PANJAB UNIVERSITY CHANDIGARH

SCHEME AND SYLLABUS

FOR

MASTER OF ENGINEERING

PROGRAMME

IN

INFORMATION TECHNOLOGY

FROM

1st TO 4th SEMESTER

BATCH 2025-2027

Scheme of Evaluation
Batch 2025-2027
M.E. (INFORMATION TECHNOLOGY)

First Semester

S. No	Subject Code	Subject Name	L-T-P	Contact hrs/week	Credits	Marks		
						Theory		Practical*
						Internal Assessment	University Exam	
1	MEIT 1201	Research Methodology	4-0-0	4	4	50	50	-
2	MEIT 1202	Advanced Optical Communications	3-0-2	5	3+1	50	50	50
3	MEIT 1203	Data Mining & Analytics	3-0-2	5	3+1	50	50	50
4	MEIT 1204	Advanced Wireless Technologies	3-0-2	5	3+1	50	50	50
5	MEIT 1205	AI and Machine Learning	3-0-2	5	3+1	50	50	50
6	MEIT 1206	Research Seminar	0-0-2	2	1	----	----	50
Total				**26**	**21**	**250**	**250**	**250**

Total Marks: 750 **Total Credits: 21**

* Practical marks are for continuous and end semester evaluation

Second Semester

S. No.	Subject Code	Subject Name	L-T-P	Contact hrs/week	Credits	Marks		
						Theory		Practical*
						Internal Assessment	University Exam	
1	MEIT 2201	Information Security	3-0-2	5	3+1	50	50	50
2	MEIT 2202	Advanced Soft Computing	3-0-2	5	3+1	50	50	50
3	MEIT 2203	Advanced DBMS	3-0-2	5	3+1	50	50	50
4		Elective – I	4-0-0	4	4	50	50	----
5		Elective - II	4-0-0	4	4	50	50	-----
6	MEIT 2215	Preliminary Thesis work	0-0-2	2	1	----	----	50
Total				**25**	**21**	**250**	**250**	**200**

Total Marks: 700 **Total Credits: 21**

* Practical marks are for continuous and end semester evaluation

Elective-I	Elective –II
(MEIT 2204) Cyber Security & Forensics (MEIT 2205) Advanced Algorithm Analysis & Data Structures (MEIT 2206) Introduction to Bioinformatics (MEIT 2207) Embedded System Design	(MEIT 2210) Advanced Software Architectures (MEIT 2211) Agile Software Development (MEIT 2212) Software Testing & Quality Assurance

Third Semester

S. No.	Subject Code	Subject Name	L-T-P	Contact hrs/week	Credits	Marks		
						Theory		Practical*
						Internal Assessment	University Exam	Internal Assessment
1		Elective III	3-0-2	5	3+1	50	50	50
2		Elective IV	3-0-2	5	3+1	50	50	50
3	MEIT 3211	Thesis-I		20	10	100	----	----
Total				**30**	**18**	**200**	**100**	**100**

Total Marks: 400 **Total Credits: 18**

*Practical marks are for continuous and end semester evaluation

Elective-III	**Elective –IV**
(MEIT 3201) Cloud Computing& IoT (MEIT 3202) Modeling and Simulation (MEIT 3203) Blockchain Technologies	(MEIT 3206) Image Processing and ComputerVision (MEIT 3207) Advanced Computer Networks (MEIT 3208) Advanced Natural Language Processing

Fourth Semester:

S. No.	Subject Code	Subject Name	Contact hrs/week	Credits	Practical Marks	
					Internal Assessment	University Exam
1	MEIT 4201	Thesis -II	25	15	100	100
Total			**25**	**15**	**100**	**100**

Total marks: 200 **Credits = 15**

M.E.(IT) (1st to 4th semester): **Total marks= 2050** **Credits = 75**

FIRST SEMESTER

Course Code	**MEIT 1201**	
Course Title	**Research Methodology**	
Type of Course	Core	
L T P	**Credits**	**Total Contact Hours**
4-0-0	4	45
Course Assessment Methods	**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
	50	50
Pre requisite	Mathematics	
Course Objective	To make students familiar with various methodologies of research.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

Introduction **(04)**

Concept of research, types, need and significance of research, research process, criteria and qualities of good research, Methods/Approaches of Research: Descriptive, Ex-post Facto, Analytical, Quantitative, Qualitative, Conceptual, Empirical, One-Time, Longitudinal,Simulation, Diagnostic, Historical, Conclusion-oriented, Decision-oriented Research. Research and research methodology.

Defining Research Problem and Reviewing Literature **(03)**

Locating and Selecting the research problem, Necessity and Technique involved in defining the research problem. Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review, citing sources

Methods of Research **(08)**

Descriptive research design-survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research

Research Design and Sampling Design **(08)**

Concept of research design, features of a good research design, formal and informal research designs, Concept of population and sample, sampling techniques-simple random sampling, stratified random sampling, systematic sampling and cluster sampling, snow ball sampling, purposive sampling, quota sampling techniques, determining size of sample

Part – B

Measurement **(08)**

Concept of measurement, Problems in measurement in research – Validity and Reliability, Levels of measurement – Nominal, Ordinal, Interval, Ratio, Design and development of measuring instruments, Tests, questionnaires, checklists, observation schedules, evaluating research instruments

Procedure for writing a research report **(06)**

Purpose, types and components of research proposal , types of research reports, steps of writing a report, layout of report, significance of report writing. Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Statistical Methods of Analysis **(08)**

Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and uses of normal curve.

Inferential statistics: t-test, Chi-square tests, Correlation (rank difference and product moment), ANOVA (one way)

Recommended Books

1. C R Kothari, Research Methodology: Research Methods and Techniques, New Age International Publishers, 2004.
2. Borg, W and Gall, M. Educational Research: An Introduction, New York, Longman, 2003
3. Gay, LR, Educational Research, Ohio: Charles E. Merril Publishing Company 2000 Wiersma William Research Methods in Education- An Introduction London, Allyn and Bacon, Inc. 2000

Course Code	**MEIT 1202**		
Course Title	**Advanced Optical Communications**		
Type of Course	Core		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Telecommunication networks	
Course Objective		To get a basic understanding of physical properties of optical networks and profound understanding of optical switching methods and networking techniques, circuit, packet, hybrid, burst and flow along with understanding of optical components and optical node design.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

SECTION-A

Optical Fiber Waveguides **(5)**

Total internal reflection, Acceptance angle, Numerical aperture, Skew rays, Electromagnetic mode theory for optical propagation, Cylindrical fiber, Step index fibers, Graded index fibers, Single-mode fibers, Advantages of Fiber optic communication.

Transmission Characteristics of Optical Fibers **(5)**

Attenuation, Material absorption losses in silica glass fibers, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Mid-infrared and far-infrared transmission, Dispersion, Material dispersion, Intermodal dispersion, Dispersion-modified singe mode fibers, Polarization, Fiber birefringence, Polarization mode dispersion, Polarization-maintaining fibers, Nonlinear effects, Soliton propagation.

Optical Fiber Connections: Joints, Couplers and Isolators **(5)**

Fiber splices, Fiber connectors, Cylindrical ferrule connectors, Fiber couplers, Fiber couplers, Three- and four-port couplers, Star couplers, Wavelength division multiplexing, Couplers, Optical isolators and circulators.

Optical Sources **(7)**

Laser: Absorption and emission of radiation, Einstein relations, Population inversion, Optical feedback and laser oscillation, Threshold condition for laser oscillation, Optical emission from semiconductors, Semiconductor injection laser.

Light-emitting diode: LED power and efficiency, Double-heterojunction LED, LED structures, Planar LED, Dome LED, Surface emitter LEDs, Edge emitter LEDs, LED characteristics, Optical output power, Output spectrum, Modulation bandwidth, Reliability, Modulation.

SECTION-B

Optical Detectors **(6)**

Optical detection principles, Absorption, Absorption coefficient, Direct and indirect absorption: silicon andGermanium, Quantum efficiency, Responsivity, Semiconductor photodiodes without internal gain, p–n photodiode, p–i–n photodiode, Semiconductor photodiodes with internal gain, Avalanche photodiodes, Silicon reach through avalanche photodiodes, Germanium avalanche photodiodes, Mid-infrared and far-infrared photodiodes, Quantum-dot photodetectors.

Optical Amplifiers **(4)**

Concepts of Optical amplifiers, Semiconductor optical amplifiers, Performance characteristics, Gain clamping, Quantum dots, Fiber and waveguide amplifiers, Rare-earth-doped fiber amplifiers, Raman and Brillouin fiber amplifiers, Waveguide amplifiers and fiber amplest, Optical parametric amplifiers, Wideband fiber amplifiers.

Optical fiber Systems **(6)**

Optical transmitter circuit, Source limitations,LED drive circuits, Laser drive circuits, Optical receiver circuit, Preamplifier, Automatic gain control, Equalization, System design considerations, Component choice, Multiplexing, Digital systems, Multiplexing strategies, Optical time division multiplexing, Subcarrier multiplexing, Orthogonal frequency division multiplexing, Wavelength division multiplexing, Optical code division multiplexing, Hybrid multiplexing, Modulation formats, Amplitude shift keying, Frequency shift keying, Phase shift keying, Polarization shift keying, Demodulation schemes, Heterodyne synchronous detection, Heterodyne asynchronous detection, Differential phase shift keying, Receiver sensitivities, ASK heterodyne detection, FSK heterodyne detection, PSK heterodyne detection, ASK and PSK homodyne detection.

Optical Networks **(7)**

Optical network concepts, Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunications network overview, Optical network transmission modes, layers and protocols, Synchronous networks, Asynchronous transfer mode, Open Systems Interconnection reference model, Optical transport network, Internet Protocol, Wavelength routing networks, Wavelength routing and assignment, Optical switching networks, Optical circuit-switched networks, Optical packet-switched networks,

Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment, Long-haul networks, Metropolitan area networks, Access networks, Local area networks, Optical Ethernet, Network protection, restoration and survivability.

RECOMMENDED BOOKS

S.No	Name	Author(s)	Publisher
1.	Optical Fiber Communications: Principles and Practice (Third edition)	John M. Senior	Pearson
2.	Optical Fiber Communication	Gerd Keiser	McGraw Hill
3.	Fiber Optic Communications (Fifth edition)	Joseph C. Palais	Pearson
4.	Fiber-Optic Communication Systems (Third edition)	Govind P. Agrawal	Wiley
5.	Textbook on Optical Fiber Communication and its Applications	S.C. Gupta	PHI
6.	Fiber Optic Communications	Harold B. Killen	Pearson College Div

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 1203**		
Course Title	**Data Mining & Analytics**		
Type of Course	Core		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Database Systems, Artificial Intelligence	
Course Objective		To learn various data mining techniques and different ways to analyze different data sets	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

Introduction to Data Mining **(08)**

Data Mining and Data Warehousing basic concepts, Functionalities, classification of data mining systems, Multidimensional data model, data cubes, Schemas for multidimensional databases, OLAP operations, Data Marts, Metadata.

Data Preprocessing **(08)**

Data cleaning, integration and transformation, Data reduction, Discretization and Concept Hierarchy Generation.

Concept Description **(08)**

Data Mining techniques-Concept description, attribute oriented induction, analytical characterization, mining class comparisons, mining descriptive statistical measures.

Part B

Association Rule Mining **(08)**

Mining single dimension rules from transactional databases, Apriori algorithm, efficiency, mining rules without candidate generation.

Classification and prediction **(8)**

Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Logistic Regression

Applications and Trends In Data Mining **(05)**

Commercial Importance of DM and DW, applications of data mining, data mining in business process, Embedded data mining, Research Areas

Recommended Books

1. Data Mining –Concepts & Techniques; Jiawei Han &MichelineKamber, Morgan Kaufmann Publishers.
2. "Data Mining" by Pieter Adrians, DolfZantinge, Addison Wesley, 1996.
3. Fundamentals of Business Analytics by R N Prasad andSeemaAcharya, Wiley India.

Online resources for Python implementation

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 1204**		
Course Title	**Advanced Wireless Technologies**		
Type of Course	Core		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Wireless communication	
Course Objective		To learn about the advanced topics in wireless networks with their architectures. Students will able to understand the various technologies in wireless networks.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

Introduction (06)
Various wireless communication systems, Intelligent Network, Evolution of Communication Systems: 2G, 2.5G, 3G, 4G and 5G.

Cellular Concepts (10)
Frequency Reuse, Handoff Strategies, Interference and System Capacity, Mechanisms for capacity and coverage improvement-cell splitting, cell sectoring and microcell zone concept

GSM and CDMA: (08)
Services and Features, System Architecture, Radio Aspects, channels and Security Aspects of GSM and CDMA, Comparison between GSM and CDMA

Part B

Multiple Access Techniques (03)
Comparison of Multiple Access Techniques: FDMA, TDMA, SSMA: types, SDMA.

Advanced Wireless Technologies: (09)
Features, Specifications, Applications: Bluetooth, Zigbee Standards, WiFi, WiMax, LTE, LTE-A

Emerging Wireless Systems: (09)
Basic Features, Applications, Architecture: Wireless Sensor Networks, Cognitive Radio Networks, Internet of Things and its protocols.

Recommended Books

1. Wireless Communications Principles and practice by Theodore S. Rappaport, Prentice Hall India, Edi 2nd .
2. Wireless and Cellular Communication by Sanjay Sharma , S.K.Kataria & Co., 2009 Ed
3. Mobile and Personal Communication Systems and services by Raj Pandya, IEEE Press, Ed 1999.
4. Cognitive Radio and Dynamic Spectrum Access by Lars Berlemann, Stefan Mangold, Wiley Publication
5. Wireless and Mobile Communication by T.G.Palanivelu, R. Nakkeeran, PHI

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 1205**		
Course Title	**AI and Machine Learning**		
Type of Course	**Core**		
L T P		**Credits**	**Total Contact Hours**
3-0-2		**3+1**	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Database Systems, Artificial Intelligence	
Course Objective		To learn various machine learning techniques and different ways to analyze different patterns.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each**.**

PART A

Introduction **(2)**

Artificial Intelligence and its applications, Foundations and history of Artificial Intelligence, Intelligent Agents, Nature and structure of Agents.

Problem solving techniques **(4)**

State space search, control strategies, Types of problem, Problem characteristics, Uninformed search strategies, Heuristic Search strategies, Hill climbing, best first search, A* search, genetic algorithm, AO*Search, alpha-beta pruning.

Regression and generative learning **(6)**

Types of learning, Simple linear regression, multiple linear regression, polynomial regression, nonlinear regression, gradient descent in linear regression, gradient descent in multiple regression, normal equation, Gaussian parameter estimation, maximum likelihood estimation, Bayesian estimation, bias and variance of estimators, discriminant analysis, naive Bayes.

Classification **(6)**

Logistic regression, decision boundary, gradient descent in logistic regression, multiclass classification, overfitting problem, cost function regularization, decision tree, Support vector machine.

Unsupervised learning **(5)**

K-means clustering, expectation maximization, Gaussian mixture density estimation, mixture of naive Bayes, model selection

PART B

Neural networks and deep learning **(10)**

The perceptron algorithm, multilayer perceptrons, back propagation, multiclass discrimination, training procedures, localized network structure,
Deep Neural networks, Convolutional Neural Network, Building blocks of CNN, Transfer Learning.

Dimensionality reduction **(8)**

Feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling

Natural language processing and Expert System **(4)**

Introduction to natural language processing, Introduction of Expert System & its examples, Expert system Architecture and its shells.

Recommended Books

1. Artificial Intelligent by Elaine Rich, Knight, McGraw Hill, 1993
2. Elements of Statistical Learning by T. Hastie, R. Tibshirani and J. Friedman, Springer, 2001.
3. Machine Learning by E. Alpaydin, MIT Press, 2010.
4. Pattern Recognition and Machine Learning by C. Bishop, Springer, 2006.
5. Machine Learning: A Probabilistic Perspective by K. Murphy, MIT Press, 2012.
6. Pattern Classification by R. Duda, E. Hart, and D. Stork, Wiley-Interscience, 2000.
7. Machine Learning by T. Mitchell, McGraw-Hill, 1997.
8. Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

MASTER OF ENGINEERING IN INFORMATION TECHNOLOGY

SECOND SEMESTER

Course Code	**MEIT 2201**		
Course Title	**Information Security**		
Type of Course	Core		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Computer Networks	
Course Objective		To gain understanding of Information Security principles and approaches .	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

Foundation of Cryptography **(07)**

Introduction to Cryptography, Types of Threats-Passive threats, Active threats, Monoalphabetic Substitution Cipher, Polyalphabetic Substitution Cipher, Transposition Cipher.

Cipher **(04)**

Block and Stream ciphers, Secret key block ciphers, Stream ciphers

Symmetric Key Ciphers **(06)**

DES Algorithm, Triple DES, Cryptanalysis of DES, Differential and Linear cryptanalysis.

Asymmetric Key Ciphers **(06)**

Principles of Public Key Cryptosystems, RSA Systems, Knapsack Systems.

Part B

Message Authentication and Hash Functions **(06)**

Authentication Requirements, Authentication Functions, Message Authentication codes, Hash

Functions, Hash Algorithms (MD-5 and SHA-1), Key Management Algorithm.

Digital Signatures And Authentication Protocols **(04)**
Digital Signatures and Digital Signature Standard, Authentication Protocols, Kerberos

IP Security **(05)**
Overview, Architecture, Authentication Header, Encapsulating Security Payload (Tunnel and Transport mode)

Web Security **(03)**
Web security consideration, Secure Socket Layer Protocol, Transport Layer Security, Secure Electronic Transaction Protocol

Firewalls **(04)**
Design Principles, Characteristics, Capabilities, Limitations, Controls, Types of Firewall, and Trusted systems, Reference monitor concepts.

Recommended Books

1. Cryptography and Network Security (Principles and Practices) by William Stallings, 5th Ed Pearson
2. A new Dimensions in Computer data security by Meyer C.H. &Matyas C.M., John Wiley & Sons. 2nd Ed
3. Applied Cryptography: Protocols, Algorithms, and Source Code in C, Bruce Schneier, Jophn.John Wiley 2nd Ed
4. Firewalls and Internet Security, Bill Cheswick and Steve Bellovin, Addision-Wesley. 2nd Ed

Practical Task: **Internal Assessment Marks: 50**
Practical based on theory

Course Code	**MEIT 2202**	
Course Title	**Advanced Soft Computing**	
Type of Course	Core	
L T P	**Credits**	**Total Contact Hours**
3-0-2	3+1	45
Course Assessment Methods	**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
	50	50
Pre requisite	Artificial Intelligence	
Course Objective	1.To familiarize with soft computing concepts. 2.To introduce the ideas of Neural networks in applications and research oriented way. 3.To introduce the concepts of Fuzzy logic, Genetic algorithm and their applications to soft computing.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

INTRODUCTION (8)

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques: Fuzzy Computing, Neural Computing, Genetic Algorithms, Classification, Clustering, Probabilistic reasoning, Bayesian Networks, Applications of soft computing.

ARTIFICIAL NEURAL NETWORKS (15)

Introduction, Model of Artificial Neuron, Biological Neural Networks, Evolution of Neural Networks, Architectures, Learning Methods and various activation functions, McCulloch-Pitts Neuron, Linear Separability, Supervised Learning Neural Networks: Perceptron Networks, Adaline, Madaline, Backpropagation Neural network. Associative Memory, Hopfield Networks, Kohonen Self Organizing Maps, Adaptive Resonance Theory Networks

Part B

FUZZY LOGIC SYSTEM (10)

Introduction to Fuzzy logic, Crisp sets vs. Fuzzy sets, Membership functions, Fuzzification, Defuzzification, Fuzzy rule bases, Fuzzy inference systems.

GENETIC ALGORITHM AND HYBRID SYSTEMS (12)

Introduction, Genetic algorithm vs. Traditional algorithms, Basic terminologies in genetic algorithm, General genetic algorithm, Operators in genetic algorithm , Problem Solving using

GA, Genetic Programming, Optimization techniques: PSO (Particle Swarm Optimization), ACO (Ant-colony Optimization). Hybrid Systems: Neuro-fuzzy hybrid systems, Genetic-neuro hybrid systems, Genetic fuzzy hybrid and fuzzy genetic hybrid systems.

Recommended Books

1. Artificial Intelligence: A Modern Approach by S. Russel and P. Norvig, Prentice Hall.
2. Artificial Intelligence by Elaine Rich, Kevin Knight, Mc-Raw Hill.
3. Principles of Soft Computing by S. N. Sivanandam, S.N. Deepa, Wiley, 2nd edition.
4. Neuro fuzzy and soft computing by Jang, Pearson Education, 1996.
5. Neural Networks, Fuzzy Logic and Genetic Algorithms by S. Rajasekaran and G.A.V.Pai, PHI, 2003.

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 2203**		
Course Title	**Advance Database Management System**		
Type of Course	Core		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Database management system	
Course Objective		1. To familiarize with Database management concepts. 2. To introduce the ideas of database management in applicationsand research oriented way. 3. To introduce the practical knowledge about the SQL, PLSQL and NoSQL.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

Introduction **(8)**

Database System Concepts and Architecture, Data Independence, Data Models, SQL: DDL, DML, DCL, Database Integrity, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF.

Advanced Transaction Processing and Concurrency Control: **(7)**

Transaction Concepts, Concurrency Control: Locking Methods, Timestamping Methods, Optimistic Methods for Concurrency Control, Concurrency Control in Distributed Systems.

SQL query execution: **(10)**

Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL Algebraic Operations, Nested Queries, Logical operators, Aggregate Operations, numeric functions, string functions, Integrity Constraints in SQL, Joins, union,intersect and minus clause.

Part B

PL/SQL query execution: (10)

If statement, If-else statement, while loop, for loop, Goto statement, Cursors : Implicit cursor, explicit cursor, Triggers , Exception handling: predefine exception, user defined exception, Savepoint and rollback.

NoSQL (5)

Install and configure database system: MongoDB, basic operations: find, insert, update, remove, Query and Write Operation Commands, aggregation commands.

Backup and Recovery Techniques: (5)

Backup and Recovery Concepts, Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Bufer Management.

Recommended Books

1. RamezElmasri, ShamkantNavathe: Fundamentals of Database Systems, Fifth Edition, Pearson Education, 2007.
2. C.J. Date: An Introduction to Database Systems, Eighth Edition, Pearson 10 Education.
3. S. K. Singh: Database Systems Concepts, Design and Applications, Pearson Education.
4. Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems, Tata McGraw-Hill.
5. Abraham Silberschatz, Henry F. Korth, S. Sudarshan : Database System Concepts, Tata McGraw-Hill

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Elective –I

Course Code	**MEIT 2204**	
Course Title	**Cyber Security and Forensics**	
Type of Course	Elective	
L T P	**Credits**	**Total Contact Hours**
4-0-0	4	45
Course Assessment Methods	**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
	50	50
Pre requisite	Network Security	
Course Objective	To provide an understanding of Computer forensics fundamentals and various computer forensics technologies.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

SECTION-A

Systems Vulnerability Scanning **(7)**

Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet.

Network Defence tools and web vulnerabilities tools **(7)**

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System . Web Application Tools Scanning for web vulnerabilities tools:Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra.

Introduction to Cyber Crime **(8)**

Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior,Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics. Laws for Cyber Crimes: Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000. Introduction to Cyber Crime Investigation : Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

SECTION-B

Intellectual property issues in cyberspace **(7)**

Introduction to intellectual property Protections via Copyright, Trade Secrets, Trademarks, Patents, Contracting to protect intellectual property, Protection options –Encryption, copyright on web-content, copyright on software Ethical Decision Making: Types of ethical choices, Making defensible decisions, Ethical dilemmas, law and ethics, Guidelines for dilemma (Informal and Formal), Four-step analysis process of solving dilemma Case studies: i) A stolen password ii) Recovery of data leads to Discovery of confidential files iii) Do copyright ethics change overseas?

Crime incident Handling Basics **(8)**

Hacking, cyber activism, Tracking hackers, clues to cyber crime, privacy act, search warrants, common terms, organizational roles, procedure for responding to incidents, reporting procedures, legal considerations Information Technology Act 2000:Scope, jurisdiction, offense and contraventions, powers of police, adjudication

Cyber Forensics **(8)**

Cyber forensics, cyber crime examples, forensics casework, investigative incident response actions, computer forensics tools, Threats in cyberspaces, Blended attacks Sample Policy Documents: i) Antivirus Guidelines Policy ii) Internal Lab Security Policy iii) Server Security Policy iv) Wireless Communications Policy; Information Security Certifications, CISSP and SSCP, CISA and CISM, SCP, GIAC, certification weaknesses.

RECOMMENDED BOOKS

1.	Anti-Hacker Tool Kit (Indian Edition)	Mike Shema	Publication McGraw Hill.
2.	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Nina Godbole, SunitBelpure	Wiley

3.	Computer Ethics	Deborah G Johnson	Pearson Education Pub
4.	Ethical Decision making and IT: An Introduction with Cases	Earnest A. Kallman, J.P Grillo	McGraw Hill Pub
5.	Cyber security Operations Handbook	John W. Rittinghouse, William M. Hancock	Elsevier
6.	Principles of Information Security	Michael E. Whitman, Herbert J. Mattord.	Cengage Learning Pub.
7.	Network Infrastructure Security	Randy Weaver , Dawn Weaver.	Cengage Learning Pub.

Course Code	**MEIT 2205**		
Course Title	**Advanced Algorithm Analysis and Data Structures**		
Type of Course	Elective		
L T P		**Credits**	**Total Contact Hours**
4-0-0		4	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Analysis and Design of Algorithms	
Course Objective		This course will provide an in-depth knowledge of different algorithm design strategies and data structures that will enable students to choose it appropriately for a specified application. It will enable to assess how the choice of data structures and algorithm design methods impacts the performance of programs.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

PART A

Algorithms Complexity and Analysis: (6)

Analyzing Algorithms, Complexity of Algorithms, Growth of Functions, Performance Measurements, Time and space tradeoffs in algorithms, Analyzing recursive algorithms using recurrence relations, Methods to solve recurrence relations

Divide and Conquer algorithms and Greedy Algorithms (7)

Introduction to Divide and Conquer strategy, Binary search, Merge sort, Quick sort, Introduction to Greedy Algorithms, Knapsack problem, Minimum spanning tree,Single source shortest path algorithm and their performance analysis

Dynamic Programming and Backtracking (7)

Dynamic Programming: Introduction, Multistage graph problem, Floyd-Warshall algorithm, 0/1 Knapsack problem, Traveling salesperson problem, Backtracking: Introduction, N- Queens algorithm, Sum of subsets

PART B

Branch-and-Bound and Lower Bound Theory **(5)**

Introduction, 0-1 knapsack problem, Traveling salesman problem

Data Structures **(12)**

Hashing: hashing as a search structure, hash table, collision resolution, universal hashing, linear open addressing, Properties and operations of Binary Search Trees, Red-Black Trees, B-Trees, Heaps: introduction, operations, Binomial Heaps, Fibonacci Heaps

Algorithms - Case studies **(8)**

Online algorithms, Approximation algorithms, Randomized algorithms, Quantum algorithms, Parallel algorithms, Streaming algorithms, Complexity theory

Recommended Books

1. Cormen, Leiserson, Rivest and Stein," Introduction to Algorithms", PHI.
2. Horowitz, Sahni and Rajsekaran, "Fundamentals of Computer Algorithms", Galgotia publications.
3. J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley.
4. Dasgupta, Papadimitriou,Vazirani: "Algorithms" , Tata McGrawHill, Ed No-1/2006
5. Aho, Hopcraft, Ullman : "The Design and Analysis of Algorithms", PearsonEducation Ed-2008

Course Code	**MEIT 2206**		
Course Title	**Introduction to Bioinformatics**		
Type of Course	Elective		
L T P		**Credits**	**Total Contact Hours**
4-0-0		4	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Basic knowledge of Biology, Mathematics and Computer.	
Course Objective		The basic objective is to give students an introduction to the basic techniques of bioinformatics. The students will become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

PART A

Biological Data Acquisition **(8)**

The form of biological information. Retrieval methods for DNA sequence, protein sequence and protein structure information.

Databases – Format and Annotation **(10)**

Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary sequence databases, protein sequence and structure databases, Organism specific databases.

Data – Access, Retrieval and Submission **(5)**

Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data.

PART B

Sequence Similarity Searches **(10)**

Local versus global. Distance metrics. Similarity and homology. Scoring matrices. Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, BLAST and PSI BLAST. Multiple Sequence Alignment and

software tools for pairwise and multiple sequence alignment.

Genome Analysis: **(6)**

Whole genome analysis, existing software tools; Genome Annotation and Gene Prediction; ORF finding.

Phylogenetic Analysis **(6)**

Comparative genomics, orthologs, paralogs. Methods of phylogenetic analysis: UPGMA, WPGMA, neighbour joining method, Fitch/Margoliash method, Character Based Methods.

Recommended Books

1. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
2. Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRC Mathematical Biology & Medicine), by SorinDraghici
3. Data base annotation in molecular biology, principles and practices, Arthur M.Lesk
4. Current topics in computational molecular biology, Tao, Jiang, Ying Xu, Michael Q.Zang

Course Code	**MEIT 2207**		
Course Title	**Embedded System Design**		
Type of Course	Core		
L T P		**Credits**	**Total Contact Hours**
4-0-0		4	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Microprocessors	
Course Objective		To have knowledge about the basic working of a microcontroller system and its programming in assembly language. To provide experience to integrate hardware and software for microcontroller applications systems.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

Introduction to Embedded System: (03)

Comparison of Microprocessors and Microcontrollers. Comparison between RISC and CISC Processors, Harvard and Von Neuman Architectures. Embedded System classification and characteristics,

.

PIC Microcontrollers (10)

Introduction and features, PIC 16C6X/7X: Architecture, Registers, Reset actions, Memory Organization, Instructions, Addressing Modes, I/O Ports, Interrupts, Timers, ADC. Input Capture, Output Compare, Frequency Measurement, Serial I/O Device

Embedded Core based Design: (10)

System on chip trends, Overview of Embedded processors like ARM Intel MMX series, Architecture, Organization and Instruction set, Memory management. Data parallel issues e.g. SIMD and other high performance approaches.

Part B

Embedded Serial Communication **(7)**

Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, 10 CAN, Field-bus (Profibus), USB (v2.0), Bluetooth, Zig-Bee, Wireless sensor network

Introduction to sensor interfacing **(5)**

Types of sensors, interfacing sensors with embedded controller, controlling sensors through webpage

Software Development & Tools **(06)**

Embedded System Evolution Trends, Round Robin, Round Robin with Interrupts, Function Scheduling architecture, Real Time scheduling: their development, applications and examples.

Real Time Operating Systems **(04)**

RTOS Architecture, Task and Task States, Tasks and Data, Semaphores and shared data, Operating System Services: message queues, timer function, events, memory management, interrupt Routines in an RTOS environment, Basic Design Using RTOS

Recommended Books

1. Micro-controllers- Ajay V. Deshmukh, TMH 2005 Ed.
2. An Embedded Software Primer by David E Simon
3. Embedded System Design by Steve Heath (Newnes Publishers, 2nd Ed)
4. ARM system architecture by Steve Furber (Addison Wesley) 1st Ed
5. Programming Embedded System in C/C++ by M.Barr (O'Reilly)2nd Ed
6. Specifications and Design of Embedded Systems by D.D.Gajski et. El. 1st Ed, Pearson
7. Hardware/Software Co-Design: Principles and Practices by J.Straunstrup et.el.2nd Ed, Springee
8. Digital Design by Wakerly 4th Ed. Prentice Hall.
9. Internet of Things by Shriram K Vasudevan, 1st Ed., Wiley

ELECTIVE - II

Course Code	**MEIT 2210**	
Course Title	**Advanced Software Architectures**	
Type of Course	Elective	
L T P	**Credits**	**Total Contact Hours**
4-0-0	4	45
Course Assessment Methods	**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
	50	50
Pre requisite	Software Engineering	
Course Objective	This course offers a good understanding of various functional units of a software system and prepares the students to be in a position to design a good software system.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

PART A

Introduction to Software Architecture: (6)

Software Architecture ,Relationships to Other Disciplines, Multi-Disciplinary Overview, Foundations of Software Architecture, Software architecture in the context of the overall software life cycle, Architectural Styles, CASE study of Architectures

Software Architecture Design: (8)

Designing, Describing, and Using Software Architecture, IS2000: The Advanced Imaging Solution, Global Analysis, Conceptual Architecture View, Module Architecture View, Styles of the Module Viewtype, Execution Architecture View, Code Architecture View. Component-and-Connector Viewtype, Styles of Component-and-Connector Viewtype, Allocation Viewtype and Styles, Documenting Software Interfaces, Documenting Behavior, Choosing the Views, Building the Documentation Package

Archetype Patterns : (8)

Archetypes and Archetype Patterns, Model Driven Architecture with Archetype Patterns, Literate Modeling, Archetype Pattern, Customer Relationship Management (CRM) Archetype Pattern, Product Archetype Pattern, Quantity Archetype Pattern, Rule Archetype Pattern.

PART B

Design Patterns: (8)

Design Patterns, Creational Patterns, Patterns for Organization of Work, Access Control Patterns, Service Variation Patterns, Service Extension Patterns. Object Management Patterns, Adaptation Patterns, Communication Patterns, Architectural Patterns, Structural Patterns, Patterns for Distribution, Patterns for Interactive Systems Adaptable Systems, Frameworks and Patterns, Analysis Patterns.Patterns for Concurrent and Networked Objects, Patterns for Resource Management, Pattern Languages, Patterns for Distributed Computing

Enterprise Architecture Integration: (8)

Defining EAI, Data-Level EAI, Application Interface-Level EAI. Method-Level EAI, User Interface-Level EAI, The EAI Process—Methodology or Madness, An Introduction to EAI and Middleware, Transactional Middleware and EAI, RPCs, Messaging, and EAI, Distributed Objects and EAI, Database-Oriented Middleware and EAI, Java Middleware and EAI, Implementing and Integrating Packaged Applications—The General Idea, XML and EAI, Message Brokers—The Preferred EAI Engine, Process Automation and EAI.

Enterprise Architecture Patterns: (7)

Layering, Organizing Domain Logic, Mapping to Relational Databases, Web Presentation, Domain Logic Patterns, Data Source Architectural Patterns, Object-Relational Behavioral Patterns, Object-Relational Structural Patterns, Object-Relational Metadata Mapping Patterns, Web Presentation Patterns, Distribution Patterns, Offline Concurrency Patterns.

Reference Books

1. Software Architecture in Practice – Len Bass, Paul Clements, Rick Kazman, 2nd Edition, Pearson Education, 2003.
2. Pattern-Oriented Software Architecture, A System of Patterns - Volume 1 – Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal, , John Wiley and Sons, 2006.
3. Mary Shaw and David Garlan: Software Architecture- Perspectives on an Emerging Discipline, Prentice-Hall of India, 2007.
4. Design Patterns- Elements of Reusable Object-Oriented Software – E. Gamma, R. Helm, R. Johnson, J. Vlissides:, Addison-Wesley, 1995. Web site for Patterns: http://www.hillside.net/patterns/
5. Applied Software Architecture ,Christine Hofmeister, Robert Nord, Deli Soni, Addison-Wesley Professional; 1st edition (November 4, 1999) ,ISBN-10: 0201325713 , ISBN-13: 978-0201325713
6. Essential Software Architecture, Ian Gorton Springer; 1 edition (2006) ISBN-10:3540287132 ISBN-13: 978- 3540287131
7. Patterns of Enterprise Application Architecture, Martin Fowler, Addison-Wesley Professional, 2003, ISBN10: 0321127420 ISBN-13: 9780321127426

Course Code	**MEIT 2211**		
Course Title	**Agile Software Development**		
Type of Course	Elective		
L T P		**Credits**	**Total Contact Hours**
4-0-0		4	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Knowledge of software development, project management	
Course Objective		To give an understanding of what Agility means, when and why to employ Agile development, the pitfalls, issues and common mistakes to watch out for.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

PART A

Fundamentals of Agile **(07)**

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

Agile Scrum Framework: **(10)**

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management

Agile Testing: **(10)**

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

PART B

Agile Software Design and Development: **(13)**

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control

Industry Trends: **(05)**

Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies

Recommended Books

1. Joshy Joseph, Craig Fellenstein , Grid Computing, First Edition, Pearson Education, 2004.
2. Broken Agile by Tim Brizard, Apress, 2015.
3. Agile Android by Godfrey Nolan, Apress, 2015.
4. Agile Performance Improvement by Bob Winter, Apress, 2015
5. JIRA Agile Essentials by Patrick Li, Packt Publishing, 2015
6. Agile Software Development with Scrum By Ken Schawber, Mike Be, Pearson, 2008.
7. Agile Software Development, Principles, Patterns and Practices By Robert C. Martin,Prentice Hall, 2002.
8. Agile Testing: A Practical Guide for Testers and Agile Teams By Lisa Crispin, Janet Gregory, Addison Wesley, 2008

Course Code	**MEIT 2212**		
Course Title	**Software Testing & Quality Assurance**		
Type of Course	Elective		
L T P		**Credits**	**Total Contact Hours**
4-0-0		4	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Software Engineering	
Course Objective		This course offers a good understanding of methods and techniques of software testing and quality management concepts and prepares students to be in a position to develop error free and quality software.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

Part A

Software Quality **(05)**

Ethical Basis for Software Quality, Quality Concepts, Total quality Management Principles, Software Quality Assurance, Software Reviews, Formal Technical Reviews, SQA Plan, Quality Standards, Practices & conventions.

Software Development **(08)**

Development models, Cleanroom methodology, Defect Prevention, Enterprises Resource Planning Software, Measurement Theory, Software quality metrics, designing software measurement programs, organizational learning.

Improving quality with methodologies **(06)**

Quality tools, Object-Oriented Software, Reverse Engineering, Measuring Customer Satisfaction, Reliability Models, Reliability Growth Models.

Part B

Software Quality Engineering **(07)**

Defining Quality Requirements, Requirement Management, Complexity Metrics And Models, Use Of CASE Tool Technology, Role Of Groupware, Data Quality Control

Project Configuration Management **(06)**

Configuration Management Concepts, Configuration Management Process, Document Control, Configuration Management Plan of the WAR Project.

Software Testing **(07)**

Introduction to software testing, verification and validation, testing techniques: Dynamic testing and static testing, Validation activities: Unit, Integration, function & System testing, Regression testing.

Risk Management **(06)**

Risk Identification, Risk Projection, risk refinement, Risk mitigation, Monitoring and Management, The RMMM plan

Recommended Books

1. Metrics and Models in Software Quality Engineering, by Stephen H. Kan, Pearson Education, second edition
2. Software Engineering, by Pressman, 6th edition, Tata McGraw Hills.
3. Software Engineering, by Ian Sommerville, Addison Wesley, 7th edition.
4. Effective Methods for Software Testing, by William E. Perry, Second Edition, John Wiley & Sons.
5. Software Testing: Principles and Practices, by Naresh Chauhan, Oxford Higher education

THIRD SEMESTER

Elective III

Course Code	**MEIT 3201**	
Course Title	**Cloud Computing & IoT**	
Type of Course	Elective	
L T P	**Credits**	**Total Contact Hours**
3-0-2	4	45
Course Assessment Methods	**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
	50	50
Pre requisite	Distributed Systems	
Course Objective	This course offers a good understanding of cloud computing and IoT concepts and prepares students to be ina position to design cloud based applications for distributedsystems.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

SECTION – A

Overview of Cloud Computing **(6)**

History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing.

Working with Private and Public Cloud **(8)**

Private Cloud Definition, Characteristics of Private Cloud, Challenges to private Cloud, Virtual Private Cloud. Implementing private cloud (one out of CloudStack, OpenStack, Eucalyptus, IBM or Microsoft), Why Public Cloud, When to opt for Public Cloud, Implementing public cloud (one out of AWS, Windows Azure,IBM or Rackspace)

Introduction to IoT **(8)**

Internet of Things, Characteristics of IoT, Physical Design, Logical Design, Functional blocks ofIoT, Communication models & APIs, IoT enabling Technologies, IoT Levels & Deployment Templates , Challenges in IoT.

SECTION-B

Internet of Things (IoT)& M2M **(4)**

Machine to Machine Architecture, Difference between IoT and M2M, SDN and NFV for IoT, SNMP protocol, IoT system management using NETCONF-YANG, IoT reference model, Domain model - information model, functional model, communication model

IoT Protocols **(5)**

Protocol Standardization for IoT, Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Unified Data Standards ,IEEE 802.15.4, BACNetProtocol,Modbus, Zigbee Architecture

Building IoT with RASPBERRY PI & Arduino **(8)**

Building IOT with RASPERRY PI,Logical Design using Python, IoT Physical Devices & Endpoints, IoT Device-Building blocks ,Raspberry Pi programming Interfaces with Python, Other IoT Platforms like Arduino.

Case Studies and Future Trends **(6)**

IoT in Agricultural, Vehicular IoT, Healthcare IoT, Data Analytics for IoT, Software & Management Tools for IoT, Cloud for IoT - Amazon Web Services for IoT

Recommended Books

NAME	AUTHOR(S)	PUBLISHER
Cloud Computing: A Practical Approach	Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter	McGraw Hill, 2010
Cloud Computing: Principlesand Paradigms	RajkumarBuyys, James Broberg, AndrzejGoscinski, (Editors)	Wiley, 2011
Internet of Things: A Hands-On Approach	Vijay Madisetti, ArshdeepBahga	Orient Blackswan Private, Ltd,2015
The Internet of Things in theCloud: A Middleware Perspective	Honbo Zhou	CRC Press, 2012
The Internet of Things – Key applications andProtocols	Olivier Hersent, David Boswarthick, Omar Elloumi	Wiley, 2012

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 3202**		
Course Title	**Modelling and Simulation**		
Type of Course	Elective		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Discrete mathematics, basic idea of MATLAB	
Course Objective		This course should provide the students with good understanding of various techniques of Simulation. At the end of this course students will be having good knowledge of simulation concepts and simulation languages	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

SECTION-A

Introduction **(6)**

What is modeling and simulation. application areas, definition and types of system, model and simulation, introduction to discrete-event and continuous simulation.

Simulation Methods **(7)**

Discrete-event Simulation, Time advance Mechanisms, Components and organization of Discrete-event simulation, Flowchart of next-event time advance approach, Continuous Simulation, Random Number generation methods.

Queuing Models **(7)**

Single server queuing system, introduction to arrival and departure time, flowcharts for arrival and departure routine. Event graphs of queuing model. Determining the events and variables.

SECTION-B

Distribution Functions **(7)**

Stochastic activities, Discrete probability functions, Cumulative distribution function, Continuous probability functions. Generation of random numbers following binomial distribution, poisson distribution, continuous distribution, normal distribution, exponential distribution, uniform distribution.

Programming in MATLAB **(6)**

Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.

Programming in GPSS and C/C++ **(6)**

Basic Introduction to Special Simulation Languages:-GPSS and Implementation of Queuing Models using C/C++.

Introduction to Simulators **(6)**

Introduction regarding features and usage of any Network simulator.

Recommended Books

1. Averill M. Law and W. David Kelton: "Simulation Modeling and Analysis",Tata McGraw-Hill Publication.
2. Geoffery Gordon: "System Simulation", Prentice-Hall of India.
3. D.S. Hira: "System Simulation", S. Chand Publication.
4. Stephen J. Chapman: "MATLAB Programming for Engineers", Thomson learning inc.
5. Jerry Banks, John S. Carson, Barry L. Nelson and David M. Nicol: "Discrete-Event System Simulation", Prentice-Hall of India.
6. Rudra Pratap: "Getting Started with MATLAB 7", Oxford University Press.

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 3203**	
Course Title	**Blockchain Technologies**	
Type of Course	Elective	
L T P	**Credits**	**Total Contact Hours**
3-0-2	3+1	45
Course Assessment Methods	**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
	50	50
Pre requisite	Database Systems, Artificial Intelligence	
Course Objective	To learn various machine learning techniques and different ways to analyze different patterns.	

SYLLABUS

Note: The examiner shall set seven questions of 10 marks each. First question has to be compulsory, having sections covering the whole syllabus. Three questions have to be set from Section A and three questions from Section B of the syllabus. Candidate is required to attempt at least two questions from each section. All the course outcomes must be covered by the question paper.

SECTION-A

UNIT I: Introduction to BlockChain (5)

Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain.

UNIT II: Blockchain Architecture (12)

Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET).

UNIT III – Overview of Cryptography (6)

Symmetric-key cryptography, Public-key cryptography, Digital Signatures, Hash functions, Elliptic curve cryptography, Basics for crypto currency, Application of Cryptography to Blockchain- Using hash functions to chain blocks, Digital Signatures to sign transactions, Using hash functions for Proof-of-Work.

SECTION-B

UNIT IV – Cryptocurrency & Bitcoin (5)

Basic of crypto-currency, Creation of coins, Payments and double spending, Bitcoin – Digital Signatures as Identities ,eWallets, Personal Crypto security, Bitcoin Mining–Mining Hardware,

Energy Consumption, Mining Pools, Mining Incentives and Strategies.
UNIT V – Ethereum and Hyperledger **(12)** Ethereum networks, Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity language, decentralized applications using Ethereum. Solidity- Smart Contracts, Attacks on smart contracts, Hyperledger fabric
UNIT VI – Case Studies **(5)** Blockchain in Supply Chain, Blockchain in Manufacturing, Blockchain in Automobiles, Blockchain in Healthcare, Blockchain in Cyber security, Blockchain in Financial Industry

Recommended Books

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd..
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited.
3. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc,
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Elective IV

Course Code	**MEIT 3206**	
Course Title	**Image Processing and Computer Vision**	
Type of Course	Elective	
L T P	**Credits**	**Total Contact Hours**
3-0-2	3+1	45
Course Assessment Methods	**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
	50	50
Pre requisite	Computer Graphics	
Course Objective	The objectives is to develop an understanding of the basic principles and techniques of image processing and image understanding ; thus enabling the students to develop skills to design and implement of computer vision applications.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each**.**

PART A

Introduction: **(6)**

Image Processing, Computer Vision and Computer Graphics , Building blocks of Digital Image Processing System, Digital Image representation, Sampling and Quantization. What is Computer Vision - Low-level, Mid-level, High-level, Overview of Diverse Image Processing and Computer Vision Applications

Image Enhancement and Restoration: **(7)**

Intensity transform functions, Histogram processing, Spatial Domain and frequency domain approaches, Image subtraction, image average, Low-pass spatial filters, Median filters, High-pass spatial filters, derivative filters, Filtering in Frequency domain, homomorphic filters, Image degradation and restoration process, Noise models, Noise filters

Image Morphology and Segmentation: **(7)**

Morphology: Introduction to basic operation on binary and grayscale images: Dilation, Erosion, Opening & Closing, Morphological Algorithms: Boundary & Region Extraction,Thinning, Thickening, Skeletons, *Segmentation:* Detection of isolated points, line detection, edge detections, region oriented segmentation, thresholding.

PART B

Depth estimation and Multi-camera views: (6)

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Feature Extraction: (6)

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Motion Analysis: (6)

Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Case Studies and Applications: (7)

CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing; Modern trends - super-resolution; GPU, Augmented Reality; cognitive models, fusion and SR&CS.

Recommended Books

1. Gonzalez and Woods: Digital Image processing, Pearson educations,2nd Edition.
2. Szeliski, R., Computer Vision: Algorithms and Applications, Springer-Verlag London Limited , latest edition.
3. Forsyth, A., D. and Ponce, J., Computer Vision: A Modern Approach, Pearson Education latest edition.
4. Anil K. Jain: Fundamentals of digital image processing, PHI.
5. Sonka, Hlavac, Boyle : Image Processing, Analysis and MachineVision 2nd Edition, PWS Publishing.

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 3207**		
Course Title	**Advanced Computer Networks**		
Type of Course	Elective		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		Computer Networks	
Course Objective		To gain knowledge of advanced concepts of computer network including IPv6, architecture, application and challenges of MANET, VANET and WSN	

Note: The examiner shall set seven questions of 10 marks each. First question has to be compulsory, having parts covering the whole syllabus. Three questions have to be set from Part A and three questions from Part B of the syllabus. Candidate is required to attempt at least two questions from each part.

PART A

INTRODUCTION **(5)**

Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, etc.

MEDIUMACCESS **(5)**

MAC protocols for high-speed LANS, MANs, and wireless LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless ethernet, etc.)

INTERNETWORKING AND ROUTING **(7)**

Packet Switching, The Internetworking Problem, The IP/TCP split connections, Scaling IP, Routers: Forwarding and Routing, The IP forwarding path, Unicast Internet routing: Intra and Inter domain routing, Router Design and Implementation, Security problems with Internet Architecture, IPV6.

RESOURCE MANAGEMENT **(6)**

End-to-End Congestion Control, Router-Assisted Congestion Control: Active Queue Management, Fair Queuing and Variants, Modeling and Measurement: Packet Trains, TCP Congestion Control Impediments, Adaptive Network Applications.

PART B

QUALITY OF SERVICE (QOS) **(4)**

Why QoS; Basic Models and Architecture, Mechanisms and Properties, Modeling and Measurement: Traffic Self-Similarity; Virus Propagation.

GROUP COMMUNICATION **(5)**

Multicast Routing and Transport, IP Multicasting: Multicast routing protocols, address assignments, session discovery etc., Multicasting in mobile networks.

TRANSPORT LAYER PROTOCOL **(5)**

TCP protocol dynamics, TCP extensions for high-speed networks, transaction-oriented applications. Other new options in TCP.

WIRELESS NETWORKS **(3)**

Wireless LAN architecture, Mobile IP, Broadcast file system, Agent technology, Satellite technology.

SECURITY **(5)**

Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, Key distribution protocols. Digital signatures, digital certificates.

BOOKS:

Andrew Tanenbaum. Computer Networks, PHI

REFERENCES:

1. W. R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley, 1994.
2. G. R. Wright. TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley, 1995.
3. W. R. Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, and the Unix Domain Protocols, Addison Wesley, 1996.
4. R. Handel, M. N. Huber, and S. Schroeder. ATM Networks: Concepts, Protocols, Applications, Addison Wesley, 1998.
5. W. Stallings. Cryptography and Network Security: Principles and Practice, 2nd Ed., Prentice Hall, 1998.
6 CE Perkins, B. Woolf, and S. R. Alpert. Mobile IP: Design Principles and Practices, Addison Wesley, 1997.

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory

Course Code	**MEIT 3208**		
Course Title	**Advanced Natural Language Processing**		
Type of Course	Elective		
L T P		**Credits**	**Total Contact Hours**
3-0-2		3+1	45
Course Assessment Methods		**End Semester Assessment (University Exam.)**	**Internal Assessment (Sessional, Assignments, Quiz)**
		50	50
Pre requisite		First-order predicate logic, Grammars, languages for the parsing	
Course Objective		This course is designed to introduce students to the fundamental concepts and ideas in natural language processing (NLP), and to get them up to speed with current research in the area.	

Note: The examiner shall set seven questions of equal marks. First question is compulsory and shall cover the whole syllabus by including questions of conceptual nature. Rest of the syllabus will be divided into A and B parts having three questions each.

PART A

Introduction to NLP **(6)**

Introduction and Survey of applications, Levels of linguistic processing: morphology, syntax, semantics, Tokenization, Stemming, N-grams Modeling.

Language Processors and Understanding **(9)**

Recognizers, transducers, parsers, generators, Language as a rule-based system, Language understanding as an inferential activity

Resources for NLP **(7)**

Introduction to lexicons and knowledge bases, Computational morphology lemmatization, Part-of-Speech Tagging, Finite-State Analysis, noun phrase chunking.

PART-B

Syntactic Processing **(6)**

Basic parsing: Top Down and Bottom Up parsing, Chart parsing, Deterministic parsing, Statistical parsing, Grammars with features, Unification Grammars, The Lexicon.

Semantic Interpretation **(6)**

Lexical semantics, Semantics and logical form, Resolving ambiguities: Word Sense Disambiguation, Linking syntax and semantics, Linking syntax and semantics in restricted domains.

Context and World Knowledge **(5)**

Discourse: linguistic context, Ellipsis; World knowledge, Discourse structure Conversation and co-operation, Introduction to Information Retrieval and Information Extraction.

NLP additional Concepts **(6)**

Named entity recognition, coreference resolution, question answering, text classification, document clustering, text summarization, machine translation, Basics of Machine Learning.

Recommended Books

1. Allen, J.: Natural language understanding, 2nd Edition, Redwood City, CA: 1994. Benjamin/Cummings.
2. Covington, M.A: Natural Language Processing for Prolog. Programmers, (1994), Prentice Hall
3. Jurafsky, D. and Martin: Speech and Language Processing, (2000), Prentice Hall
4. Gazdar, G. &Mellish, C.: Natural Language Processing in Prolog: An Introduction to Computational Linguistics,(1989), Addison Wesley.

Practical Task: **Internal Assessment Marks: 50**

Practical based on theory