Seva Mandal Education Society's
Smt. Kamlaben Gambhirchand Shah Department of Computer Applications
under
Dr. Bhanuben Mahendra Nanavati College of Home Science (Autonomous)
NAAC Re-Accredited 'A+' Grade with CGPA 3.69 / 4
UGC Status: College with Potential for Excellence
'Best College Award 2016-17' adjudged by S.N.D.T. Women's University
Smt. Parmeshwari Devi Gordhandas Garodia Educational Complex
338, R.A. Kidwai Road, Matunga, Mumbai - 400019. Tel: 24095792 Email: smesedu@gmail.com

APPROVED SYLLABUS UNDER AUTONOMY

PROGRAMME: MASTER OF SCIENCE (COMPUTER SCIENCE)

DEPARTMENT OF COMPUTER APPLICATIONS
SEMESTER – I (2020-21)

PROGRAM OBJECTIVES

This program will enable the students to:

1. Gain in-depth knowledge in the key areas of computer science and practice in emerging, cutting edge Computational Technologies.
2. Develop software solutions to real world problems through Information Technological skills with international standards and facilitate them to be outstanding professionals.
3. Contribute to scientific research by independently designing, conducting and presenting the results of small-scale research.
4. Be a part of skilled manpower in the various areas of computer science such as Algorithm Analysis and Design, Data warehousing and Mining, Software Engineering, Advanced Computing technologies, Web-based Applications Development, and Data Science.

PROGRAM OUTCOME

The completion of the post-graduation programme:

1. Takes forward the knowledge gained by the students at the undergraduate level and provides them with an advanced level of learning and understanding of the subject.

2. Provides students with higher educational degree of technical skills in problem solving and application development.
3. Helps students to acquire an analytical and managerial skills to enhance employment potential.

PROGRAM SPECIFIC OUTCOME

1. The main outcome of this programme is enhancement in the Technical and Analytical skills of computer science enthusiasts and provide them with the perfect amalgamation of theory as well as practical knowledge in the various thrust areas of the field.
2. The students will acquire broad knowledge in core areas of computer science, current and emerging computing technologies.
3. The students also acquire a research oriented professional approach to provide sustainable solution to real life problems which can be solved using computational technologies.

Eligibility

- A Science Graduates in
  - BSc. (Physics),
  - BSc. (Maths.),
  - BSc (Elect.),
  - BSc. (IT),
  - B.Sc. (CS) or
  - BCA or
  - any engineering graduate in allied subject from the recognized university

  with an aggregate mark not less than 50% (Open Category) and 45% (Reserved category).

- Mathematics at 12th Level or 100 marks mathematics studied at graduation level is minimum requirement.

Master of Science (Computer Science)

SYLLABUS

M.Sc. (COMPUTER SCIENCE) SEMESTER - I (FIRST YEAR)

PROPOSED SYLLABUS FOR THE ACADEMC YEAR 2020-21

Course Code	Course	Course Type	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
			L	Pr./ Tu	Int.	Ext.	Total	
MCS101	Programming Concepts and Design, Analysis of Algorithms	CC	4	-	2	2	4	2
MCS102	Data Communication and Networking	CC	4	-	2	2	4	2
MCS 103	Software Engineering	CC	4	-	2	2	4	2
MCSL104	Programming Concepts Lab	CC	-	2	1	1	2	1
MCSL105	Networking Lab	CC	-	2	1	1	2	1
MCSL106	Software Testing Lab	SEC	-	2	1	1	2	1
MCSL107	Advanced Web Technology Lab	AECC	-	2	1	1	2	1
Choice Based Credit System (CBCS)								
MCS108A	Operating Systems (CBCS)	CC	4	-	2	2	4	2
MCS108B	Swayam or other online courses (CBCS)	SEC	4	-	2	2	4	2
	Total		**16**	**8**			**24**	**-**

SEMESTER-I	**1 Credit=25 Marks** **Total Credits = 24** **Total Marks = 24*25=600**

COURSE TITLE : PROGRAMMING CONCEPTS AND DESIGN, ANALYSIS OF ALGORITHMS

COURSE OBJECTIVES::

- To introduce students to the programming concepts
- To introduce the classic algorithms in various computer domains, and techniques for designing efficient algorithms.
- To make the students aware of and well-trained in the use of the tools and Techniques of designing and analyzing algorithms.

Learning Outcomes:

The course will help:

- To prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains;
- To apply the algorithms and design techniques to solve problems
- To appreciate the impact of algorithm design in practice
- To analyze the complexities of various problems in different domains.

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS101	**Programming Concepts and Design, Analysis of Algorithms**	**4**	**-**	**2**	**2**	**4**	**2**

Module No.	Objective	Content	Evaluation
1	To introduce students to programming concepts	**Programming Concepts** Object Oriented Programming, Review of OOP - Objects and classes, inheritance, polymorphism, abstraction, Event driven programming, graphics programming, event handling, generic programming – generic classes – generic methods – generic code and virtual machine	Assignment (Marks–05)
2	To explain and use various types of analyses of algorithms To study the role of available tools in solving a problem;	**Design strategies and Analysis of Algorithms** Role of Algorithms in Computing: Algorithms as a technology, Characteristics and building blocks of Algorithm. Getting Started: Designing algorithms, Well known Sorting algorithms (Insertion sort, Bubble Sort, Selection Sort, Shell Sort, Heap Sort). Divide-and-Conquer Technique: The maximum-subarray problem, Integer Multiplication, Strassen's algorithm for matrix multiplication, the substitution method for solving recurrences. Probabilistic Analysis and Randomized Algorithms: The hiring problem, Indicator random variables, Randomized algorithms. Analyzing algorithms, Growth of Functions: Some Useful Mathematical Functions & Notations, Asymptotic Functions & Notation.	Unit Test-1 (Marks-25)
3	To study and apply the dynamic programming and greedy algorithms for solving problems.	**Advanced Design** Dynamic Programming: Rod cutting, Elements of dynamic programming, longest common subsequence, The Problem of Making Change, Matrix Multiplication Using Dynamic Programming. Greedy Algorithms: An activity-selection problem, Elements of the greedy strategy, Huffman codes, Minimum Spanning Trees, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.	Oral Presentation (Marks 10)

4	To study and apply various graph search techniques.	**Graph Algorithms** Representations of graphs, Traversing Trees, Breadth-first search, Depth-first search, Best-First Search & Minimax Principle, Topological Sort. Single-Source Shortest Paths: The Bellman-Ford algorithm, Single-source shortest paths in directed acyclic graphs	Class Test (Marks 10)

EVALUATION:

Evaluation	Details **(* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)**	Marks
Internal	• **Unit test** • **Oral Test** • **Class Test** • **Assignments**	**50 Marks**
External	**Final Examination**	**50 Marks**
Total marks		**100 Marks**

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, (2009), *Introduction to Algorithms*, Third Edition, PHI Learning Pvt. Ltd-New Delhi
2. Richard F Gilberg, Behrouz A Forouzan , (2005), *Data Structure A Pseudocode Approach with C*. Second edition, Cengage Publisher

REFERENCE BOOKS:

1. Sanjoy Dasgupta, Christos H. Papadimitriou, Umesh Vazirani, (2006), *Algorithms*, McGraw-Hill Higher Education
2. Grokking Algorithms: An illustrated guide for programmers and other curious people, MEAP, Aditya Bhargava,(2010) http://www.manning.com/bhargava
3. Shaum‟s Outlines Data Structure Seymour Lipschutz TMH (2012)
4. Michael T.Goodrich, *Data Structures and Algorithms in C++*, (2015) Wiley Publications

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COURSE TITLE : DATA COMMUNICATION AND NETWORKING

Course Objectives:

- To help students to get a grounding of network components and architecture.
- To explore networking models.
- To learn the way protocols are used in networks and their design issues.

Learning Outcomes:

The students will be able to:

- Comprehend the basic concepts of computer networks and data communication systems.
- Analyse basic networking protocols and their use in network design
- Explore various advanced networking concepts.

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS102	**Data Communication and Networking**	**4**	**-**	**2**	**2**	**4**	**2**

Module No.	Objective	Content	Evaluation
1	To introduce to basic concepts of networking	**Introduction to Networking** Internet and Intranet, Protocol layer and their services, Network Applications like Web, HTTP, FTP and Electronic Mail in the Internet, Domain Name System, Transport-Layer Services, Multiplexing and Demultiplexing, UDP, TCP, TCP Congestion Control, Network Layer, Virtual Circuit and Datagram Networks, Need of Router, The Internet Protocol (IP), Routing Algorithms, Routing in the Internet.	Students will be evaluated by taking viva. (Marks 05)
2	To elaborate network virtualization	**Network Virtualization** Need for Virtualization, The Virtual Enterprise, Transport Virtualization-VNs, Central Services Access: Virtual Network Perimeter, A Virtualization Technologies primer: theory, Network Device Virtualization, Data-Path Virtualization, Control-Plane Virtualization, Routing Protocols.	Written Unit Test – I (Marks 25)
3	To elaborate the concept of Adhoc networking	**Adhoc Networking** Introduction, application of MANET, challenges, Routing in Ad hoc networks, topology & position-based approaches, Routing protocols: topology based, position based, Broadcasting, Multicasting, & Geocasting, Wireless LAN, Transmission techniques, MAC protocol issues, Wireless PANs, The Bluetooth technology.	Written Class Test will be conducted. (Marks 10)

4	To elaborate wireless sensor networks	**Wireless sensor networks** Need and application of sensor networks, sensor networks design considerations, empirical energy consumption, sensing and communication range, design issues, localization scheme, clustering of SNs, Routing layer, Sensor networks in controlled environment and actuators, regularly placed sensors, network issues, RFID as passive sensors.	Assignments will be given for the above topics. (Marks 10)

EVALUATION:

Evaluation	Details **(* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)**	Marks
Internal	• **Unit test** • **Viva** • **Class Test** • **Assignments**	**50 Marks**
External	**Final Examination**	**50 Marks**
Total marks		**100 Marks**

TEXT BOOKS:

1. James F. Kurose, Keith W. Ross, Pearson (2012), *Computer Networking: A Top-Down Approach* 6th edition, Pearson
2. Victor Moreno, Kumar Reddy, (2006), *Network Virtualization*, Cisco Press.
3. Carlos de Morais Cordeiro, Dharma Prakash Agrawal, (2011), *Ad Hoc and Sensor Networks: Theory and Applications*, World Scientific Publishing Company; 2nd edition

REFERENCE BOOKS:

1. Behrouz Forouzan, (2009), *TCP/IP Protocol Suite* 4 edition, McGraw-Hill Science
2. Jonathan Loo, Jaime Lloret Mauri, Jesús Hamilton Ortiz, (2011), *Mobile Ad Hoc Networks: Current Status and Future Trends*, CRC Press
3. S. Jochen Schiller, (2012), *Mobile Communications*, Second Edition, Pearson Education
4. William Stallings, (2013), *Wireless Communications and Networks*, Pearson Education
5. Vijay Garg, (2002), *Wireless network evolution: 2G to 3G*, Prentice Hall
6. Ivan Stojmenovic, *(2010),Handbook of Wireless Networks and Mobile Computing*, Wiley India Edition

COURSE TITLE : SOFTWARE ENGINEERING

Course Objectives:

- The basic objective of software engineering is to develop methods and procedures for software development that can scale up for large systems.
- It can be used consistently to produce high-quality software at low cost and with a small cycle of time.

Learning Outcomes:

Students will be able to:

- Apply use of knowledge of Software Life Cycle to successfully implement the projects in the corporate world
- Identify the Inputs, Tools and techniques to get the required Project deliverable and Product deliverable using knowledge areas of Project Management.

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS103	Software Engineering	4	-	2	2	4	2

Module No	Objective	Content	Evaluation
1	The objective of this module is to introduce the student to the basic foundations of software development using software engineering principles.	**Introduction to software engineering and project management** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional, Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC), Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.	Unit Test-1 (Marks-25)
2	To introduce students to Software Requirement elicitation techniques	**Software Requirement Analysis and Specification** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Data Dictionary Decision Tables, SRS Document, IEEE Standards for SRS. Requirement Elicitation: Interviews, Questionnaire, Brainstorming, Facilitated Application Specification Technique (FAST), Use Case Approach. SRS Case study.	Online Test (Marks-15)
3	This will introduce	**Software Project Planning and Scheduling** Business Case, Project selection and Approval,	

	the students to the basic concepts of software project scheduling & design	Project charter, Project Scope management: Scope definition and Project Scope management, Creating the Work Breakdown Structures, Scope Verification, Scope Control. Staffing Level Estimation, Effect of schedule Change on Cost, Degree of Rigor & Task set selector, Project Schedule, Schedule Control **Software Design** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	
4	To understand the importance of Software Testing strategies and Quality Assurance during the software development process.	**Software Testing and Quality Assurance** Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.	Assignment (Marks-5)
5	The objectives of this module is to introduce the fundamentals of software costing and maintenance To describe three metrics for software productivity assessment.	**Software Maintenance and Software Project Management** Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Software Estimation: Size Estimation: Function Point (Numericals). Cost Estimation: COCOMO (Numericals), COCOMO-II (Numericals). Software Risk Analysis and Management.	Assignment (Marks-5)

EVALUATION:

Evaluation	Details (* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)	Marks
Internal	• **Unit test** • **Online Test** • **Assignment**	**50 Marks**
External	**Final Examination**	**50 Marks**
Total marks		**100 Marks**

TEXT BOOKS:

1) Roger S Pressman, *Software Engineering*, 5th and 7th edition, (2018)McGraw Hill publication.
2) Kathy Schwalbe, *Managing Information Technology Project*, 6edition, (2016) Cengage Learning publication.

REFERENCE BOOKS:

1) Jack T Marchewka , *Information Technology Project Management* , (2010) Wiley India publication.
2) KK Agrawal, Yogesh Singh, *Software Engineering* 3rd edition (2015)by New Age International publication.
3) Richard H. Thayer, *Software Engineering Project Management*, (2016) Wiley India Publication.
4) Douglas Bell, *Software Engineering for students: A Programming Approach*, (2018) Pearson publication.

COURSE TITLE : PROGRAMMING CONCEPTS LAB

Course Objectives:

- Identify the way of implementation algorithms required for sorting searching, sorting array
- Identify the method of implementation of graph related algorithms

Learning Outcomes:

The students will be able to:

- Understand the concept of implementation of various algorithms
- Understand the measuring of performance values of various algorithms

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCSL104	**Programming Concepts Lab**	-	**2**	**1**	**1**	**2**	**1**

Module No	Objective	Content	Evaluation
1	To implement sorting algorithms	**Implementation of Sorting Algorithms** Insertion sort, Bubble Sort, Selection Sort, Shell Sort	Students will be evaluated using Lab Manual. (Marks 5)
2	To implement divide and conquer method-based algorithms	**Implementation of Algorithms based on divide and conquer** Quick sort implementation, Binary search algorithm	Class Test (Marks 10)
3	To implement shortest path and minimum spanning tree algorithm	**Implementation of MST and Shortest path algorithm** Find Minimum Cost Spanning Tree of a given undirected graph using Kristal‟s algorithm, from a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijikstra‟s algorithm.	
4	To implement graph traversal algorithms	**Implementation of Graph Algorithms** Traverse a graph using Breadth-first search, Depth-first search	Practical Exam will be conducted. (Marks 10)
Programming Language: C/C++			

EVALUATION:

Evaluation	Details **(* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)**	Marks
Internal	• **Lab Manuals** • **Class Test** • **Practical Test**	**25 Marks**
External	**Final Examination (Practical)**	**25 Marks**
Total marks		**50 Marks**

TEXT BOOKS:

1) Narasimha Karumanchi, (2016), *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*, CareerMonk Plublications
2) Dorothy Graham, E. P. (2006). Foundations of Software Testing: ISTQB Certification. USA: 2006.
3) James F. Kurose, K. W. (2007). Computer Networking: A Top-down Approach Featuring the Internet. USA: Pearson/Addison Wesley.

REFERENCE BOOKS:

1) Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, (2009), *Introduction to Algorithms*, Third Edition, PHI Learning Pvt. Ltd-New Delhi
2) Sanjoy Dasgupta, Christos H. Papadimitriou, Umesh Vazirani, (2006), *Algorithms*, McGraw-Hill Higher Education
3) Grokking Algorithms: An illustrated guide for programmers and other curious people, MEAP, Aditya Bhargava, http://www.manning.com/bhargava

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COURSE TITLE : NETWORKING LAB

COURSE OBJECTIVES:

- This practical subject introduces the student actual implementation of various types of networks using simulating software
- The objective of this subject is to give hands on experiment of hardware establishment of networks using simulating software

LEARNING OUTCOMES:

- The students will be able to configure various types of networks
- Students will implement various networks using simulating software

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCSL105	**Networking Lab**	**-**	**2**	**1**	**1**	**2**	**1**

Module No.	Objective	Content	Evaluation
1	To introduce students to IDE of simulating software	**Study of simulating software interface** Basic Configuration of router, assigning ipv4 and ipv6 addresses to the interfaces of the routers	Lab manual for 05 marks
2	To elaborate the configuration of VLANs and PPP	Configure VLANs on the router, Spanning tree, Configuration of PPP	Online test of 10 marks
3	To demonstrate the configuration of RIPv2, EIGRP and OSPF	Configure RIPv2, Configure EIGRP, Configure OSPF	
4	To implement configuration of switch	Access List Configuration, Configuration of NAT, Configuration of DCHP, Configuration of switch	Practical test of 10 marks
Practical's to be done Packet Tracer (or other simulating software)			

EVALUATION:

Evaluation	Details (* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)	Marks
Internal	• **Lab Manuals** • **Online Test** • **Practical Test**	**25 Marks**
External	**Final Examination (Practical)**	**25 Marks**
Total marks		**50 Marks**

TEXT BOOKS:

1) Forouzan B A., "Data Communication and Networking", Third Edition, 2004, McGraw Hill.Andrew Tenenbaum, Computer Networks, PHI
2) Jorgensen, P. C. (2002). Software Testing: A Craftsman's Approach. USA: CRC Press.
3) Kshirasagar Naik, P. T. (2010). SOFTWARE TESTING AND QUALITY ASSURANCE: THEORY AND PRACTICE. INDIA: John Wiley & Sons.

REFERENCE BOOKS:

1) Kurose, J.F. and Ross K.W., "Computer Networking: A Top-Down Approach Featuring the Internet", Third Edition, 2005, Addison-Wesley.
2) An Engineering Approach to Computer Networking, (2018) S. Keshav, Addision-Wesley.

COURSE TITLE : SOFTWARE TESTING LAB

Course Objectives:

- Identify the need of software testing in current industry scenario, techniques and tools in area of software testing
- Demonstrate the ability to apply multiple methods to check reliability of a software system and to identify and apply redundancy and fault tolerance for a medium-sized application,
- Identify the Fault in program logic that fails to validate data and values properly before they are used
- Discuss the distinctions between validation and defect testing,
- Understand types of testing and essential characteristics of tool used for test automation

Learning Outcomes:

The students will be able to:

- Understand the concept and need of software testing
- Understand the need and usage of software tools required for manual and automated testing

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCSL106	**Software Testing Lab**	**-**	**2**	**1**	**1**	**2**	**1**

Module No	Objective	Content	Evaluation
1	To understand the concepts of software testing	**Introduction to Software Testing** Functional and non-functional Testing, Writing Test cases, Testing Framework, Test Documents, Static Testing: Data Flow Analysis, Control Flow Analysis, Cyclomatic Complexity, White Box Testing: Statement Coverage, Branch Coverage, Path Coverage, State Transition, Black Box Testing: Equivalence Class Partitioning, Boundary Value Analysis, Cause Effect Graphing and Decision table technique, Use case testing	Students will be evaluated using Lab Manual. (Marks 5)
2	To perform manual testing	**Software Testing Strategies and Manual Testing** Characteristics, Integration Testing, Functional Testing, Object-oriented Testing, Alpha and Beta Testing, overview of testing tools, Manual Testing on existing Project	Class Test (Marks 10)
3	To perform automation testing using QTP	**Automation Testing using QTP** QTP Introduction, recording and replaying test cases, QTP Synchronization Point, QTP Parameterization, QTP Checkpoints (Windows and Web application), Recording modes in QTP	
4	To perform automation testing using Bugzilla	**Automation Testing using Bugzilla** Bugzilla Introduction and usage, Creating Reporting a new bug, Viewing Bug reports, Modifying Bug reports, Performance Testing Concepts: Load Testing, Stress Testing	Practical Exam will be conducted. (Marks 10)
Note: Manual Testing (MT), Automation Testing (AT)			

EVALUATION:

Evaluation	Details **(* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)**	Marks
Internal	• **Lab Manuals** • **Class Test** • **Practical Test**	**25 Marks**
External	**Final Examinations (Practical)**	**25 Marks**
Total marks		**50 Marks**

TEXT BOOKS:

1) Nastase, R. (2017). Computer Networking: Beginner's Guide for Mastering Computer Networking and the OSI Model. USA: Independently Published.
2) Sebesta, R. W. (1989). Concepts of programming languages. USA: Pearson Education.
3) Sestoft, P. (2017). Programming Language Concepts. USA: Springer International Publisher.

REFERENCE BOOKS:

1) Shende, *Testing in 30 + open source tools*, (2016) SPD
2) Dandreas Spillner, *Software testing foundations*, (2014) SPD

COURSE TITLE : ADVANCED WEB TECHNOLOGY LAB

Course Objectives:

- The students will Study the architecture of Dot Net framework
- Understand the basic principles of website development using IDE
- Learn advanced windows and web development techniques using dot NET

Learning Outcomes:

- The students will be able to create user interface-based applications
- Design and develop secure web applications using asp.net according to industry standards

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCSL107	Advanced Web Technology Lab	-	2	1	1	2	1

Module No.	Objective	Content	Evaluation
1	To introduce students to IDE of Asp.net web application	**Asp.Net Web Application** ASP.net server controls: Button, TextBox, Labels, CheckBoxex, Radio Buttons, List Controls. Web config and global.aspx files, data types, variables, statements, organizing code	Lab manual for 05 marks
2	To elaborate the use of validation controls in asp.net	**Validation Control** Validation techniques, state, management using view state, using session state, using application state, using cookies and URL encoding, Master page, content pages, nesting master pages, accessing master page controls from a control page, Site navigation Controls	Online test of 10 marks
3	To demonstrate	**Database Connectivity** Introduction, using SQL data sources, GridView	Practical exam of 10 marks

	the use of data base connectivity	Control, DetailView and FormView Controls, ListView and DataPager Controls in ASP.NET	
4	To implement LINQ with asp.net	**LINQ** Operators, implementation, LINQ to objects, XML and ADO.net, AJAX: Introduction and working, asp.net Ajax server control, JQuery: Introduction, UI Library, working	

EVALUATION:

Evaluation	Details **(* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)**	Marks
Internal	• **Lab Manuals** • **Online Test** • **Practical Test**	**25 Marks**
External	**Final Examination (Practical)**	**25 Marks**
Total marks		**50 Marks**

TEXT BOOKS:

1) Stephen Walther,(2011), ASP.NET 3.5 Unleashed,SAMS Publishing,ISBN0-672-33011-3.
2) Stephen Walther, (2010), ASP.NET MVC Framework, Unleashed

REFERENCE BOOKS:

1) Beginning C# - Wrox Publication (2012)
2) Chirag Patel, (2010), Advance .NET Technology second edition, DreamTech Press
3) Jonathan Chaffer and Karl Swedberg, Learning jQuery Third Edition - SPD Publication (2010)
4) Professional C# (2012) and .NET 4.5- Wrox Publication
5) Raj Kamal, Internet and Web Technologies, Tata McGraw Hill (2015)
6) .NET programming Black Book (2015)
7) Murach's ASP. Net 4. 0 Web Programming with C# 2010
8) Andrew Trolsen, *Pro C# 5.0 and the .NET 4.5 Framework*, APress (2011)
9) Vijay Mukhi , *C# with Visual Studio* –BPB (2010)
10) Heard First C# Second Edition , O'Reilly (2015)
11) Murach's ADO. Net 4 Database Programming with C# 2010 4th Edition
12) Web Technologies Black book , DreamTech Press (2016)
13) Ralph Moseley & M. T. Savaliya, (2011), *Developing Web Application*- Second Editon - Wiley

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CHOICE BASED CREDIT SYSTEM

COURSE TITLE : OPERATING SYSTEMS

Course Objectives:

- To learn the fundamentals of Operating Systems.
- To learn the mechanisms of operating system to handle processes and threads and their communication
- To learn the mechanisms involved in memory management in contemporary operating systems

Learning Outcomes:

The students will be able to:

- Analyse the structure of OS and basic architectural components involved in operating system design
- Conceptualize the components involved in designing a contemporary operating system

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS108	Operating Systems	4	-	2	2	4	2

Module No.	Objective	Content	Evaluation
1	To introduce to basic concepts of operating systems	**Introduction to Operating System** Introduction to Linux kernel, Types of kernel (monolithic, micro, exo), Operating system booting process GRUB-I, GRUB-II. Processes, Interprocess Communication, Scheduling.	Written Unit Test – I (Marks 25)
2	To elaborate memory management in operating system	**Memory management and virtual memory in Linux** Basic memory management, swapping, virtual memory, Page replacement algorithms, Design issues for paging systems, segmentation. Case Study: Linux memory management.	
3	To elaborate the concept of Input and Output operations	**Input/ Output in Linux** Principles of I/O Hardware, Principles of I/O Software, Deadlocks, RAM Disks, Disks, Terminals. File Systems: Files, Directories, File System Implementation, Security, Protection mechanisms in different Linux versions	Written Class Test will be conducted. (Marks 10)
4	To elaborate android operating system	**Android Operating System** The Android Software Stack, The Linux Kernel – its functions, essential hardware drivers. Libraries - Surface Manager, Media framework, SQLite, WebKit, OpenGL. Android Runtime - Dalvik Virtual Machine, Core Java Libraries. Application Framework - Activity Manager, Content Providers, Telephony Manager, Location	Assignments will be given for the above topics. (Marks 15)

		Manager, Resource Manager. Android Application – Activities and Activity Lifecycle, applications such as SMS client app, Dialer, Web browser, Contact manager	

EVALUATION:

Evaluation	Details **(* please give details of assessment in terms of Unit test/ Project/ quiz /or other assignments and marks allotted for it)**	Marks
Internal	• **Unit test** • **Class Test** • **Assignments**	**50 Marks**
External	**Final Examination**	**50 Marks**
Total marks		**100 Marks**

TEXT BOOKS:

1) Pramod Chandra, P. Bhatt, (2014), An Introduction to Operating Systems: Concepts and Practice (GNU/Linux), 4th edition
2) Avi Silberschatz, Peter Baer Galvin, Greg Gagne, (2009), *Operating System Concepts with Java* Eight Edition, John Wiley & Sons, Inc., http://codex.cs.yale.edu/avi/os-book/OS8/os8j
3) Evi Nemeth, Garth Snyder, Tren Hein, Ben Whaley, (2011), *UNIX and Linux System Administration Handbook*, Fourth Edition, Pearson Education, Inc.
4) Reto Meier, (2012), *PROFESSIONAL Android™ 4 Application Development*, John Wiley & Sons, Inc.

REFERENCE BOOKS:

1) Andrew S. Tanenbaum, Albert S. Woodhull, (2006), *Operating Systems: Design and Implementation*, Third Edition, Prentice Hall, 2006.
2) Fedora Documentation, http://docs.fedoraproject.org/en-US/index.html
3) Official Ubuntu Documentation, https://help.ubuntu.com/
4) Android Developers, http://developer.android.com/index.html

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COURSE: SWAYAM OR OTHER ONLINE COURSES

Course Objectives:

Through the medium of online courses we aim to:

- Offer high quality, job-relevant online education to students
- Engage learners in the learning process by better user-accessibility and time flexibility.
- Help the students in their endless pursuit of knowledge through online resources such as videos, research papers, books, articles & course modules
- Provide a user-friendly platform for learner that can help them in achieving their goals in their desired working area.

LEARNING OUTCOMES:

On completion of the online course, the student will be able to:

- Earn credits on completion of the course
- Learn courses that are valuable to them professionally and personally & enhance their employability quotient
- Graduate with an industry-relevant university credential

Code No.	Course	TC	Th C	Tu C	Int	Ext	Total
MCS09	SWAYAM OR OTHER ONLINE COURSES	4	2	2	50	50	100

Sr. No.	Name of the Course	Portal	Duration	Enrolment date	Exam date
1	Introduction to Operating System By Prof. Chester Rebeiro – IIT Madras	NPTEL	8 weeks	14 Sep 2020	18 Dec 2020
2	Computer Architecture And Organization Prof. Indranil Sengupta, Prof. Kamalika Datta – IIT Kharagpur	NPTEL	12 weeks	20-May-2020 to 21-Sep-2020	19-Dec-2020
3	Object Oriented System Development using UML, Java and Patterns Prof. Rajib Mall - IIT Kharagpur	NPTEL	12 weeks	20-May-2020 to 21-Sep-2020	19-Dec-2020
4	Introduction to Internet of Things (IOT) Prof. Sudip Misra - IIT Kharagpur	NPTEL	12 weeks	20-May-2020 to 21-Sep-2020	20-Dec-2020
5	Software Testing Prof. Meenakshi D'souza - IIIT Bangalore	NPTEL	12 weeks	20-May-2020 to 21-Sep-2020	20-Dec-2020
6	Linux Operating System Prof. Kannan Moudgalya – Principal	AICTE	12 weeks	27 Mar 2020	

	Investigator of Spoken Tutorial Project, IIT Bombay				
7	Programming in C++ Prof. Partha Pratim Das – IIT Kharagpur	AICTE	8 weeks	14-Sep-2020 to 21-Sep-2020	18-Dec-2020
8	Computer Graphics Prof. Samit Bhattacharya – IIT Guwahati	AICTE	8 weeks	14-Sep-2020 to 21-Sep-2020	19-Dec-2020
9	Database Management System Prof. Partha Pratim Das, Prof. Samiran Chattopadhya - IIT Kharagpur	NPTEL	8 weeks	14-Sep-2020 to 21-Sep-2020	18-Dec-2020
10	Data Stuctures & Algorithms using Java Prof. Debasis Samanta - IIT Kharagpur	NPTEL	12 weeks	14-Sep-2020 to 21-Sep-2020	19-Dec-2020

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