise Chapter 1	**02**
3	NoSQL	1. What is NoSQL? NoSQL business drivers; NoSQL case studies; 2. NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns; 3. Using NoSQL to manage big data: What is a big data NoSQL solution? Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; Four ways that NoSQL systems handle big data problems	**No-SQL book**	**04**
4	MapReduce and the New Software Stack	**Distributed File Systems :** Physical Organization of Compute Nodes, Large-Scale File-System Organization. **MapReduce:** The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. **Algorithms Using MapReduce**: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step.	**Text Book 1**	**06**

5	Finding Similar Items	Applications of Near-Neighbor Search, Jaccard Similarity of Sets, Similarity of Documents, Collaborative Filtering as a Similar-Sets Problem . **Distance Measures:** Definition of a Distance Measure , Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance.	**Text Book 1**	**03**
6	Mining Data Streams	**The Stream Data Model**: A Data-Stream-Management System, Examples of Stream Sources, Stream Querie, Issues in Stream Processing. **Sampling Data in a Stream** : Obtaining a Representative Sample , The General Sampling Problem, Varying the Sample Size. **Filtering Streams**: The Bloom Filter, Analysis. **Counting Distinct Elements in a Stream** The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . **Counting Ones in a Window**: The Cost of Exact Counts, The Datar-Gionis-Indyk-Motwani Algorithm, Query Answering in the DGIM Algorithm, Decaying Windows.	**Text Book 1**	**06**
7	Link Analysis	PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Use of Combiners to Consolidate the Result Vector. Topic sensitive Page Rank, link Spam, Hubs and Authorities.	**Text Book 1**	**05**
8	Frequent Itemsets	**Handling Larger Datasets in Main Memory** Algorithm of Park, Chen, and Yu, The Multistage Algorithm, The Multihash Algorithm. **The SON Algorithm and MapReduce** **Counting Frequent Items in a Stream** Sampling Methods for Streams, Frequent Itemsets in Decaying Windows	**Text Book 1**	**05**
9	Clustering	CURE Algorithm, Stream-Computing , A Stream-Clustering Algorithm, Initializing & Merging Buckets,	**Text**	**05**

		Answering Queries	Book 1	
10	Recommendation Systems	A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering.	**Text Book 1**	**04**
11	Mining Social-Network Graphs	Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, SimRank, Counting triangles using Map-Reduce	**Text Book 1**	**05**

Text Books:

1. Anand Rajaraman and Jeff Ullman "**Mining of Massive Datasets**", Cambridge University Press,

2. Alex Holmes "Hadoop in Practice", Manning Press, Dreamtech Press.

3. Dan McCreary and Ann Kelly "**Making Sense of NoSQL" – A guide for managers and the rest of us**, Manning Press.

References:

1. Bill Franks **, "Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics**", Wiley

2. Chuck Lam, "**Hadoop in Action**", Dreamtech Press

3. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "**Big Data for Dummies",** Wiley India

4. Michael Minelli, Michele Chambers, Ambiga Dhiraj, "**Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses",** Wiley India

5. Phil Simon**, "Too Big To Ignore: The Business Case For Big Data",** Wiley India

6. Paul Zikopoulos, Chris Eaton**, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data',** McGraw Hill Education.

7. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich**, "Professional Hadoop Solutions",** Wiley India.

Oral Exam:

An oral exam will be held based on the above syllabus.

Term work:

Assign a case study for group of 2/3 students and each group to perform the following experiments on their case-study; Each group should perform the exercises on a large dataset created by them.

Term work: (15 marks for programming exercises + 10 marks for mini-project)

Suggested Practical List: Students will perform at least 8 programming exercises and implement one mini-project. The students can work in groups of 2/3.

1. Study of Hadoop ecosystem
2. 2 programming exercises on Hadoop
3. 2 programming exercises in No SQL
4. Implementing simple algorithms in Map- Reduce (3) - Matrix multiplication, Aggregates, joins, sorting, searching etc.
5. Implementing any one Frequent Itemset algorithm using Map-Reduce
6. Implementing any one Clustering algorithm using Map-Reduce
7. Implementing any one data streaming algorithm using Map-Reduce
8. Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web)
   a) Twitter data analysis
   b) Fraud Detection
   c) Text Mining etc.

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC803	Computer Simulation and Modeling	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
BEITC803	Computer Simulation and Modeling	20	20	20	80	25	25	---	150

Course Objectives:

This course presents an introduction to discrete event simulation systems. Emphasis of the course will be on modeling and the use of simulation languages/software to solve real world problems in the manufacturing as well as services sectors. The course discusses the modeling techniques of entities, queues, resources and entity transfers in discrete event environment. The course will teach the students the necessary skills to formulate and build valid models, implement the model, perform simulation analysis of the system and analyze results properly.

The "theory" of simulation involves probability and statistics, thus a good background in probability and statistics is a required prerequisite

Course Outcomes:

- Understand the meaning of simulation and its importance in business, science, engineering, industry and services
- Identify the common applications of discrete-event system simulation.
- Practice formulation and modeling skills.

- Understand simulation languages
- Ability to analyze events and inter-arrival time, arrival process, queuing strategies, resources and disposal of entities
- An ability to perform a simulation using spreadsheets as well as simulation language/package
- Ability to generate pseudorandom numbers using the Linear Congruential Method
- Ability to perform statistical tests to measure the quality of a pseudorandom number generator
- Ability to define random variate generators for finite random variables
- Ability to analyze and fit the collected data to different distributions

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	UNIT - I Introduction to simulation	Introduction to Simulation. Simulation Examples. General Principles	15
2	UNIT - II Mathematical & Statistical Models in Simulation	Statistical Models in simulation. Queuing Models	8
3	UNIT - III Random Numbers	Random Number Generation. Testing random numbers (Refer to Third edition) Random Variate Generation: Inverse transform technique, Direct Transformation for the Normal Distribution, Convolution Method, Acceptance-Rejection Technique (only Poisson Distribution).	9
4	UNIT – IV Analysis of simulation data	Input Modeling Verification, Calibration and Validation of Simulation Models Estimation of absolute performance.	12
5	UNIT V	Case study	

	Application	• Processor and Memory simulation	**4**
		• Manufacturing & Material handling	

Text Books:

Discrete Event System Simulation; Third Edition, Jerry Banks, John Carson, Barry Nelson, and David M. Nicol, Prentice-Hall

Discrete Event System Simulation; Fifth Edition, Jerry Banks, John Carson, Barry Nelson, and David M. Nicol, Prentice-Hall

References:

1. System Modeling & Analysis; Averill M Law, 4th Edition TMH.
2. Principles of Modeling and Simulation; Banks C M , Sokolowski J A; Wiley
3. System Simulation ; Geoffrey Gordon ; EEE
4. System Simulation with Digital Computer; Narsing Deo, PHI

Term work:

Laboratory work: 10 marks

Mini Simulation Project presentation: 10 marks

Attendance / Quiz: 5 marks

Suggested Practical List (If Any):

Perform simulation exercises given in the text book (third edition) using spreadsheets and/or simulation language/package

- Queue- single server, multi-server, classic case- dump truck
- Inventory – Lead time=0, lead time fixed, lead time probabilistic
- Reliability problem
- Tutorials on statistical models
- Random number generate and test
- Goodness of fit test
- Output analysis – Point estimate and Confidence Interval

Simulation: Real World Examples – can be in the field of business, transportation, medical, computing, manufacturing and material handling- Presentation to be taken.

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC8041	Enterprise Resource Planning	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC8041	Enterprise Resource Planning	20	20	20	80	25	---	25	150

Course Objectives: This course presents an introduction to ERP and related technologies. The course discusses ERP Manufacturing Perspective and ERP modules. The course will teach the learners the ERP implementation lifecycle, emphasis on ERP benefits and introduces the ERP tools.

Course Outcomes: The learner will be familiar with ERP and related technologies like Business Processing Reengineering (BPR), Supply Chain Management (SCM),Customer Relationship Management(CRM), MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System etc. The learner should gain the knowledge on ERP tools and ERP benefits.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	Introduction to ERP	Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model	04
2.	ERP and Related Technologies	Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM), MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System	06
3.	ERP Manufacturing Perspective	MRP - Material Requirement Planning, BOM - Bill Of Material, MRP - Manufacturing Resource Planning, DRP - Distributed Requirement Planning, PDM - Product Data Management	06
4.	ERP Modules	Finance, Plant Maintenance, Quality Management, Materials Management	06
5.	Benefits of ERP	Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality, Costs, Improved Information Accuracy and Design-making Capability	06
6.	ERP Implementation Lifecycle	Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)	06
7.	ERP case Studies	E-Commerce to E-business E-Business structural transformation, Flexible Business Design, Customer Experience, Create the new techo enterprise, New generation e-business leaders, memo to CEO, Empower your customer, Integrate Sales and Service, Integrated Enterprise applications	06
8.	E-Business	Enterprise resource planning the E-business Backbone Enterprise architecture, planning, ERP usage in Real	08

	Architecture	world, ERP Implementation, Future of ERP applications, memo to CEO ,E-Procurement, E-Governance, Developing the E-Business Design	
9.	Introduction to ERP tools	JD Edwards-Enterprise One Microsoft Dynamics-CRM Module	04

Text Books:

1. Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill.
2. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
3. Enterprise Resource Planning - Ravi Shankar & S. Jaiswal , Galgotia.

Reference Books:

1. Guide to Planning ERP Application, Annetta Clewwto and Dane Franklin, McGRaw-Hill, 1997
2. The SAP R/3 Handbook, Jose Antonio, McGraw – Hill
3. E-Business Network Resource planning using SAP R/3 Baan and Peoplesoft : A Practical Roadmap For Success By Dr. Ravi Kalakota

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs/Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC8042	Wireless Sensor Networks	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC8042	Wireless Sensor Networks	20	20	20	80	25	---	25	150

Course Objectives:

1. To understand the concepts of sensor networks and study the architecture of WSN.

2. To understand applications of WSN.

3. To discuss the challenges in designing MAC and routing protocols for wireless sensor networks.

4. To study different operating systems and look at performance issues.

5. To understand WSN Standards and future trends in WSN.

5. To study Challenges of Security in Wireless Sensor Networks and Protocols and Mechanisms for Security.

Course Outcomes:

1. Students shall be able to understand and study the functionalities, applications and architecture of WSN.

2. Students shall be able to describe the challenges in designing various protocols for wireless sensor networks.

3. Students shall be able to understand the current technology trends for the implementation and deployment of wireless sensor networks.

4. Students shall gain an understanding of WSN Standards and future trends in WSN.

5. Students shall be able to understand security aspects like Privacy issues, attacks and countermeasures.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	Overview and Introduction of Wireless Sensor Network	Background of Sensor Network Technology; Types of Application; Challenges for WSNs: Characteristics requirements, Required mechanism; Basic Sensor Network Architectural Elements; Sensor Network scenarios: Types of sources and sinks, single-hop versus multi hop networks, Multiple sinks and sources, three types of mobility; Some examples of sensor nodes: Mica Mote family, EYES nodes, BT nodes.	**6**
2.	Applications of Wireless Sensor Network	Category 1(C1WSNs), Category 2(C2WSNs), Range of Applications, Examples of Category 1 WSN (C1WSNs) Applications, and Examples of Category 2 WSN(C2WSNs) Applications.	**4**
3.	MAC Protocols	Fundamentals of (wireless) MAC protocols, Requirements and design considerations for MAC Protocols in WSN, Low duty cycle protocols and wakeup concepts, STEM,S-MAC, Mediation device protocol, Wakeup radio concepts, Contention- based protocols, CSMA protocols, PAMAS, Schedule-based protocols, LEACH, SMACS, Traffic-adaptive medium access protocol(TRAMA),IEEE 802.15.4 MAC protocol, Slotted CSMA-CA protocol	**9**

4.	Network and Transport layer Protocol.	Network layer : Data Dissemination and Gathering, Routing Challenges and Design Issues, Routing Strategies: Flooding and it's variants, Power-Efficient Gathering in Sensor Information Systems, Geographical routing, Transport layer : Transport protocol Design issues, Examples of Existing Transport Control Protocols: CODA, ESRT, RMST, PSFQ, GARUDA, ATP; Performance of Transport Control Protocols :Congestion, packet loss recovery.	**7**
5.	Operating Systems , Performance and Traffic Management Issues	Operating System Design Issues, Examples of Operating Systems: TinyOS, Mate, MagnetOS, MANTIS,OSPM,EYES OS, SenOS, EMERALDS, PicOS , WSN Design Issues, Performance Modeling of WSNs	**7**
6.	WSN standards and Future trends in wireless sensor networks	Wireless sensor network standards-IEEE 802.15.4 Low rate WPAN standard, The ZIGBEE alliance etc. Future trends in wireless sensor networks: Wireless Multimedia Sensor Networks, Sensor Network Applications in Challenging Environments.	**6**
7	Security	Fundamentals of Network Security ,Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security	**9**

Text Books:

1. HOLGER KARL,ANDREAS WILLIG., "*Protocols, and Architectures: For Wireless Sensor Networks*", Wiley Student Edition
2. Kazem Sohraby, Daniel Minoli, Taieb Znati., "*Wireless Sensor Networks: Technology, Protocols, and Applications*", Wiley Student Edition.
3. Waltenegus Dargie and Christian Poellabauer., "*Fundamentals of Wireless Sensor Networks-Theory & Practice*", John Wiley publication, 2010.
4. J. Zheng and A. Jamalipour, "*Wireless Sensor Networks : A Networking Perspective* " John Wiley publication,2009

References:

1. Edgar H. Callaway Jr., *"Wireless Sensor Networks - Architectures and Protocols",*AUERBACH Publications, CRC Press, 2004.

2. Feng Zhao, Leonidas Guibas ,*"Wireless Sensor Networks: An Information Processing Approach"* , Morgan Kaufmann Series in Networking 2004.

Term work: Term work shall consist of at least 06 experiments from the suggested list & 04 assignments based on the syllabus.

Distribution of marks for term work shall be as follows.

   1.   Attendance (Theory & Practical) :05 marks

   2.   Laboratory Work (Experiment & Journal):15 marks

   3.   Assignment : 05 marks.

 The final certification and acceptance of Term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Suggested Practical List :

1. Installation of OMNET ++.

2. Installation & configuration of TinyOS.

3. Implementation of any two routing algorithms using JAVA

4. Implementation of any two programs on Tiny OS.

5. Study of any of the WSN operating systems.

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Term Work /Practical	Tutorial	Total
BEITC8043	Geographical Information Systems	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Internal assessment		End Sem. Exam				
		Test 1	Test 2					
BEITL8043	Geographical Information Systems	20	20	80	25	---	25	150

Course Objective:
- To provide an understanding of the basic concepts and uses of GIS technology
- To develop an ability to analyze, interpret geospatial data
- To provide an understanding of the basic principles of Remote Sensing and its use in GIS
- To provide a research platform for students in the area of GIS adapting to ever changing Technologies

Course Outcomes:
After completing this course, students will be able to:

- Apply the knowledge of science for real world applications in GIS
- Design and conduct experiments as well as analyze, interpret the geospatial data using GIS tools
- Function with multidisciplinary Teams.
- Use the techniques, skills and modern engineering tools necessary for engineering practice.
- Adapt to Open source standards

DETAILED SYLLABUS:

Module No.	Unit No.	Details of Topic	Hrs.
1.0		**Fundamentals of GIS**	06
	1.1	Introduction, Definition of GIS, Evolution of GIS , components of GIS,	
	1.2	Geospatial Data, Geographic Coordinate System, Map Projections, Commonly Used Map Projections, UTM grid system, Map Scale	
	1.3	Cartographic Symbolization, Types of Maps, Typography, Map Design, Map Production	
2.0		**Data Management, Models and Quality Issues**	06
	2.1	Vector Model : Topology, Non topological Vector models, Attribute Data in GIS, Attribute Data Entry, Vector Data Query, Manipulation of Fields and Attribute Data	
	2.2	Raster Data Model : Elements of Raster Data Model, Types of Raster Data, Raster Data Structure, Raster Data Query, Data Compression, Data Conversion, Integration of Raster and Vector data	
	2.3	Data input and editing, Data quality Issues: Accuracy, Consistency, Precision and Resolution, Completeness; sources of error in GIS	
3.0		**GIS Data Exploration Analysis and Visualization**	2+2+4+4=12
	3.1	Data exploration: Descriptive statistics, Graphs, Dynamic Graphics	
	3.2	Vector Data Analysis: Buffering, Overlay, Distance Measurement, Pattern Analysis, Map Manipulation	
	3.3	Raster Data Analysis: Local Operations, Neighborhood Operations, Zonal Operations, Data Extraction, Data Generalization, Comparison of Vector and Raster Based Data	
	3.4	Spatial Interpolation: Elements of Spatial Interpolation, Global methods, Local Methods, Kriging, Comparison of Spatial Interpolation Methods	
4.0		**Terrain mapping, Geocoding and Segmentation**	04
	4.1	Terrain Mapping and Analysis: Data for Terrain Mapping and Analysis: DIM, TIN, Terrain Mapping, Slope and Aspect, Surface Curvature, Raster versus TIN	
	4.2	Geocoding and Dynamic Segmentation: Geocoding, Applications of Geocoding, Dynamic Segmentation, Applications of Dynamic Segmentation	

5.0			**Remote Sensing Fundamentals**	12
	5.1		Remote Sensing: Basic Principles, Electromagnetic Remote Sensing, Energy Sources, Energy Interactions with Surface Materials, , Energy Interactions with Earth's Atmosphere, Spectral Reflectance Curves	
	5.2		Microwave Remote Sensing, The Radar Principle, Factors Affecting Microwave Measurements, Radar Wavebands, SLAR Systems, SAR, Interpreting SAR Images, Geometrical Characteristics, Remote Sensing, Platform and Sensors, Satellite System Parameters, Sensor Parameters, Imaging Sensor Systems, Earth Resources Satellites, Meteorological Satellites. Data Formats, Standard Products	
	5.3		Visual Image Interpretation: Information Extraction By human and Computer, Remote sensing Data Products, Image Interpretation, Elements of Image Interpretation	
6.0			**Project Management**	04
	6.1		Planning of Project , Implementation of Project, Management of Project, Case study	
7.0			**Modern trends and Applications of GIS**	04
	7.1		Multimedia GIS, Internet GIS, Mobile GIS ,Applications of GIS in Urban and municipal area	

Recommended Books

1. Kang-tsung Chang, "Introduction to Geographical Information Systems", Tata McGraw Hill, Third Edition, 2003
2. M. Anji Reddi, "Remote Sensing and Geographical Information Systems", B. S. Publications, Second Edition, 2001
3. Basudeb Bhatta ,Remote Sensing and GIS ,Oxford University Press,2nd Edition
4. Ian Heywood, Sarah Cornelius & etal., "An Introduction to Geographical Information Systems", 2nd Edition, Pearson Education
5. A.M. Chandra and S.K. Ghosh, Remote Sensing and Geographical Information Systems , Narosa Publishing House Pvt ltd.
6. Peter A Burrough and McDonell, "Principles of Geographical Information Systems", Oxford University Press, 1998.
7. M. N. DeMers, "Fundamentals of Geographic Information Systems", 3rd edition, Wiley.
8. George B Korte, "The GIS Book", Onword press, Thomson Learning, 5th Edition, 2003
9. Tor Bernhardsen, "Geographic Information Systems – An Introduction", 3rd edition, Wiley Publications

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of the syllabus. The average marks of both the tests will be considered as final IA marks.

Term Work:

Term Work shall consist of at least 10 programs based on the above syllabus using any suitable software.

Distribution of marks for term work shall be as follows:
1. Attendance (Theory and Practical): 05 Marks
2. Laboratory work (Performing Experiments and Journal): 20 Marks

The final certification and acceptance of TW ensures the satisfactory performance of laboratory Work and Minimum Passing in the term work.

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Term Work /Practical	Tutorial	Total
BEITC8044	Robotics	04	02	---	04	01	---	05

Course Code	Course Name	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Internal assessment		End Sem. Exam				
		Test 1	Test 2					
BEITL8044	Robotics	20	20	80	25	---	25	150

Course Objectives: The Lerner is introduced to the fundamentals and kinematics of Robots. The topics like Differential motions & velocities, Trajectory Planning, Mobile Robot Motion Planning etc. are discussed.

Course Outcomes: At the end of this course, learners will be able to

a. Understand kinematics and dynamics of stationary and mobile robots
b. Understand trajectory planning for rigid robot and mobile robots
c. Implement trajectory generation and path planning algorithms
d. Work in interdisciplinary projects

Detailed Syllabus:

1. Fundamentals	Robot Classification, Robot Components, Degrees of freedom, Joints, Coordinates, Coordinate frames, workspace, applications	03 Hrs	Chapter 1 – Text Book 1
2. Kinematics of Robots	Homogeneous transformation matrices, Inverse transformation matrices, Forward and inverse kinematic equations – position and orientation, Denavit-Hatenberg representation of forward kinematics, Inverse kinematic solutions, Case studies	07 Hrs	Chapter 2 – Text Book 1
3. Differential motions and velocities	Differential relationship, Jacobian, Differential motion of a frame and robot, Inverse Jacobian	06 Hrs	Chapter 3 – Text Book 1
4. Dynamic Analysis of	Lagrangian mechanics, Moments of	07 Hrs	Chapter 4 –

Forces	Inertia, Dynamic equations of robots, Transformation of forces and moment between coordinate frames		Text Book 1
5. Trajectory Planning	Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories	07 Hrs	Chapter 5 – Text Book 1
6. Mobile Robot Motion Planning	Concept of motion planning, Bug Algorithms – Bug1, Bug2, Tangent Bug	04 Hrs	Chapter 2 – Text Book 2
7. Potential Functions and Visibility Graphs	Attractive/Repulsive potential, Gradient descent, wave-front planner, navigation potential functions, Visibility map, Generalized Voronoi diagrams and graphs, Silhouette methods	08 Hrs	Chapter 4 & 5 – Text Book 2
8. Coverage Planning	Cell Decomposition, Localization and Mapping	06 Hrs	Chapter 6, 9 – Text Book 2

Text Books

1. Saeed Benjamin Niku, "Introduction to Robotics – Analysis, Control, Applications", Wiley India Pvt. Ltd., Second Edition, 2011
2. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, "Principles of Robot Motion – Theory, Algorithms and Implementations", Prentice-Hall of India, 2005.

Reference Books

1. Mark W. Spong & M. Vidyasagar, "Robot Dynamics & Control", Wiley India Pvt. Ltd., Second Edition, 2004
2. John J. Craig, "Introduction to Robotics – Mechanics & Control", Third Edition, Pearson Education, India, 2009
3. Aaron Martinez & Enrique Fernandez, "Learning ROS for Robotics Programming", Shroff Publishers, First Edition, 2013.

Term Work:

Term Work shall consist of at least 10 programs based on the above syllabus using any suitable software.

Distribution of marks for term work shall be as follows:
1. Attendance (Theory and Practical): 05 Marks
2. Laboratory work (Performing Experiments and Journal): 20 Marks

The final certification and acceptance of TW ensures the satisfactory performance of laboratory Work and Minimum Passing in the term work.

List of Experiments:

Note: At least one experiment shall be performed from every group. Total number of experiments should be 10.

1. Forward kinematics of n-DOF robot arm – Simulation – (maximum 2 experiments)
2. Inverse Kinematics of n-DOF robot arm – Simulation (maximum 2 experiments)
3. Dynamic modeling of n-DOF robot arm & Simulation (maximum 2 experiments)
4. Trajectory planning of n-DOF robot arm (maximum 2 experiments)
5. Simulation of Bug1, bug2 and tangent bug algorithms (maximum 3 experiments)
6. Simulation of Potential field, voronoi graph, and visibility graph methods (maximum 3 experiments)

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs/Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC8045	Soft Computing	04	02	---	04	01	---	05

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC8045	Soft Computing	20	20	20	80	25	---	25	150

Course Objectives:

AIM: To introduce the techniques and methodologies of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

- To introduce the ideas of soft computational techniques based on human experience.
- To generate an ability to design, analyze and perform experiments on real life problems using various Neural Learning Algorithms.
- To conceptualize fuzzy logic and its implementation for various real world applications.
- To apply the process of approximate reasoning using Neuro-Fuzzy Modeling.
- To provide the mathematical background to carry out optimization using genetic algorithms.

Course Outcomes:

Student should be able to mimic human like thought process on deterministic machines and apply it to different real world problems faced in the professional front.

DETAILED SYLLABUS:

Sr.No.	Module	Detailed Content	Hours
1	Introduction to Soft Computing	**Neural Networks:** Definition, Advantages, Applications, Scope. **Fuzzy logic:** Definition, Applications. **Hybrid System:** Definition, Types of Hybrid Systems, Applications. **Genetic Algorithms:** Definition, Applications.	2
2	Neural Networks	**Fundamental Concepts and Models of Artificial Neural Systems:** Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Neural Processing, Learning and Adaptation, Neural Network Learning Rules and Comparison. **Linearly and Non-Linearly Separable Pattern Classification. Perceptron Convergence Theorem. Multi-layer Feedforward Network:** Delta Learning Rule for Multiperceptron Layer, Generalized Delta Learning Rule, Feedforward Recall and Error Back-propagation Training, LearningFactors,CharacterRecognitionApplication. **Associative Memory:** Hopfield Network, Bidirectional Associative Memory. **Radial Basis Function Networks.**	20
3	Fuzzy Set Theory	Brief Review of Conventional Set Theory, Introduction to Fuzzy Sets, Properties of Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions.Fuzzy Extension Principle, Fuzzy Relations, Projection and Cylindrical Extension of Fuzzy Relations, Fuzzy Max-Min and Max-Product Composition. Fuzzy Knowledge Based Systems with Applications, Defuzzification Methods, Fuzzy Composition Rules, Architecture of Mamdani Type Fuzzy Control Systems.	16
4	Hybrid Systems	**ANFIS**: Adaptive Neuro-Fuzzy Inference Systems: Introduction, ANFIS Architecture, and Hybrid Learning Algorithm.	4
5	Genetic Algorithms	What are Genetic Algorithms? Why Genetic Algorithms? Biological Background: The Cell, Chromosomes, Genetics, Reproduction, Neural Selection, Traditional Optimization and Search Techniques, Genetic Algorithm and Search space: Simple GA, General GA, Operators in GA, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA flow, Constraints in GA, Problem solving using GA, Classification of GA.	6

Text Books:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems," Jaico Publishing House.

2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," 3rd ed. Wiley India.

3. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing," 2nd ed. Wiley India.

4. Jang J.S.R, Sun C. T. and Mizutani E., "Neuro-Fuzzy and Soft Computing – A Computational Approach to Learning and Machine Intelligence," PHI.

References:

1. Laurene Fausett, "Fundamentals of Neural Networks – Architectures, Algorithms, And Applications," Pearson Education.
2. Hagan T. Martin, H. B. Demuth, and Mark Beale, "Neural Network Design," Thomson Learning.
3. Satish Kumar, "Neural Networks – A classroom Approach," 2nd ed. Tata McGraw Hill.
4. Kishan Mehrotra, Chilukuri. K. Mohan, and Sanjay Ranka, "Elements of Artificial Neural Networks," 2nd ed. Penram Int. Publishing India.
5. H. J. Zimmermann, "Fuzzy Set Theory and its Applications," Allied Publishers Ltd.
6. Driakov D. Hellendoorn H. and Reinfrank M., "An Introduction to Fuzzy Control," Narosa Publishing House.

Term work:
Term work will be based on Practical and Assignments covering the topics of the syllabus.

Suggested Practical List (If Any):
1. Fuzzy membership function
2. Fuzzy Extension principle
3. Fuzzy controller
4. Perceptron Learning rule
5. Delta Learning Rule
6. Associative Memory
7. Genetic Algorithm
8. Competitive Learning

Theory Examination:
• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC8046	Software Testing & Quality Assurance	04	02	---	04	01	--	05

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITC8046	Software Testing & Quality Assurance	20	20	20	80	25		25	150

Course Objectives: The students will learn

- I.   Basic software debugging methods.
- II. White box and Black box testing methods
- III. Writing the testing plans
- IV. Different testing tools

Course Outcomes:

After completion of course the students will able to:

1: Identify the reasons for bugs and analyze the principles in software testing to prevent and remove bugs.
2: Implement various test processes for quality improvement
3: Apply the software testing techniques in commercial environments
4: Provides practical knowledge of a variety of ways to test software and an understanding of some of the trade-offs between testing techniques.
5: Familiar with the open source testing tools.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Unit-I Testing Methodology	Introduction, Goals of Software Testing, Software Testing Definitions, Model for Software Testing, Effective Software Testing vs Exhaustive Software Testing, Software Failure Case Studies, Software Testing Terminology, Software Testing Life Cycle (STLC), Software Testing methodology, Verification and Validation, Verification requirements, Verification of high level design, Verification of low level design, validation.	**10**
	Unit II Testing Techniques	Dynamic Testing : Black Box testing: boundary value analysis, equivalence class testing, state table based testing, cause-effect graphing based testing, error guessing. White box Testing Techniques: need, logic coverage criteria, basis path testing, graph matrices, loop testing, data flow testing, mutation testing. Static Testing. Validation Activities: Unit validation, Integration, Function, System, Acceptance Testing. Regression Testing: Progressive vs. Regressive, regression testing produces quality software, regression testability, objectives of regression testing, regression testing types, define problem, regression testing techniques.	**12**
	Unit III Managing the Test Process	Test Management: test organization, structure and of testing group, test planning, detailed test design and test specification. Software Metrics: need, definition and classification of software matrices. Testing Metrics for Monitoring and Controlling the Testing Process: attributes and corresponding matrics, estimation model for testing effort, architectural design, information flow matrix used for testing, function point and test point	**10**

		analysis. Efficient Test Suite Management: minimizing the test suite and its benefits, test suite minimization problem, test suite prioritization its type , techniques and measuring effectiveness.	
	Unit IV Test Automation	Automation and Testing Tools: need, categorization, selection and cost in testing tool, guidelines for testing tools. Study of testing tools: WinRunner, QTP, LoadRunner, TestDirector and IBM Rational Functional Tester, Selenium etc.	**8**
	Unit V Testing for Specialized Environment	Testing Object Oriented Software: OOT basics, Object-oriented testing. Testing Web based Systems: Web based system, web technology evaluation, traditional software and web based software, challenges in testing for web based software, testing web based testing, Testing a data warehouse	**5**
	Unit VI Quality Management	Software Quality Management, McCall's quality factors and Criteria, ISO 9126 quality characteristics, ISO 9000:2000,software quality management	**3**

Text Books:

1. Software Testing Principles and Practices Naresh Chauhan Oxford Higher Education

2. Effective Methods for Software Testing , third edition by Willam E. Perry, Wiley Publication

3. Software Testing and quality assurance theory and practice by Kshirasagar Naik, Priyadarshi Tripathy , Wiley Publication

4. Software Testing Concepts and Tools by Nageswara Rao Pusuluri , dreamtech press

References:

1. Foundation of Software Testing 2 e , by Aditya P. Mathur , Pearson publication

2. Software Testing Tools by Dr. K.V.K.K. Prasad , dreamtech press

3. Software Testing Principles, techniques and tools by M.G. Limaye , Mc Graw Hill publication

Term work:

Term work will be based on Practical and Assignments covering the topics of the syllabus.

Suggested Practical List:

1. Write programs in C Language to demonstrate the working of the following
a. constructs: i) do...while ii) while….do iii) if…else iv)switch v) for
2. A program written in C language for Matrix Multiplication fails. Introspect the causes for its failure and write down the possible reasons for its failure.

3. Take any system (e.g. ATM system) and study its system specifications and report the various bugs.

4. Write the test cases for any known application (e.g. Banking application)

5. Create a test plan document for any application (e.g. Library Management System)

6. Design Test case using boundary value analysis by taking quadratic equation problem.

7. Design a test cases using equivalent class partitioning taking triangle problem

8. Study of any testing tool (e.g. Win runner)

9. Study of any web testing tool (e.g. Selenium)

10. Study of any test management tool (e.g. Test Director)

12. Study of any open source-testing tool (e.g. Test Link)

Theory Examination:

• Question paper will comprise of 6 questions, each carrying 20 marks.
• Total 4 questions need to be solved.
• Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
• Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.

Course Code	Course Name	Teaching Scheme (Hrs./Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITP805	Project II	---	**	---	---	06	---	06

**Work load of the teacher in semester VIII is equivalent to 12 hrs/week.

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
BEITP706	Project I	---	---	---	---	50	---	50	100

Course Objectives:

1. Implimentaion of the topic selected in Project-I.

2. Initiating the learners to technical writing and documentation for reuse.

3. Developing proficiency in carrying out critical analysis, review and study of existing literature on technological experimentation and finding out of scholastic investigation

Outcomes: The learner should be able to:

1. Demonstrate the product that is implemented.

2. Produce the proper documentation of the work.

3. Able to work in team and communicate with peers.

4. Develop skills required by the industry.

Guidelines for Project

o Students should do literature survey/visit industry/analyze current trends and identify the problem for Project and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by experimental/simulation methods. The solution to be validated with proper justification and compile the report in standard format.

Guidelines for Assessment of Project II

o Project II should be assessed based on following points
  - Quality of problem selected
  - Clarity of Problem definition and Feasibility of problem solution
  - Relevance to the specialization / Industrial trends
  - Clarity of objective and scope
  - Quality of work attempted
  - Validation of results
  - Quality of Written and Oral Presentation

o Report should be prepared as per the guidelines issued by the University of Mumbai.

o Project II should be assessed through a presentation jointly by Internal and External Examiners approved by the University of Mumbai

o Students should be motivated to publish a paper based on the work in Conferences/students competitions