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 – IV (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.

M.Sc. (COMPUTER SCIENCE) SEMESTER - IV (SECOND YEAR)

Code	Subject Title	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS401	Cloud Computing	4	-	2	2	4	2
MCS402	Elective II	4	-	2	2	4	2
MCSL403	Research Paper Writing	-	4	2	2	4	-
MCSL404	Software Project	-	12	6	6	12	-
	Total	**8**	**16**			**24**	**-**

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

Elective II	
Course Code	**Course Nomenclature**
MCS402A	Digital Image Processing
MCS402B	Robotics
MCS402C	Blockchain Technology
MCS402D	Modeling and Simulation

COURSE: CLOUD COMPUTING

CREDIT - 04

Objectives:
- To learn the concept of parallel and distributed computing
- To enable the students to gain knowledge of cloud-based computing technologies
- To learn to deploy cloud-based computing environment

Outcomes:

The students will be able to:
- Design and implement software application in a cloud environment.
- Manipulate large data sets in a parallel computing environment.

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS401	Cloud Computing	4	-	2	2	4	2

Module No.	Objective	Content	Evaluation
1	To elaborate the concept of parallel and distributed computing and virtualization	**Parallel, Distributed Computing and Virtualization** Elements of parallel computing, elements of distributed computing, Technologies for distributed computing: RPC, Distributed object frameworks, Service oriented computing, Virtualization – Characteristics, taxonomy, virtualization and cloud computing.	Unit Test-1 (Marks-25)
2	To introduce students with cloud computing services	**Computing Platforms and Cloud technologies** Cloud Computing definition and characteristics, Enterprise Computing, The internet as a platform, Cloud computing services: SaaS, PaaS, IaaS, Enterprise architecture, Types of clouds, Cloud computing platforms, Web services, AJAX, mashups, multi-tenant software, Concurrent computing: Thread programming, High-throughput computing: Task programming, Data intensive computing: Map-Reduce programming.	Oral Presentation (Marks 10)
3	To demonstrate the use of cloud-based software architecture	**Software Architecture** Dev 2.0 platforms, Enterprise software: ERP, SCM, CRM, Custom enterprise applications and Dev 2.0, Cloud applications.	Class Test (Marks 10)
4	To demonstrate the use of cloud-based services provider	**Amazon Web Services (AWS) Essentials** Architecting on AWS, building complex solutions with Amazon Virtual Private Cloud (Amazon VPC), Leverage bootstrapping and auto configuration in designs, Architect solutions with multiple regions, Employ Auto Scaling design patterns, Amazon CloudFront for caching, Big data services including AWS Data Pipeline, Amazon Redshift and Amazon Elastic MapReduce. AWS OpsWorks.	Assignment (Marks 05)

EVALUATION:
1) On Four Modules of 50 marks
2) Final examination of 50 marks
3) Total marks = Internal 50 + External 50 = 100

TEXT BOOKS:

1) Gautam Shroff, (2010), *Enterprise Cloud Computing Technology, Architecture, Applications*, Cambridge University Press

2)   Mastering In Cloud Computing, Tata Mcgraw-Hill Education, 2013

REFERENCE BOOKS:

1)   Rajkumar Buyya, Christian Vecchiola And Thamari Selvi S, (2009), *Cloud Computing: A Practical Approach, Anthony T Velte*, Tata Mcgraw Hill
2)   Michael J. Kavis, (2014), *Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)*, Wiley CIO
3)   Kris Jamsa, Jones (2013), *Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More,* Bartlett Learning
4)   AWS Training, http://aws.amazon.com/training.

_____

COURSE: ELECTIVE II – DIGITAL IMAGE PROCESSING

CREDIT - 4

Objectives:
- To enable the understand the concepts of output primitives of Computer Graphics.
- To Learn 2 D and 3 D graphics Techniques.
- To Study various Image Processing techniques

Outcomes:
The students will be able to:
- Understand various 2D Geometric Transformations & Clipping,
- Understand the basic 3D Concepts & Fractals, Introduction of Animation, Image Enhancement Techniques

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	**Pr./ Tu**	**Int.**	**Ext.**	**Total**	
MCS402A	**Digital Image Processing**	**4**	**-**	**2**	**2**	**4**	**2**

Module No.	Objective	Content	Evaluation
1	To introduce students to image processing concepts	**Introduction** Fundamental Steps in Digital Image Processing: Components of an Image Processing System, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-Level Resolution.	Written Unit Test – I (Marks 25)
2	To demonstrate techniques of image enhancement	**Image Enhancement in the Spatial Domain** Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, and PowerLaw Transformations. Piecewise-Linear	Assignments will be given for the above topics. (Marks 5)

3	To demonstrate the concept of transformation of image	**Transformation Functions** Contrast stretching, Gray-level slicing, Bit plane slicing. Histogram Processing: Image Histogram and Histogram Equalization, Image Subtraction, and Image Averaging.	Assignments will be given for the above topics. (Marks 5)
4	To elaborate filtering concept	**Spatial Filtering** Basics of Spatial Filtering, Smoothing Spatial Filters Smoothing Linear Filters, Order-Statistics Filters. Sharpening Spatial Filters: Use of Second Derivatives for Enhancement–The Laplacian, Unsharp masking and High-Boost Filtering: Use of First Derivatives for (Nonlinear) image sharpening - The Gradient– Robert, Prewitt and Sobel Masks. Combining Spatial Enhancement Methods.	Online Class test will be conducted. (Marks 15)

EVALUATION:
1) On Four Modules of 50 marks
2) Final examination of 50 marks
3) Total marks   = Internal 50 + External 50 = 100

TEXT BOOKS:

1) Amrendra Sinha, ArunUdai, (2007), *Computer Graphics* –Tata McGraw-Hill Education
2) Rajesh K. Maurya- Computer Graphics -- Wiley India Pvt. Limited, 2011

REFERENCE BOOKS:

1) Donald Hearn and M Pauline Baker, (2007), *Computer Graphics C Version -- Computer Graphics, C Version*, 2/E, Pearson Education.
2) Rafael C. Gonzalez and Richard E. Woods, (2010), *Digital Image Processing* (3rd Edition), Pearson Education.
3) Roy A. Plastock, Roy A. Plastock- (2009), *Schaum's Outline of Computer Graphics* 2/E
4) James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes,(2000), *Computer Graphics: Principles and Practice in C,* Pearson Education.
5) David F. Rogers, James Alan Adams, (1990), *Mathematical elements for computer graphics, McGraw-Hill*
6) Peter Shirley, Stephen Robert Marschner (2009) *Fundamentals of Computer Graphics* A K Peters, Limited, 3rd ed.
7) Anil K. Jain, (1989), *Fundamentals of digital image processing*, Prentice Hall

---

COURSE: ELECTIVE II – ROBOTICS
CREDIT - 4

Objectives:
- To enable students to design an agent that is Robot

- To enhance understanding in implementation of Robot

Outcomes:
The students will be able to:
- Understand Robots design and implementation in detail
- Understand detailed working of Robot

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS402B	**Robotics**	4	-	2	2	4	2

Module No.	Objective	Content	Evaluation
1	To study the basics of the robot and the theory behind it.	**Introduction to Robotics** What is a Robot? Definition, History of Robots: Control Theory, Cybernetics, Grey Walter Tortoise, Analog Electronic Circuit, Reactive Theory, Braitenberg's Vehicle, Artificial Intelligence, Vision Based Navigation, Types of Robot Control.	Written Unit Test – I (Marks 25)
2	To study the different components of the Robot and the actions the robot would perform	**Robot Components** Embodiment, Sensors, States, Action, Brains and Brawn, Autonomy, Arms, Legs, Wheels, Tracks, and What really drives them effectors and actuators: Effector, Actuator, Passive and Active Actuation, Types of Actuator, Motors, Degree of freedom Locomotion: Stability, Moving and Gaits, Wheels and Steering, Staying on the path. Manipulators: End effectors, Teleoperation, why is manipulation hard? Sensors: Types of Sensors, Levels of Processing, Passive and Active sensors, Switches, Light sensors, Resistive position sensor.	Assignments will be given for the above topics. (Marks 5)
3	To elaborate on sensing through Sonar, Lasers and Cameras	**Sonar, Lasers and Cameras** Ultrasonic and Sonar sensing, Specular Reflection, Laser Sensing, Visual Sensing, Cameras, Edge Detection, Motion Vision, Stereo Vision, Biological Vision, Vision for Robots, Feedback or Closed Loop Control: Example of Feedback Control Robot, Types of feedback control, Feed forward or Open loop control.	Assignments will be given for the above topics. (Marks 5)
4	To study languages to program Robot	**Languages for Programming Robot** Algorithm, Architecture, many ways to make a map, what is planning, Cost of planning, Reactive systems, Action selection, Subsumption architecture, How to sequence behavior through world, hybrid control, Behavior based control and	Online Class test will be conducted. (Marks 15)

		Behavior Coordination, Behavior Arbitration, Distributed mapping, Navigation and Path planning.	

EVALUATION:
1) On Four Modules of 50 marks
2) Final examination of 50 marks
3) Total marks   = Internal 50 + External 50 = 100

TEXT BOOK:

1) Deepak Khemani, (2013), *A First course in Artificial Intelligence*, Tata McGraw Hill Education (India) private limited

REFERENCE BOOKS:

1) Maja J Matarić, (2007), *The Robotics Primer*, MIT press Cambridge, Massachusetts, London, England
2) Milan Sonka,Vaclav Hlavac, Roger Boyle, *Image Processing, Analysis, and Machine Vision*, Thomson Learning
3) Robert Haralick and Linda Shapiro, *Computer and Robot Vision*, Vol I, II, Addison-Wesley, 1993.

COURSE: ELECTIVE – BLOCKCHAIN TECHNOLOGY

CREDIT - 4

Objectives:
- To elaborate the functional/operational aspects of cryptocurrency ECOSYSTEM.
- To Understand emerging abstract models for Blockchain Technology.
- To Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain

Outcomes:
The students will be able to:
- Understand various Blockchain, Ethereum Blockchain, and Algorithms and Techniques
- Understand the concept of Trust Essentials, Hyperledger, Smart Contracts, Fabric Composition

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	

MCS402C	Blockchain Technology	4	-	2	2	4	2

Module No.	Objective	Content	Evaluation
1	To introduce students to Blockchain technology and its fundamentals	**Introduction to centralized/decentralized currency** Intent of centralized/decentralized currency, the consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)	Written Unit Test – I (Marks 25)
2	To introduce students to the basics of cryptography and cryptocurrency	**Cryptographic basics for cryptocurrency** Short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography, Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin	Assignments will be given for the above topics. (Marks 5)
3	To elaborate the concept of EVM	**Ethereum** Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts.	Assignments will be given for the above topics. (Marks 5)
4	To demonstrate new trends in Blockchain technology	**Trends and Topics** Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.	Online Class test will be conducted. (Marks 15)

EVALUATION:
1) On Four Modules of 50 marks
2) Final examination of 50 marks
3) Total marks   = Internal 50 + External 50 = 100

TEXT BOOKS:
1) Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016

REFERENCE BOOKS:
1) Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015

2)   J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310. (eprint.iacr.org/2016/1048)

3)   R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017, (eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles). 4. R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint.iacr.org/2016/916).

_____

COURSE: ELECTIVE – MODELING AND SIMULATION

CREDIT - 4

Objectives:
- To provide basic understanding of Modeling and Simulation
- Students will find it easy to use this knowledge in profession for applying to various systems and design

Outcomes:

The students will be able to:
- Understand the techniques of modeling in the context of hierarchy of knowledge about a system and develop the capability to apply the same to study systems
- Students will learn different types of simulation techniques.

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCS402D	Modeling and Simulation	4	-	2	2	4	2

Module No.	Objective	Content	Evaluation
1	Students will study the basics of modeling paradigms appropriate for conducting simulations.	**Simulation Concepts** Systems, modeling, general system theory, concept of simulation, simulation as a decision-making tool, types of simulation.	Written Unit Test – I (Marks 25)
2	Students will learn various distributions and testing of random numbers	**Random Numbers** Pseudo random numbers, methods of generating random varieties, discrete and continuous distributions, testing of random numbers.	Assignments will be given for the above topics. (Marks 5)
3	Students will understand the concept of designing simulation experiments	**Design and simulation experiments** Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size,	Assignments will be given for the above topics.

		experimental design consideration, output analysis and interpretation validation.	(Marks 5)
4	Students will learn various simulation-based case studies	**Simulation Languages and Case Studies** Comparison, and selection of simulation languages, study of any one simulation language, development simulation models using the simulation language studied for systems like queuing systems, production systems, inventory systems.	Online Class test will be conducted. (Marks 15)

EVALUATION:
1) On Four Modules of 50 marks
2) Final examination of 50 marks
3) Total marks = Internal 50 + External 50 = 100

TEXT BOOKS:

1. Ross, (2010), *Simulation*, 4e, Elsevier, ISBN-9788131214626

REFERENCE BOOKS:

1. Zeigler, *Theory of Modeling and Simulation*, 2e, Elsevier, ISBN-9788131207406
2. Birta, *Modeling and Simulation: Exploring Dynamic System Behaviour*, Springer, IBSN978-81-8489-365-6
3. Jerry Banks and John, S. Carson, *Discrete Event System Simulation,* PHI
4. Shannon, R.E., *Systems Simulation, The Art and Science*, PHI

_____

COURSE: RESEARCH PAPER WRITING

CREDIT - 4

Objectives:
- To enable the students to gain experience of identification of research problem
- To perform research to solve real time problem using new technologies

Outcomes:
The students will be able to:
- Understand various processes involved in writing research paper
- Write research paper in specified format

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCSL403	**Research Paper Writing**	-	**4**	**2**	**2**	**4**	-

Module No.	Objective	Content	Evaluation
1	To help students to identify research problem	Research Problem Identification and Literature Review	Presentation (Marks 10)
2	To design the experiment to be conducted	Research Design	Presentation (Marks 10)
3	To conduct experiment after data collection	Data Collection, Experiment Conducted	Presentation (Marks 15)
4	To perform analysis and presentation of results	Data Analysis and Result Presentation	Presentation (Marks 15)

EVALUATION:
1) On Four Modules of 50 marks
2) Final examination of 50 marks
3) Total marks   = Internal 50 + External 50 = 100

TEXT BOOKS:
1) Brinoy J Oates, (2006), *Researching Information Systems and Computing*, Sage Publications India Pvt Ltd

REFERENCE BOOKS:
1) Kothari, C.R., (1985), *Research Methodology*, Methods and Techniques, third edition, New Age International
2) Juliet Corbin & Anselm Strauss, (2008), *Basic of Qualitative Research* (3rd Edition), Sage Publications
3) Willkinson K.P, L Bhandarkar, (2010), *Formulation of Hypothesis*, Hymalaya Publication, Mumbai
4) John W Best and V. Kahn, (2010), *Research in Education*, PHI Publication.

_____

COURSE: SOFTWARE PROJECT

CREDIT: 12

Objectives:
- Achieve hands on experience in an organization
- Relate classroom and textbook learning to the real world.
- Learn the professional skills and interpersonal relationship in professional environment

Outcomes:
The students will be able to
- Attain an exposure to real life organizational and environmental situations
- Attain technical skills as per the requirements of the domain
- Adapt professional and interpersonal ethics.

- Articulate SDLC phases in developing software project and in writing the project document.

Code	Course	Teaching Period / Week		Credit			Duration of Theory Exam (in Hrs.)
		L	Pr./ Tu	Int.	Ext.	Total	
MCSL404	Software Project	-	12	6	6	12	-

Module No.	Objective	Content	Evaluation
1	To help students to identify problem, check its feasibility, gather requirements and analyse them	Problem Identification, Feasibility study, Requirement Gathering, Requirement Analysis	Presentation 1 (50 marks)
2	To help students to plan project activities	Project planning, design	Presentation 2 (30 marks)
3	To perform software coding and testing	Project Coding and Testing	Presentation 3 (20 marks)
4	To present the developed software	Final Presentation of the Project	Presentation 4 (50 marks)

EVALUATION:
1) On four Modules of 150 marks
2) Final examination of 150 marks
3) Total marks   = Internal 150 + External 150 = 300

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

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

■■■