

AC 6/6/2012
Item No. 4.75

UNIVERSITY OF MUMBAI



Revised Syllabus for the
M. E. (Information Technology)

(As per Credit Based Semester and Grading System with
effect from the academic year 2012–2013)

Program Structure for ME Information Technology Mumbai University

(With Effect From 2012-2013)
Semester I

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
ITC101	Advanced Data Mining with BI	04	--	--	04	--	--	04	
ITC102	Data Storage Management and Retrieval	04	--	--	04	--	--	04	
ITC103	Network Design and Management	04	--	--	04	--	--	04	
ITE101X	Elective I	04	--	--	04	--	--	04	
ITE102X	Elective II	04	--	--	04	--	--	04	
ITL101	Laboratory I – Course Lab	--	02	--	--	01	--	01	
ITL102	Laboratory II – Elective Lab	--	02	--	--	01	--	01	
Total		20	04	--	20	02	--	22	
Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem.E exam.	Exam Duration (hrs)			
		Test1	Test 2	Avg.					
ITC101	Advance Data Mining with BI	20	20	20	80	3	--	--	100
ITC102	Data Storage Management and Retrieval	20	20	20	80	3	--	--	100
ITC103	Network Design and Management	20	20	20	80	3	--	--	100
ITE101X	Elective I	20	20	20	80	3	--	--	100
ITE102X	Elective II	20	20	20	80	3	--	--	100
ITL101	Laboratory I – Course Lab	--	--	--	--		25	25	50
ITL102	Laboratory II – Elective Lab	--	--	--	--		25	25	50
Total		100	100	100	400		50	50	600

Semester II

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
ITC201	Advanced Software Architecture	04	--	--	04	--	--	04	
ITC202	Enterprise Security and Risk management	04	--	--	04	--	--	04	
ITC203	Soft Computing	04	--	--	04	--	--	04	
ITE201X	Elective III	04	--	--	04	--	--	04	
ITE202X	Elective IV	04	--	--	04	--	--	04	
ITL203	Laboratory III - Course Lab	--	02	--	--	01	--	01	
ITL204	Laboratory IV - Elective Lab	--	02	--	--	01	--	01	
Total		20	04	--	20	02	--	22	
Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam	Exam Duration (hrs)			
		Test1	Test 2	Avg.					
ITC201	Advanced Software Architecture	20	20	20	80	3	--	--	100
ITC202	Enterprise Security and Risk management	20	20	20	80	3	--	--	100
ITC203	Soft Computing	20	20	20	80	3	--	--	100
ITE201X	Elective III	20	20	20	80	3	--	--	100
ITE202X	Elective IV	20	20	20	80	3	--	--	100
ITL203	Laboratory III - Course Lab	--	--	--	--		25	25	50
ITL204	Laboratory IV - Elective Lab	--	--	--	--		25	25	50
Total		100	100	100	400		50	50	600

Semester III

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
ITS301	Seminar	--	06	--	--	03	--	03	
ITD301	Dissertation 1	--	24	--	--	12	--	12	
Total		--	30	--	--	15	--	15	
Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Oral.	Oral
		Internal Assessment			End Sem.Exam.				
		Test1	Test 2	Avg.					
ITS301	Seminar	--	--	--	--	50	50	100	
ITD301	Dissertation 1	--	--	--	--	100	--	100	
Total		--	--	--	--	150	50	200	

Semester IV

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
ITD401	Dissertation II	--	30	--	--	15	--	15	
Total		--	30	--	--	15	--	15	
Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Oral	Total
		Internal Assessment			End Sem.Exam.				
		Test1	Test 2	Avg.					
ITD401	Dissertation II	--	--	--	--	100	100	200	
Total		--	--	--	--	100	100	200	

* The Term Work and Oral of Project II of Semester IV should be assessed jointly by the pair of Internal and External Examiners

Note- The Contact Hours for the calculation of load of teacher are as follows
 Seminar - 01 Hour / week / student
 Project I and II - 02 Hour / week / student

End Semester Examination: In all six questions to be set, each of 20 marks, out of these any four questions to be attempted by students. Each question will comprise of mixed questions from different units of the subjects.

Subject Code	Elective I	Subject Code	Elective II
ITE1011	Operation Research	ITE1021	Software Quality Assurance
ITE1012	Applications of DSP for Multimedia Communications	ITE1022	BioInformatics
ITE1013	Usability Engineering	ITE1023	E-Business Techniques

Subject Code	Elective III	Subject Code	Elective IV
ITE2011	Wireless Ad-hoc Sensor Network	ITE2021	Ubiquitous computing
ITE2012	Virtualization and Cloud Computing	ITE2022	Ethical hacking and digital Forensic
ITE2013	Knowledge Management	ITE2023	Next Generation Network

Subject Code	Subject Name	Credits
ITC 101	Advanced Data Mining with Business Intelligence	04
<p>Objectives of the course: This is an advanced course in data mining with particular thrust to business applications. Students learn how decision making in organisations can be supported by information systems such as decision support systems (DSS) and business intelligence systems (BIS) that draw their data and information from internal and external sources. The tools, techniques and models for intelligence analysis and visualisation are examined with an emphasis on new and emerging technologies such as data mining and performance management. Students are also introduced to a range of research methods suitable for information systems professionals.</p> <p>Prerequisite – Basic data warehousing and Mining course</p>		

Module	Detailed content	Hours
1	Review of data mining concepts	03
2	Data Cube Technology <ol style="list-style-type: none"> 1. Brief Overview of OLAP and Cube technology 2. Data Generalization by Attribute-Oriented Induction 3. Efficient Methods for Data Cube Computation 4. Exploration and Discovery in Multidimensional Databases 	03
3	Advanced Data mining Algorithms –Mining Frequent patterns <ol style="list-style-type: none"> 1. Mining Frequent Itemsets using vertical data formats 2. Mining closed and Max patterns 3. Pattern Evaluation Methods& Applications of frequent pattern and associations 4. Advanced pattern mining: multilevel multidimensional space, constrained based, colossal, approximate and compressed patterns. Pattern exploration and applications 	08
4	Advanced Classification: <ol style="list-style-type: none"> 1. Improving Classification Accuracy : Bagging Boosting 2. Bayesian Belief Networks 3. Pattern-Based Classification;Lazy Learners 	08
5	Advanced Clustering: <ol style="list-style-type: none"> 1. Density-Based Methods; Probabilistic Clustering 	08

	<ul style="list-style-type: none"> 2. Clustering High-Dimensional Data 3. Clustering Graph and Network Data; Clustering with constraints 	
6	Introduction to Business Intelligence: Framework, Architecture, benefits, Tools and techniques	03
7	Business Performance Management <ul style="list-style-type: none"> 1. Methodologies (balanced scorecard, dashboards 2. BPM vs BI 	03
8	Text mining for Business Intelligence <ul style="list-style-type: none"> 1. Concepts and definitions 2. Applications & Tools: Marketing, Security & Biomedical Applications, 	02
9	Forecasting Time Series <ul style="list-style-type: none"> 1. Introduction 2. Explanatory versus Predictive Modeling 3. Popular Forecasting Methods in Business 4. Combining Methods & Time Series Components 	02
9	Business Intelligence Implementation: Emerging Trends <ul style="list-style-type: none"> 1. Implementing BI: BI Implementations Factors, 2. BI and Integration Implementation, Connecting BI Systems to Databases and Other Enterprise Systems, On-Demand BI 3. Key Characteristics and Benefits; Legal Issues, Privacy 4. Ethics in Decision Making and Support 5. The Future of Business Intelligence; Social Networks and BI: Collaborative Decision Making, RFID and New BI Application Opportunities, Reality Mining, 	04
10	Trends and Research Frontiers in Data Mining	04

Text Books:

1. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber, 3rd edition Publisher: Morgan Kaufmann; 3 edition
2. Business Intelligence, 2/E; Efraim Turban, Ramesh Sharda, Dursun Delen, David King; pearson Education
3. Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with Xlminer; 2nd edition, Galit Shmueli, Nitin R. Patel and Peter C. Bruce; John Wiley
4. Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management, Author: Berry, Gordon S. Linoff, Format: Paperback, 648 pages, Edition: 3; Publisher: John Wiley & Sons Inc,

References

1. Robert Groth, Data Mining: Building Competitive Advantage, Prentice Hall, 2000.
2. P. N. Tan, M. Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education
3. Alex Berson and Smith, "Data Mining and Data Warehousing and OLAP", McGraw Hill Publication.
4. E. G. Mallach, "Decision Support and Data Warehouse Systems", Tata McGraw Hill.
5. Michael Berry and Gordon Linoff "Mastering Data Mining- Art & science of CRM", Wiley Student Edition

Assessment:

Internal: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITC102	Data Storage Management and Retrieval	04

Module	Detailed content	Hours
1	Introduction: Client-Server Architecture, Data creation and understand the value of data to a business, Challenges in Data Storage and Management, Data Storage Infrastructure, Information Life Cycle.	04
2	Intelligent Disk Sub systems - Storage Virtualization with RAID (RAID 0,1,5,6,1+0)	04
3	I/O Techniques -SCSI, FC protocol stack, FC SAN, IP Storage, Infiniband, FCoE	06
4	FS and NAS device:Local File Systems on Linux, SMBFS, Network File Systems and File servers, Comparison between different FS, Setup and installation of Samba and NFS.	06
5	Storage Virtualization: Forms, Challenges, Types of Storage Virtualizations, Virtualization in the I/O path, Implementation considerations, Storage Virtualization on Block and File level.	06
6	Application of Storage Networks, Network Back-up, Network Back-up services, Back-up Clients, Back-up Database, Back-up File Systems.	06
7	Business Continuity and Management of Storage Networks: Data Availability, Business continuity, Failure Analysis, Business impact Analysis, Differentiate between business continuity (BC). System Management, Management Interfaces, In-band and out-band Management.	06
8	Data Retrieval: What is information retrieval , Significance of information retrieval and storage, Definition of information retrieval system, Objectives of information retrieval system, Function overview, Relationships between Digital library and IRS, Algorithm, Data structure, Measure of information systems, Logical organization, Physical organization, Components of information retrieval systems, Comparisons among different information systems.	06
9	Vector retrieval model: Vector model, document-term matrix, methods for designing weights to terms, query in the vector model, spatial representation of a document in vector model.	04

Reference Books

1. “Storage Networks Explained: Basic And Applications Of Fibre Channel SAN, NAS, ISCSI And Infiniband by Ulf Troppen, Rainer Erkens and Wolfgang Mueller, Wiley.
2. EMC Educational Services, “Information Storage and Management”, Wiley India.
3. Meet Gupta, “Storage Area Network Fundamentals”, Pearson Education Limited, 2002.
4. Information Storage and Retrieval by R. R. Korfhage, published by John Wiley & Sons in 1997. ISBN 0-471-14338-3.

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End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITC103	Network Design and Management	04

Module	Detailed content	Hours
1	Requirements Planning and Choosing Technology: User Requirements, documentation and planning, traffic sizing, tuning data size across the network, traffic characteristics, time and delay consideration.	4
2.	Traffic Engineering and Capacity Planning: Poisson Arrivals, Markov processes, Voice traffic modeling, Queuing system models, Markovian queuing system models M/D/1, M/M/1, Bernoulli process, Erlang formulas and M/M/c/e system priority queue system, LAN Traffic Modeling, Availability and Reliability.	6
3	Network Design: Designing the network topology and solutions-Top down Approach – Network Design Layers--Application Layer, Premises Architecture or Local Enterprise, Architecture Layer, Access Layer, Backbone Layer, Access Layer Design, Backbone Network Design.	6
4.	Enterprise LAN Design: Ethernet Design Rule. 100 Mbps Fast Ethernet Design rules, Gigabit Ethernet Design Rules, 10 Gigabit Ethernet Design rules, 10GE Media types.	6
5.	Network Management—Challenges of Information Technology Managers, Goals, Network Provisioning, Installation and Maintenance.	5
6.	Network Management Protocols: SNMP v1,v2,v3, RMON1, RMON2, Netflow, Syslog. Network Management Standards, ASN.1, encoding structure, Macros, Functional Model.	6
7.	Telecommunication Network management--Terminology, functional	5

	architecture, information architecture, TMN Cube, TMN & OSI.	
8.	Functional Areas of Network Operations and Management: Configuration Management, Performance Management, Fault Management, Accounting Management, Security Management, Policy Based Management.	5
9.	Network Management Tools: Basic software tools, SNMP MIB tools, Protocol Analyzer.	5

References:

1. Data Network Design, Darren L. Spohn, Tata McGraw Hill Edition.
2. Network Management Principles and Practice, Mani Subramanian, Pearson Education.
3. Network Analysis, Architecture, and Design 3rd Edition, James D, Morgan Kaufman.
4. Wide Area Network Design: Robert S Kahn, Morgan Kaufman.
5. Fundamentals of Telecommunication Network Management --Lakshmi Raman IEEE Communication Society, Prentice Hall of India Edition 1999.
6. Cisco press CCDA official Guide.
7. Telecommunication Network Modeling, Planning & Design-- by Sharon Evans (BT Comm.Tech.) 2009.
8. High Speed Networks and Internets: Performance and Quality of Service, William Stallings, Prentice Hall.
9. Computer Networks – A Systems Approach, Larry L. Peterson and Bruce S. David, 4th Edition, Elsevier, 2007.
10. Computer Networking, A Top-Down Approach Featuring the Internet”, James F. Kurose, Keith W. Ross, Third Edition, Addison Wesley, 2004.

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Subject Code	Subject Name	Credits
ITE1011	Operation Research	04

Module	Detailed content	Hours
1	Overview of Operation Research and Modelling Approach	02
2	Linear Programming: Introduction to Linear Programming , Formulation of LP Model, Graphical solution , Assumptions , Simplex Method, Duality theory and Sensitivity Analysis , Transportation and Assignment Problems, Network Optimization Models	10
3	Dynamic Programming	03
4	Non-linear Programming One variable and Multi-variable unconstrained optimization, Quadratic Programming , Seperable Programming, Convex Programming,	05
5	Decision Analysis Decision Trees, Utility Theory, Application of Decision Analysis	06
6	Queueing Theory Queueing Models, Notations and Little's law, Role of exponential Distribution , Birth and Death Process, Markovian Queues – Single and Multi Server Models, Queueing Models involving non-exponential distribution, Queueing Networks	08
7	Inventory Model Continuous Review Model , Deterministic Periodic Review Model , Stochastic Continuous Review Model	07
8	Simulation Discrete Event Simulation and Applications , Generation of Random Numbers , Generation of Random Observation from a probability Distribution	07

References:

1. Introduction to Operations Research – Concepts and Cases ; 8th Edition , Fredrick S. Hillier , Gerald J. Lieberman ; SIE – McGraw Hill.
2. Operation Research – An Introduction – Hamdy A. Taha , Pearson Education

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End Semester Examination:

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Subject Code	Subject Name	Credits
ITE1012	Applications of DSP for Multimedia Communications	04

Module	Detailed content	Hours
1	<p><u>Basic Revision</u> :FIR and IIR filters design, the discrete Fourier transform, FFT and basic theory of random processes.</p>	06
2	<p><u>Advance Digital Signal Processing Theory:</u></p> <p><i>Optimal/Adaptive Filters for Multimedia Communication:</i></p> <p>Linear Random processes; optimal filter design, Wiener filter; linear predictor, adaptive filter, Least Mean Square (LMS) filter and Recursive Least Square (RLS) filter.</p> <p><i>Fast Algorithms:</i></p> <p>Cyclic Convolutions, Radix-2 fast Fourier transform(FFT), Radix-4 algorithm, Split- Radix algorithm, Rader algorithm, Goertzel algorithm, prime factor algorithm</p> <p><i>Modern Transforms for Multimedia Applications</i></p> <p><i>DCT (Discrete Cosine Transform)</i> - Orthogonal transforms, Karhunen Loeve transform, correlation properties, discrete cosine transform, fast DCTs and integer cosine transform.</p> <p><i>Wavelet Transform</i> - multirate systems, wavelet basis and scaling function, continuous and discrete wavelet transforms, dyadic structure, multi-resolution analysis, pyramid algorithm, wavelet filters, realization and application examples.</p>	10

3	<u>Video Algorithms and Coding</u> Critical issues and fast algorithms for image coding and motion picture processing, motion estimation, and compression. Realisation aspects on video compression, standards, such as JPEG and MPEG, and essence of video- conferencing systems.	10
4	<u>Speech and Audio Coding</u> DSP aspects of Linear Prediction Model, Realisation of speech processing & synthesis algorithms, speech processor structure. Audio Compression and Psychoacoustic Model, and AC3 and voice part of MPEG standard.	10
5	<u>DSP in Multimedia Communications Systems</u> Channel identification/equalization Echo cancellation ADSL - high speed telephone line modem (Asymmetric Digital Subscriber Line modem) Modulation for digital TV (Orthogonal Frequency Division Multiplexing - OFDM) Mobile phone (LPC coding, equalization) etc.	12

Reference book:

1. Proakis, Rader, Ling and Nikias, *Advanced Digital Signal Processing*, Macmillan Publishing Co., 1992V Britanak, P. Yip and R.Rao, *Discrete Cosine and Sine Transforms*, Academic Press, Inc., 2007.
2. H. Sun, X. Chen and T. Chiang, *Digital Video Transcoding for Transmission and Storage*, CRC Press, 2005.
3. Madisetti, *Digital Signal Processors – An Introduction to Rapid Prototyping and Design Synthesis*, IEEE Press, 1995.

4. Lapsley, Bier, Shoham and Lee, *DSP Processor Fundamentals – Architectures and Features*, IEEE Press, 1997.
5. H.J. Nussbaumer, *Fast Fourier Transform and Convolution Algorithms*, Springer-Verlag, 1982.
6. E.O. Brigham, *The Fast Fourier Transform and Its Applications*, Prentice-Hall Inc., 1988.
7. A. N. Netravali and B.G. Haskell, *Digital Pictures Representation and Compression*, New York: Plenum, 1991.
8. V. Bhaskaran and K. Konstantinides, *Image and Video Compression Standards: Algorithms and Architectures*, Kluwer Academic Publishers, 1995.
9. Simon Haykin, *Adaptive Filter Theory*, Prentice Hall Information and System Sciences Series, 1995.
10. L.R. Rabiner and R.W. Schafer, *Digital Processing of Speech Signals*, Prentice Hall Signal Processing Series.
11. Walter Y. Chen, *DSL: Simulation Techniques and Standards Development for Digital Subscriber Line Systems*, Macmillan Technical Publishing, 1998.
12. Asha Mehrotra, *GSM System Engineering*, Artech House Inc., 1997.
13. Selected reading from recent issues of IEEE Transactions on Acoustics, Speech, and Signal Processing, Proceedings of ICASSP and IEE Proceedings.

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE1013	Usability Engineering	04

Module	Detailed content	Hours
1	Introduction : Paradigms for interaction, Time-sharing, Video display units, Programming toolkits, Personal computing, Window systems and the WIMP interface, The metaphor, Direct manipulation, Language versus action, Hypertext, Multi-modality, Computer-supported cooperative work, The world-wide web, Agent-based interfaces, Ubiquitous computing. Principles to support usability, Learnability, Flexibility, Robustness.	08
2	<u>Goals of HCI</u> <u>Processes and methods for user-centered design</u>	06
3	<u>Processes and methods for user-centered design</u> <u>User and task analysis</u>	06
4	Conceptual Design, Conceptual Design Methods.	06
5	Interaction Paradigms and human factors: Models, metaphors and paradigms	08
6	Detailed design and Prototyping, High-level psychological concepts,	08
7	Usability testing: Methods: Analytical methods, Empirical methods. Prepare for usability testing ;Assemble testable prototypes, Write script including informed consent and task instructions, Perform practice test(s) with team member as participant.	06

Recommended Books:

5. *Interaction Design*, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
6. HUMAN-COMPUTER INTERACTION SECOND EDITION, Alan Dix - Janet Finlay - Gregory Abowd - Russell Beale PRENTICE HALL © 1998

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End Semester Examination:

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Subject Code	Subject Name	Credits
ITE1021	Software Quality Assurance	04

Module	Detailed content	Hours
1	Introduction to Software Quality Assurance: Software fault, Error, Failure. Error classification, software quality factors, Need for software quality requirement, Classification of requirement into quality factors. Product quality factors, Software compliance with quality factors	04
2	Components of Software Quality Assurance system : Software Quality Assurance architecture, Pre-project components, contract review, Project Life cycle (PLC) components, Integrating quality activities in PLC, Review. Management and assessment of software components. Quality of maintenance component. Software quality infrastructure component-Procedure and work instructions.	12
3	Development and Quality plan: Objectives, elements, Development and quality plans for small/internal projects.	04
4	Software Quality Metrics: Product metrics, Process metrics, implementation and limitations of metrics. Cost of metrics.	04
5	Software Testing strategies and implementation: Testing strategies, test classification, white box testing, Black box testing. Testing process, Test case design, Automated testing, Alpha & Beta testing	10
6	Corrective and Preventive action and Control: Corrective and Preventive Process, information collection and analysis. Development of solutions and Implementation. Documentation control, Project progress control.	10
7	Software Quality Assurance standards, Templates and checklist. CASE tools and their effects on Software Quality.	04

Text Book:

1. Software Quality Assurance: From theory to implementation by Daniel Galin. Pearson education.
2. Software Quality Theory and Management by Alan C. Gillies, Cengage Learning.

References:

1. Software Quality Assurance: Principles And Practice by Nina S. Godbole Publisher Alpha Science International Limited, 2004
2. Aditya Mathur, Foundations of software testing, Pearson Education, 2008

3. Srinivasan Desikan and Gopaldaswamy Ramesh, Software testing – principles and practices , Pearson education, 2006
4. Ron Patton, Software testing , second edition, Pearson education, 2007

Assessment:

Internal: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE1022	BioInformatics	04

Module	Detailed content	Hours
1	Introdcution: History of Bioinformatics, Biological information resources and retrieval system, Knowledge Discovery and data mining, data characteristics and presentation	3
2	Protein Information Resources: Biological databases, Primary sequence databases, protein sequence databases, Secondary databases, protein pattern databases, and structure classification databases.	8
3	Genome Information Resources : Computational methods: Gene identification methods; data mining (Genome databases) and phylogenetic analysis; Predictive methods using nucleic acids and protein sequences. DNA sequence databases, specialized genomic resources. Gene identification methods Genomics and Human genome project; Strategy of genome sequencing	12
4	Bioinformatics Software : Molecular structure drawing tool (Chemdraw); VMD/Rasmol/Insight-II; Clustal X1.8; OLIGO; Molecular modelling/ Docking(CAChe);	8
5	Biological Data Bases And Their Management: Introduction to SQL (Sequence Query Language) Concept on data base in Protein and nucleic acids, Various programmes for sequence comparison and analysis, Database searching, Alphabets and complexity, Algorithm programs. Comparing two sequences, sub sequences, identity and similarity, The Dotplot, Local and global similarity, different alignment techniques. Dynamic programming , pair wise searching, importance and need of secondary database searching. secondary database structure and building a sequence search protocol	12

6	Various Development In Bioinformatics: Genome projects (human, Rice), Molecular modeling and structure function relationship, Proteomics, Molecular Dynamics Analysis package structure, commercial software, comprehensive, current trends and future prospects of bioinformatics.	5
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Text Books:

1. Cynthia Gibas ,Per Jambeck "Developing Bioinformatics Computer Skills". Publisher: O'Reilly,First Edition April 2001
2. T.K.Attwood And D J Parry-Smith Addison” Introduction To Bioinformatics” Wesley longman
3. Jean –Michel, Clavreriw, cerdric notredame, “Bioinformatics-A Beginnrr’s Guide” Willy dreamlech india pvt. Ltd.

Reference Books

1. Introduction to Bioinformatics, Arthur M. lesk, OXFORD publishers (Indian edition)
2. Baxevanis AD, Ouellette BFF (eds): "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins"
3. Higgins D, Taylor W (eds): "Bioinformatics: Sequence, Structure and Databanks".

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE1023	E-Business Techniques	4
Module	Detailed content	Hours
1.	Defining E-business, Framework for understanding e-business, Fundamental model of e-business, Preparing e-business plan	04
2.	Environmental forces affecting Planning and Practice	04
3.	Ethical Legal and Social concerns	04
4.	Developing e-business model: Characteristic of Internet based software and E-business solutions	04
5	A Multilevel Organizational approach, Strategic planning and value chain, building online presence of existing business.	04
6	Researching and analyzing Opportunities for growth. E-business research process, method of research, benefit of research.	04
7	Understanding online Communication and behavior. Sources of influences on Buyer Behavior and Decision-Making	03
8	Organizational and Managerial Issues	03
9	Financial planning and working with investor	03
10	Implementation and control of e-business plan	03
11	E-business Revenue model	03
12	Virtual community, social network	03
13	Technology: Web Hosting and E-business software	03
14	Technology: Online Security and Online payment system	03

Reference book

1. E-business Theory and Practice : Brahm Canzer, Cengage
2. E-commerce: Ninth edition, Gary Schneider, cengage
3. Effortless E-commerce: Pearson education

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITL101	Laboratory 1-Core Course Lab	01

Module	Detailed content	Lab. Sessions
1	Two Laboratory Practicals to be conducted for each of the core subjects.	24

Modality and Assessment:

1. Each Laboratory assignment will be done in a group of two students. The Faculty teaching each core subject will be required to propose and evaluate the respective Laboratory assignments. These will be essentially hands-on practical and not theory / research review types of assignments.
2. **End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners

Subject Code	Subject Name	Credits
ITL102	Laboratory II –Elective Lab	01

Module	Detailed content	Lab. Sessions
1	One Mini Project based on any one of the selected elective subject.	24

Modality and Assessment:

1. Each mini project assignment will be done by individual student. The Faculty teaching elective subject will be required to propose and evaluate the respective mini projects. These will be essentially hands-on practical and not theory / research review types of projects
2. **End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners

Semester II

Subject Code	Subject Name	Credits
ITC 201	Advanced Software Architecture	04

Module	Detailed content	Hours
1	Introduction to Software Architecture : Software Architecture , Foundations of Software Architecture , Software architecture in the context of the overall software life cycle, Architectural Styles, CASE study of Architectures	04
2	Modeling: Modeling concepts, Views and viewpoints, Early Architectural Description Language (ADL), Domain and style specific ADLs.	08
3	Analysis: Static, Dynamic and Scenario – based Analysis. Architectural Trade-off Analysis Method.	04
4	Introduction to Design Patterns: Structural Patterns, Patterns for Organization of Work, Access Control Patterns, Management Patterns, Communication Patterns.	08
5	Architecture Pattern: Structural Patterns (Layers, Pipe& Filter, Blackboard) , Patterns for Distribution (Broker), Patterns for Interactive Systems (MVC, Presentation-Abstraction-Control), Adaptable Systems (Microkernel, Reflection), Frameworks and Patterns.	10
6	Applied Architecture and styles: Network architecture (Cloud), Decentralized architecture (Grid), Service oriented Architecture and Web Services, Architecture for specific Domains (Wireless network).	10
7	Designing for Non-Functional Properties: Efficiency, Complexity, Scalability and Heterogeneity, Adaptability and Dependability.	04

References:

1. R. N. Taylor, N. Medvidovic, and E. M. Dashofy. *Software Architecture: Foundations, Theory, and Practice*, John Wiley & Sons, 2009.
2. *Pattern-Oriented Software Architecture* by Frank Buschmann, Hans Rohnert, Kevin Henney, Douglas C. Schmidt, Publisher: Wiley; Volume 1 (2004).
3. *Design Patterns: Elements of Reusable Object-Oriented Software* (Addison-Wesley Professional Computing Series) by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides Publisher: Addison-Wesley Professional; 1st edition (1995)
4. *Software Architecture in Practice* by Len Bass, Paul Clements, Rick Kazman, Pearson.
5. *The art of Software Architecture* by Stephen T. Albin

Assessment:**Internal:**

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITC 202	Enterprise security and risk management	04

Module	Detailed content	Hours
1	Introduction to assessing Network Vulnerabilities: type and procedure of network vulnerability assessment	08
2	Principles of Security: Information Classification, Policy framework, role based security in an organization	04
3	Risk Assessment: Laws, Mandates and Regulations, Risk assessment best practices, Risk assessment best practice.	06
4	Risk Assessment Methodologies: Defense –in depth approach, risk analysis, Asset valuation approach, Quantitative and Qualitative risk-assessment approaches. Scoping the project, Understanding the attacker.	08
5	Performing the Assessment: Vulnerability scan and Exploitation: Internet Host and network enumeration, IP network Scanning, Assessing Remote Information Services, Assessing Web servers, Assessing Web Applications, Assessing Remote Maintenance Services, Assessing Database services, Assessing Windows Networking Services, Assessing Email services.	08
6	Open source tools used for Assessment and Evaluation, and exploitation framework	08
7	Final Report Preparation and Post Assessment Activities	02
8	Advanced Cryptography: The Addition Law, Elliptic curve Mod p, Factoring with Elliptic Curves, Elliptic Curve Cryptosystems	02
9	Web Apps Security: Understanding OWASP top 10	02

Reference books:

1. Network Security assessment, Chris McNab, O'reilly
2. Inside Network Security Assessment, Michael Gregg, Pearson
3. Security in Computing, fourth Edition, Charles Pfleeger, Pearson
4. The Security Risk Assessment Handbook: Douglas LanDoll, Auerbach Publication.
5. Nina Godbole, "Information Systems Security", Wiley
6. Whitman & Mattord. *Management of Information Security*. Thomson Course Technology (2004). ISBN: 0-619-21515-1

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITC203	Soft Computing	04

Module	Detailed content	Hours
1	Introduction to soft Computing: Introduction, Fuzzy Computing, Neural Computing, Genetic Algorithms, associative Memory, adaptive Resonance Theory, applications.	06
2	Fundamentals of neural Network: Model of artificial neuron, Architectures, Learning Methods, Taxonomy of NN Systems, single-Layer NN system, applications	08
3	Back propagation Network	06
4	Associative Memory: Description, Auto-associative Memory, bi-directional hetero-associative memory	06
5	Adaptive Resonance Theory: Supervised, unsupervised, backprop algorithms, competitive Learning; SPD, ART Networks, Iterative Clustering, Unsupervised ART Clustering	06
6	Fuzzy Set Theory: Fuzzy set: Membership, operations, properties; Fuzzy relations	04
7	Fuzzy Systems: Fuzzy logic, Fuzzification, Fuzzy inference, fuzzy rule based system, defuzzification	04
8	Hybrid System: Genetic algorithm, GA Based Back Propagation, Networks, Fuzzy Associative Memories, simplified Fuzzy ARTMAP	08

References:

- 1) Principle of Soft computing:, sivanandam, wiley
- 2) Neural Network, fuzzy logic, and genetic algorithm, Rajasekaran, Printice hall
- 3) Soft computing and Intelligent Systems- theory and application by Naresh sinha, Addison wesley

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE2012	Wireless Ad-hoc Sensor Network	04

Module	Detailed content	Hours
1	Introduction: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for WSNs, Why are sensor networks different, Enabling technologies.	4
2	ARCHITECTURES: Single node architecture: Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Some examples of sensor nodes. Network architecture: Sensor network scenarios, Optimization goals & figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.	8
3	COMMUNICATION PROTOCOLS: Physical Layer: Introduction, Wireless channel and communication fundamentals, Physical layer & transceiver design considerations in WSNs. MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol, How about IEEE 802.11 and Bluetooth? Link Layer Protocols: Fundamentals: Tasks and requirements, Error control, Framing, Link management. Naming and Addressing: Fundamentals, Address and name management in wireless sensor networks. Assignment of MAC addresses, Distributed assignment of locally unique addresses, Content-based and geographic addressing.	12

4	<p>Time Synchronization: Introduction to the time synchronization problem, Protocols based on sender/receiver synchronization, Protocols based on receiver/receiver synchronization.</p> <p>Localization and Positioning: Properties of positioning, Possible approaches, Mathematical basics for the lateration problem, Single-hop localization, Positioning in multi-hop environments, Impact of anchor placement.</p>	8
5	<p>Topology control: Motivation and basic ideas, Flat network topologies, Hierarchical networks by dominating sets, Hierarchical networks by clustering, Combining hierarchical topologies and power control, Adaptive node activity.</p> <p>Routing protocols: The many faces of forwarding and routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Mobile nodes.</p> <p>Data-centric and content-based networking: Introduction, Data-centric routing, Data aggregation, Data-centric storage</p>	8
6	<p>Transport Layer and Quality of Service: The transport layer and QoS in wireless sensor networks, Coverage and deployment, Reliable data transport, Block delivery, Congestion control and rate control.</p> <p>Advanced application support: Advanced in-network processing, Security and Application-specific support</p>	4
7	<p>Security in Wireless Sensor network: Vulnerability and attack in WSN, Key management in WSN, WSN Link Layer Security Framework, Secure Routing in WSN, Secure Data aggregation, Privacy protection, Intrusion detection techniques and Remote attestation identification in WSN</p>	4

Recommended Books:

1. Protocols and Architectures for Wireless Sensor Networks by Holger Karl and Adreas Willig Pearson Education
2. Ad Hoc Wireless Networks by [C. Siva Ram Murthy](#), [B. S. Manoj](#), Pearson Education
3. Wireless Communications & Networks by William Stallings 2/e Pearson Education
4. Communication Networks by Leon-Garcia and Indra Widjaja, 2e, Tata McGraw-Hill Publications.
5. Wireless Sensor network Security, Javier Lopez IOS press

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

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Subject Code	Subject Name	Credits
ITE2012	Virtualization and Cloud Computing	04

Module	Detailed content	Hours
1	Virtualization: What is Virtualization, Virtualization theory, VMDK File Structure, Advantages and Disadvantages of machine being a file, CPU Virtualization, Memory Virtualization, Interrupt Management VMFS file system, Storage Virtualization, Network Virtualization, Virtual machine and Security issues	6
2	VMware Virtualization Technologies : ESX internals Microsoft –Windows Virtualization Technologies :Hyper-V Xen and KVM Hypervisor. QEMU , SUN’s VirtualBox	06
3	Introduction to cloud computing, cloud architecture and service models, the economics and benefits of cloud computing, horizontal/vertical scaling, thin client, multimedia content distribution, multiprocessor and virtualization, distributed storage, security and federation/presence/identity/privacy in cloud computing, disaster recovery,	06
4	free cloud services and open source software, and example commercial cloud services Cloud Computing and Virtualization Host Clusters Storage Virtualization VM clusters Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security Cloud computing security challenges: Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.	12
5	Cloud Platform Architectures o Amazon AWS o Microsoft Azure o Google App Engine o Google MapReduce / Yahoo Hadoop o Eucalyptus, Nimbus, OpenStack	10
6	Issues in cloud computing, Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in	08

	a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud	
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Reference Book:

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
2. Enterprise Cloud Computing by Gautam Shroff, Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4. Google Apps by Scott Granneman, Pearson
5. Cloud Security & Privacy by Tim Malhar, S.Kumaraswamy, S.Latif (SPD, O'REILLY)
6. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,
7. Cloud Computing Bible by Barrie Sosinsky, Wiley India
8. Stefano Ferretti et.al., "QoS-aware Clouds", 2010 IEEE 3rd International Conference on Cloud Computing
9. Virtualization for Dummies: Wiley -india

Assessment:

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End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE2013	Knowledge Management Systems	04

Module	Detailed content	Hours
1	What is knowledge Management? Understanding Knowledge	06
2	KM System Life Cycle, Implications of KM	06
3	Knowledge creation and Knowledge Architecture	06
4	Capture tacit Knowledge and other Knowledge capture techniques	06
5	Knowledge Codification	06
6	System testing and Development	04
7	Knowledge Transfer and Sharing in E-World	04
8	learning from data & Data mining, KM System tools & Portals	06
9	Ethical Legal and Managerial Issues	04

Text Books:

1. Knowledge Management , Elias M.Awad , Hassan M. Ghaziri, Pearsons Education
2. Knowledge Management Systems And Processes ; Rajiv Sabherwal, Irma Becerra Fernandez PHI India.
3. Knowledge Management Toolkit: Orchestrating IT, Strategy, and Knowledge Platforms; Amrit Tiwana, 2nd edition Prentice hall.
4. Ian Watson (2002). Applying Knowledge Management: Techniques for Building Corporate Memories. Morgan Kaufmann. ISBN: 1558607609.
5. Madanmohan Rao (2004). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Butterworth-Heinemann. ISBN: 0750678186.
6. Stuart Barnes (ed) (2002). Knowledge Management Systems Theory and Practice. Thomson Learning.

Assessment:

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End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE2021	Ubiquitous computing	04

Module	Detailed content	Hours
1	Ubiquitous Computing: Basics and Vision. Living in a Digital World. Modelling the Key Ubiquitous Computing Properties. Ubiquitous System Environment Interaction. Architectural Design for UbiCom Systems: Smart DEI Model.	04
2	Applications and Requirements. Introduction. Example Early UbiCom Research Projects. Everyday Applications in the Virtual, Human and Physical World.	04
3	Smart Devices and Services. Introduction. Service Architecture Models. Service Provision Life-Cycle. Virtual Machines and Operating Systems.	04
4	Smart Mobiles, Cards and Device Networks. Introduction. Smart Mobile Devices, Users, esources and Code. Operating Systems for Mobile Computers and Communicator Devices. Smart Card Devices. Device Networks.	04
5	Human–Computer Interaction. Introduction. User Interfaces and Interaction for Four Widely Used Devices. Hidden UI Via Basic Smart Devices. Hidden UI Via Wearable and Implanted Devices. Human-Centred Design (HCD). User Models: Acquisition and Representation. iHCI Desi	06
6	Tagging, Sensing and Controlling. Introduction. Tagging the Physical World. Sensors and Sensor Networks. Micro Actuation and Sensing: MEMS. Embedded Systems and Real-Time Systems. Control Systems (for Physical World Tasks). Robots	06
7	Context-Aware Systems. Introduction. Modelling Context-Aware Systems. Mobility Awareness. Spatial Awareness. Temporal Awareness: Coordinating and Scheduling. ICT System Awareness.	06
8	Intelligent Systems (IS). Introduction. Basic Concepts. IS Architectures. Semantic KB IS. Classical Logic IS. Soft Computing IS Models. IS System Operations. Intelligent System Interaction. Introduction. Interaction Multiplicity. Is Interaction Design. Some Generic Intelligent Interaction Applications.	06

9	Autonomous Systems and Artificial Life. Introduction. Basic Autonomous Intra-Acting Systems. Reflective and Self-Aware Systems. Self-Management and Autonomic Computing. Complex Systems. Artificial Life	04
10	Ubiquitous Communication. Introduction. Audio Networks. Data Networks. Wireless Data Networks. Universal and Transparent Audio, Video and Alphanumeric Data. Ubiquitous Networks. Further Network Design Issues. Ubiquitous System: Challenges and Outlook. Introduction. Overview of Challenges. Smart Devices. Smart Interaction. Smart Physical Environment Device Interaction. Smart Human–Device Interaction. Human Intelligence Versus Machine Intelligence. Social Issues: Promise Versus Peril.	04

Reference books

1. Ubiquitous Computing: Smart Devices, Environments and Interactions, Stefan Poslad, Wiley Publication
2. Ubiquitous Computing Fundamentals, John Krumm, CRC Press.
3. Everywhere The Drawing age of Ubiquitous Computing, Adam Greenfield.
4. Ubiquitous Computing: Design, Implementation, and Usability, Yin-Leng Theng; Henry B. L. Duh, IGI Global

Assessment:

Internal: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE2022	Ethical hacking and digital Forensic	04

Module	Detailed content	Hours
1	Overview of computer Forensics Technology- Introduction to computer forensics, use of forensics in law enforcement, employment proceedings, computer Forensics services. Types of computer Forensics Technology- Military, law, spyware and Adware, Biometrics security systems.	04
2	Types of Computer Forensics systems Internet security, IDS, Firewall, Public key, net privacy systems, vendor and computer Forensics services.	04
3	Computer Forensics evidence and capture Data recovery, evidence collection and data seizure, duplication and preservation of digital evidence, computer image verification and authentication	04
4	Computer Forensics Analysis Discovery of electronic evidence- electronic document discovery, identification of data- Time keeping, forensic identification and analysis of technical surveillance devices. Reconstructing fast events	04
5	Hacking Methodology : Enumeration, Scanning, Gaining Access , Maintaining access, Clearing Tracks	04
6	Reconnaissance , Scanning Host discovery, Network devices discovery, service discovery	04
7	Backdoors and Trojan horses , Buffer Overflows	04
8	Covering Tracks : Networks and Systems	04
9	Denial of Service Attacks, Exploiting System using Netcat	04
10	IP address Spoofing, Network sniffing	04
11	Password Attacks, rootkits	04
12	Session Hijacking and Defenses	04

Reference BOOKS:

1. By John R. Vacca Computer forensics: computer crime scene investigation, Volume 1
2. *Computer Forensics: Incident Response Essentials*, Warren G. Kruse II & Jay G. Heiser
3. *Computer Forensics & Privacy*, Michael Caloyannides
4. Encase Computer Forensics, Sybex
5. *Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes*, edited by Albert J. Marcella Jr. & Robert S. Greenfield
6. *Handbook of Computer Crime Investigation*, edited by Eoghan Casey
7. Jon Erickson, Hacking: The Art of Exploitation, Second Edition
8. Hacker Techniques, Exploits & Incident Handling (*Security 504*)
<http://www.sans.org/training/description.php?mid=40>
9. Brain Hatch, Hacking Linux Exposed, 3rd edition Hacking Linux Exposed, 3rd edition

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITE2023	Next Generation Network	04

Module	Detailed content	Hours
1	NEXT GENERATION TECHNOLOGIES, NETWORKS, AND SERVICES: Introduction, Next Generation (NG) Technologies, Wireline NG Technologies, FTTP, Long-Haul Managed Ethernet	08
2	Wireless NG Technologies Broadband Bluetooth and ZigBee Personalized and Extended Wi-Fi Mobile Worldwide Inter-operability for Microwave Access (M-WiMax) Long Term Evolution (LTE) Enhanced HSPA Evolution Data Optimized (EVDO) and Ultra Mobile Broadband (UMB) Mobile Ad Hoc Networking (MANET) and Wireless Mesh Networking (WMN) Cognitive (and Software Defined) Radios and Their Interworking	10
3	Software and Server NG Technologies (Virtualization)	10
4	IMS AND CONVERGENCE MANAGEMENT	08
5	NEXT GENERATION OSS ARCHITECTURE	08
6	MANAGEMENT OF WIRELESS AD HOC AND SENSOR NETWORKS	04

Recommended Books:

1. Next Generation Telecommunications Networks, Services, and Management by Thomas Plevyak, VeliSahin, ISBN: 978-0-470-57528-4 , Wiley-IEEE Press
2. Data Communication and Network Security by Carr and Snyder, McGraw Hill Publications.
3. Communication Networks by Leon-Garcia and Indra Widjaja, 2e, Tata McGraw-Hill Publications.

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Subject Code	Subject Name	Credits
ITL203	Laboratory III-Core Course Lab	01

Module	Detailed content	Lab. Sessions
1	Two Laboratory Practicals to be conducted for each of the core subjects.	24

Modality and Assessment:

- Each Laboratory assignment will be done in a group of two students. The Faculty teaching each core subject will be required to propose and evaluate the respective Laboratory assignments. These will be essentially hands-on practical and not theory / research review types of assignments.
- End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners
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Subject Code	Subject Name	Credits
ITL204	Laboratory IV –Elective Lab	01

Module	Detailed content	Lab. Sessions
1	One Mini Project based on any one of the selected elective subject.	24

Modality and Assessment:

- Each mini project assignment will be done by individual student. The Faculty teaching elective subject will be required to propose and evaluate the respective mini projects. These will be essentially hands-on practical and not theory / research review types of projects
- End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners

Subject Code	Subject Name	Credits
ITD301	Seminar	03

Guidelines for Seminar

- Seminar should be based on thrust areas in Information Technology
- Students should do literature survey and identify the topic of seminar and finalize in consultation with Guide/Supervisor. Students should use multiple literatures (at least 10 papers from Refereed Journals) and understand the topic and compile the report in standard format and present in front of Panel of Examiners. (pair of Internal and External examiners appointed by the University of Mumbai)
- **Seminar should be assessed based on following points**
 - Quality of Literature survey and Novelty in the topic
 - Relevance to the specialization
 - Understanding of the topic
 - Quality of Written and Oral Presentation

IMPORTANT NOTE :

1. Assessment of Seminar will be carried out by a pair of Internal and External examiner. The external examiner should be selected from approved panel of examiners for Seminar by University of Mumbai, OR faculty from Premier Educational Institutions /Research Organizations such as IIT, NIT, BARC, TIFR, DRDO, etc. OR a person having minimum Post-Graduate qualification with at least five years' experience in Industries.
2. Literature survey in case of seminar is based on the broader area of interest in recent developments and for dissertation it should be focused mainly on identified problem.
3. At least 4-5 hours of course on Research Methodology should be conducted which includes Literature Survey, Problems Identification, Analysis and Interpretation of Results and Technical Paper Writing in the beginning of 3rd Semester.

Subject Code	Subject Name	Credits
ITD301 / ITD401	Dissertation (I and II)	12 + 15

Guidelines for Dissertation

- Students should do literature survey and identify the problem for Dissertation and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by analytical/simulation/experimental methods. The solution to be validated with proper justification and compile the report in standard format.

Guidelines for Assessment of Dissertation I

- Dissertation I should be assessed based on following points
 - - Quality of Literature survey and Novelty in the problem
 - Clarity of Problem definition and Feasibility of problem solution
 - Relevance to the specialization
 - Clarity of objective and scope
- Dissertation I should be assessed through a presentation by a panel of Internal examiners appointed by the Head of the Department/Institute of respective Programme.

Guidelines for Assessment of Dissertation II

- Dissertation II should be assessed based on following points
 - Quality of Literature survey and Novelty in the problem
 - Clarity of Problem definition and Feasibility of problem solution
 - Relevance to the specialization or current Research / Industrial trends
 - Clarity of objective and scope
 - Quality of work attempted
 - Validation of results
 - Quality of Written and Oral Presentation
- Dissertation II should be assessed through a presentation jointly by Internal and External Examiners appointed by the University of Mumbai
- Students should publish at least one paper based on the work in reputed International / National Conference (desirably in Referred Journal)