

Scheme of Study (MCA-SE)

SECOND SEMESTER EXAMINATION

Paper ID	Paper Code	Paper	L	T/P	Credit
44602	IT602	Data Communication and Networking	3	1	4
44604	IT604	Operating Systems	3	1	4
44606	IT606	Software Testing and Quality Assurance	3	1	4
44608	IT608	AI and Machine Learning	3	1	4
44626	IT626	Human Values and Professional Ethics (NUES)	2		2
Core (School) Elective – I (Select any one)					
44610	IT610	Software Requirement & Elicitation	4	0	4
44612	IT612	Computer Graphics & Multimedia	4	0	4
44614	IT614	Internet of Things	4	0	4
44616	IT616	Theory of Computation	4	0	4
44618	IT618	Optimization Techniques	4	0	4
44620	IT620	Front End Design Techniques	4	0	4
44622	IT622	Simulation and Modelling	4	0	4
44624	IT624	Mobile Computing	4	0	4
Open Elective – I (Select any one)					
		Electives offered by USIC&T or any School of the University			Minimum 3 credits
Practical					
44662	IT662	Software Testing and Quality Assurance Lab	0	2	1
44664	IT664	Lab Based on Core-Elective -I	0	2	1
44666	IT666	Term Paper II (NUES*)	0	4	2
		Total	18	12	29

INSTRUCTIONS TO PAPER SETTERS:**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks

Course Outcomes:

CO 1	Apply the basic concepts of networking and to analyse different parameters such as bandwidth, delay, throughput of the networks for the given problem
CO 2	Apply different techniques to ensure the reliable and secured communication in wired and wireless communication
CO 3	Analyse the networking concepts of TCP/IP for wired and wireless components. Identify the issues of Transport layer to analyse the congestion control mechanism
CO 4	Design network topology with different protocols and analyse the performance using networking tools

Course Outcomes -Program Outcomes Matrix

Filled on a scale of 1 to 3 (3=High; 2=Moderate; 1=Low; '-' for no correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	1	1	2	1	-	-	-	1
CO2	3	2	3	2	-	1	2	1	-	-	-	1
CO3	2	2	2	2	-	1	2	1	-	-	-	1
CO4	3	2	2	2	1	1	2	1	-	-	-	1

UNIT 1

Computer Networks: Introduction, Data Communications, Network and types, OSI model. TCP/IP model, LAN, WAN, MAN. Physical Link Layer: Data and Signals, Analog and digital signals, Transmission Impairment, Performance. Transmission: Digital Conversions, Analog Conversions, multiplexing, Transmission media: guided media and unguided media. switching: circuit-switched networks, packet switching

UNIT 2

Data Link Layer: Design issues, addressing. Error Detection and Correction: Types of Errors, Block Coding, Cyclic Codes, Checksum, Forward Error Correction, Data-Link Layer Protocols: Simple Protocol, Stop-and-Wait Protocol and Piggybacking, HDLC, PPP. Medium Access Control: Random Access, Controlled Access, Channelization. Wired LANs: Standard Ethernet, Fast Ethernet. Wireless LAN: Architecture, IEEE 802.11.

UNIT 3

Network Layer: Network-Layer Services, Packet Switching, Network-Layer Performance, IPV4 Addresses, Network-Layer Protocols: IP, ICMPV4, Routing Protocols: Unicast Routing Protocols: RIP, OSPF, BGP4. Congestion Control. ARP, RARP. Transport Layer: Services, Addressing, Connection establishment and release, error control and flow control, ATM Layers, Transport-Layer protocols, UDP and TCP.

UNIT 4

Application Layer: DHCP, DNS, Telnet, FTP, HTTP and SNMP. Network Security: Security goals and attacks, Ciphers. Internet Security: IPSec, Virtual Private Network (VPN). Transport Layer Security: SSL Architecture and Protocols. Firewalls: Packet-Filter Firewall, Proxy Firewall

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, Tata McGraw Hill, 2013
2. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education India 2013.
3. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, India, 2017
4. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Elsevier, 2012

References Books:

1. Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson Education, 2005
2. James F. Kurose and Keith W., "Computer Networking: A Top-Down Approach", 7th Edition, Pearson Education, 2017.
3. Natalia Olifer and Victor Olifer, "Computer Networks: Principles, Technologies and Protocols for Network Design", Wiley, 2006
4. Jerry FitzGerald, Alan Dennis and Alexandra Durcikova, "Business Data Communications and Networking", John Wiley & Sons, 2019

INSTRUCTIONS TO PAPER SETTERS:**Maximum Marks : 751.**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks

Course Outcomes:

CO 1	Students will be able to learn the role of operating system in a computing device and scheduling of process over a processor
CO 2	Students will learn how to synchronize programs and make the system deadlock free. Further they will learn concepts of semaphore and its use in process synchronization
CO 3	Students will learn about paging and segmentation methods of memory binding and their pros & cons
CO 4	Virtual memory concepts will be known. Students will be able to understand file system like file access methods, directory structures, file space allocation in disk and free space management in disk. Further, they will learn disk scheduling and disk recovery procedures

Course Outcomes -Program Outcomes Matrix

Filled on a scale of 1 to 3 (3=High; 2=Moderate; 1=Low; '-' for no correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	1	-	1	1	-	1	1	-	-	-	-
CO 2	-	1	-	1	2	-	1	1	-	-	-	-
CO 3	-	1	-	1	1	-	1	1	-	-	-	-
CO 4	-	1	-	1	1	-	1	1	-	-	-	-

UNIT 1

Introduction to the Operating System. Types of OS: Batch System, Time Sharing System, Real Time System, Multiuser/Single User System Functions of Operating System: Process Management, Memory Management, File Management, I/O Devices Management, Information Management.

Process Management: Process concepts, Process State, Process Control Block, Context Switch, CPU Scheduling, Scheduling Criteria, Scheduling Algorithms, Pre Emptive/ Non Preemptive Scheduling, Threads, Thread Structure.

UNIT 2

Process Synchronisation: Critical Section Problem, Race Condition, Synchronisation Hardware, Semaphores, Classical Problems of Synchronisation.

DeadLock: Characterisation, Deadlock Prevention, Deadlock Avoidance, Detection and Recovery.

UNIT 3

Memory Management: Contiguous Allocation, External Internal Fragmentation, Paging, Segmentation, Segmentation with Paging, Virtual Memory Concept and its Implementation, Thrashing

UNIT 4

File Handling: Access Methods, Directory Structure, Allocation Methods - Contiguous Allocation, Linked Allocation, Indexed Allocation, Free Space Management.

Device Management: Disk Structure, Disk Scheduling Algorithms, Disk Management, Case study on Window and UNIX operating systems.

Text Books:

1. Silbershatz, Galvin and Gagne, "Operating Systems Concepts", Wiley, Ninth edition, 2012

References Books:

1. J. Archer Harris, "Operating Systems", McGraw Hill Education Private Limited, 2014
2. Flynn, Mchoes, "Understanding Operating System", Thomson Press, Third Edition, 2003
3. Godbole Ahyut, "Operating System", PHI, 2003

INSTRUCTIONS TO PAPER SETTERS:**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks

Course Outcomes:

CO 1	Understanding software quality, quality factors and standards.
CO 2	Understanding the software testing fundamentals, testing process and different verification methods.
CO 3	Understanding the software validation techniques.
CO 4	Understanding the agile based testing and automated testing tools.

Course Outcomes -Program Outcomes Matrix

Filled on a scale of 1 to 3 (3=High; 2=Moderate; 1=Low; '-' for no correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	3	2	2	2	2	2	2	2
CO 2	3	3	3	3	3	2	2	3	2	2	2	2
CO 3	3	3	3	3	3	2	2	3	2	2	2	2
CO 4	3	3	3	3	3	2	2	3	3	2	2	2

UNIT 1

What is software quality, Expectations and Challenges, Software Quality Factors, Components of Software Quality Assurance System, Quality Metrics, Costs of Software Quality, Quality Management Standards, SQA unit and other actors in SQA system, Quality standards: ISO-9000, CMM, Six Sigma, Software Quality, Bad Smells in the code, Refactoring and its effects on software quality

Fundamentals of software testing, The psychology of testing, testing throughout software life cycle, Terminologies: Error, Fault, Failure, Incident, Test Cases, Test Suite, Deliverables and Milestones, Software Testing Process, Developing the Test Plan, Verification, validation, Alpha, Beta and Acceptance Testing

UNIT 2

Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause-Effect Graphing Technique

Structural Testing: Control Flow Testing, Statement Coverage Branch Coverage Condition Coverage Path Coverage, Data Flow Testing, DU path, DC path, Slice Based Testing, Mutation Testing

UNIT 3

Regression Testing: Selection, Minimization and Prioritization of Test Cases for Regression Testing, Regression Testing Process, Selection of Test Cases, Regression Test Cases Selection, Reducing The Number of Test Cases, Minimization of Test Cases, Prioritization of Test Cases
Agile Testing: What is Agile Testing? Challenges, testing quadrants, creating user stories, test scenarios and test cases. Agile test automation strategy and tool (selenium) for automation

UNIT 4

Software Metrics, Characteristics of Software Metrics, Measurement Basics, Product and Process Metrics, Measurement Scale, Measuring Size, Measuring Software Quality Software, Quality Metrics Based on Defects, Defect Density, Phase-Based Defect Density, Defect Removal Effectiveness, Usability Metrics, Testing Metrics, OO Metrics, Some Popular OO Metric Suites, Dynamic Software Metric

Tool support for Testing, Selecting and Installing Software Testing tools. Automation and Testing Tools - Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, JMeter, JUNIT, Selenium, and Cactus.

Text Books:

1. Daniel Galin, "Software Quality Assurance – From Theory to Implementation", Addison Wesley, Pearson Education, 2003
2. Yogesh, Singh, "Software Testing", Cambridge University Press, 2011
3. Ruchika Malhotra, Empirical Research in Software Engineering: Concepts, Analysis and Applications, CRC press, 2016

References Books:

1. William E. Perry, "Effective Methods for Software Testing", Third edition, Wiley, 2006
2. Renu Rajni, Pradeep Oak, "Software Testing: Effective Methods, Tools and Techniques", McGraw Hill Education, 2004.
3. Rahul Shedye, "Software Automation Testing Tools for Beginners", Shroff Publishers, 2012.
4. K.V.K.K. Prasad, "Software Testing Tools", DreamTech Press, 2008
5. Nageswara Rao Pusuluri, "Software Testing Concepts and Tools", DreamTech Press, 2007.
6. Robert Dunn, "Software Quality Concepts and Plans", Prentice-Hall, 2003.
7. Alan Gillies, "Software Quality, Theory and Management", Chapman and Hall, 2004.
8. Naresh Chauhan, "Software Testing – Principles and Practices", Oxford University Press, 2010.
9. Jeannine M. Siviyy, M. Lynn Penn, Robert W. Stoddard, "CMMI and Six Sigma: Partners in Process Improvement", Pearson Education, 2007.
10. Rex Black, Erik Van Veenendaal, Dorothy Graham, "Foundation of Software Testing", ISTQB Certification, third Edition, Cenage learning, 2015
11. John W. Horch, "Practical Guide to Software Quality Management", second edition, Artech House, London.

Paper ID: 44610

L T/P C

Code: IT610

Paper: Software Requirement and Estimation

3 0 3

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks

Course Outcomes:

CO 1	To be able to understand the concept, process and the types of software requirement
CO 2	To be able to model different requirements through various modelling diagrams and the requirements validation process
CO 3	To have a knowledge and ability to analyse the requirements and estimation of the software accordingly
CO 4	To get equipped with the knowledge of estimation methods along with practical implications through some case studies

Course Outcomes -Program Outcomes Matrix

Filled on a scale of 1 to 3 (3=High; 2=Moderate; 1=Low; '-' for no correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	3	-	3	2	-	-	2	1
CO 2	3	3	3	3	3	-	3	2	-	-	2	1
CO 3	3	3	3	3	3	-	3	2	-	-	2	1
CO 4	3	3	3	3	3	-	3	2	-	-	2	1

UNIT 1

Software Requirement Fundamentals: Definition of Software Requirement, Good Practices for Requirements Engineering, Identifying Requirements, Product and Process Requirements, Improving Requirements Processes, Functional and Non-Functional Requirements, Quantifiable Requirements, System Requirement and Software Requirements.

Requirements elicitation: Elicitation techniques, setting requirements priorities, Requirements attributes, Internal and external quality attributes, Quality attribute trade-offs, Implementing quality attribute requirements, Requirements management Principles and practices, Change Management Process, Requirements Traceability Matrix, Informal and formal requirements specification languages: syntactic and lexical elements.

UNIT 2

Requirements Analysis: Requirement Analysis Documentation, Review, Requirements Classification, Conceptual Modeling, Analysis Models, Architectural Design and Requirements Allocation, Requirements Negotiation, Software requirements and risk management, Risk reduction through

prototyping, System Requirements Specification (SRS creation), System Definition Document (SDD creation)

Requirements Validation: Setting requirement priorities, Verifying Requirement Quality, Requirements Reviews, Prototyping, Testing the requirements, Model Validation, Acceptance Tests, Practical Considerations: Iterative Nature of the Requirements Process,

Tools for Requirements Management and Estimation: Benefits, commercial requirements management tool, Rational Requisite pro, Caliber – RM, implementing requirements management automation.

UNIT 3

Software Estimation: Components of Software Estimations, Software Pricing Factors, Estimation methods: Algorithmic cost modelling, Expert judgement, Estimation by analogy, Parkinson's Law, Pricing to win, Delphi Technique, Work Breakdown Structure (WBS), Three Point Estimation, Problems associated with estimation, Key project factors that influence estimation Size Estimation.

UNIT 4

Effort, Schedule and Cost Estimation: Productivity, Estimation Factors, Approaches to Effort and Schedule Estimation, Function Point Analysis, Object point Analysis, Mark II FPA, Full Function Points, LOC Estimation, Conversion between size measures, FP counting using case study from DFD, review of COCOMO I, COCOMO II, Putnam Estimation Model, Algorithmic models, Cost Estimation

Six Forms Of Software Cost Estimation, Software Cost-Estimating Tools And Project Success And Failure Rates, Sources Of Error In Software Cost Estimation, Cost-Estimating Adjustment Factors, Activity-Based Software Cost Estimating, Software Estimation Tools: Desirable Features In Software Estimation Tools, IFPUG, USC's Cocomo II, Slim (Software Life Cycle Management) Tools.

Text Books:

1. "Software Engineering Body of Knowledge (SWEBOK)", IEEE Computer Society.
2. Karl E. Weigers, Joy Beatty, "Software Requirements", 3rd Edition, Microsoft Press, 2003.
3. Capers Jones, "Estimating Software Costs: Bringing Realism to Estimating", McGraw Hill Professional, 2007

References Books:

1. Swapna Kishore and Rajesh Naik, "Software Requirements and Estimation", Tata Mc Graw Hill, 2001.
2. Richard D. Stutzke, "Estimating Software-Intensive Systems: Projects, Products, and Processes", Addison-Wesley Professional; 1st Edition, 2005
3. M. A. Parthasarathy, "Practical Software Estimation: Function Point Methods for Insourced and Outsourced Projects", Addison-Wesley Professional, 2007

Paper ID: 44614

L T/P C

Code: IT614

Paper: Internet of Things

3 0 3

INSTRUCTIONS TO PAPER SETTERS:	Maximum Marks: 75
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.	
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks	

Course Outcomes:

CO 1	To introduce the terminology, technology and its applications. M2M (machine to machine) with necessary protocols
CO 2	To introduce the Python Scripting Language which is used in many IoT devices
CO 3	To introduce the Raspberry PI platform, that is widely used in IoT applications
CO 4	To introduce the implementation of web-based services on IoT devices

Course Outcomes -Program Outcomes Matrix

Filled on a scale of 1 to 3 (3=High; 2=Moderate; 1=Low; '-' for no correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	1	-	1	1	-	1	1	-	-	-	-
CO 2	-	1	-	1	2	-	1	1	-	-	-	-
CO 3	-	1	-	1	1	-	1	1	-	-	-	-
CO 4	-	1	-	1	1	-	1	1	-	-	-	-

UNIT 1

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT 2

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT 3

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT 4

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins. IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti ,”Internet of Things - A Hands-on Approach” , Universities Press, 2015, ISBN: 9788173719547
2. Matt Richardson & Shawn Wallace ,”Getting Started with Raspberry Pi”, O’Reilly (SPD), 2014, ISBN: 9789350239759

References Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013

Paper ID: 44608

L T/P C

Code: IT608 Paper: AI & Machine Learning

3 1 4

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks

Course Outcomes:

CO 1	To introduce AI, state space search, heuristic search and control strategies
CO 2	To understand knowledge representation, statistical reasoning
CO 3	To understand fuzzy logic and genetic algorithms
CO 4	To introduce machine learning paradigms and neural networks,

Course Outcomes -Program Outcomes Matrix

Filled on a scale of 1 to 3 (3=High; 2=Moderate; 1=Low; '-'for no correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	3	2	3	3	-	2	1	3
CO 2	3	3	3	3	3	2	3	3	-	2	1	3
CO 3	3	3	3	3	3	2	3	3	-	2	1	3
CO 4	3	3	3	3	3	2	3	3	-	2	1	3

UNIT 1

Foundations of Artificial Intelligence: AI Problems, AI Technique, criteria for success. State Space Search and control Strategies. Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis, A* algorithm.

UNIT 2

Knowledge Representation: Representations and Mappings, Approaches and Issues in Knowledge Representation. Using Predicate Logic, Rules, Symbolic Reasoning under Uncertainty: Nonmonotonic reasoning. Statistical Reasoning: probability and Bayes theorem, certainty factors and rule-based systems, Bayesian networks, Dempster-Shafer theory. Weak slot-and-filler structures, Strong slot-and-filler structures.

UNIT 3

Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems. Overview of genetic algorithms.

UNIT 4

Machine learning paradigms: Introduction, machine learning systems, supervised and unsupervised learning, inductive learning, deductive learning, clustering, support vector machines, case based reasoning and learning, Artificial neural networks: Introduction, artificial networks, single layer feed forward networks, multi layered forward networks, design issues of artificial neural networks.

Text:

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill , 2017
2. S. N. Sivanandam, S. N. Deepa, “Principles of Soft Computing”, 2nd Edition, Wiley India, 2011

References:

1. Richard E. Neapolitan, Xia Jiang, “Artificial Intelligence with introduction to Machine Learning”, 2nd edition , Chapman and Hall/CRC, 2018
2. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Pearson Education”, 2015
3. G. A. Vijayalakshmi Pai, Sanguthevar Rajasekaran, “Neural Networks, Fuzzy Logic And Genetic Algorithm: Synthesis And Applications”, 2nd Edition, PHI Learning, 2017