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MSc(IT) Program

Master of Science (Information Technology) is an intensive program designed for students who wish to pursue a professional career in Information Technology. The courses have been carefully designed to guide the student through basic concepts up to current practices in industry. Hands-on laboratory experience is emphasized at every stage of the program. The program requires the student to do foundational courses in the first two semesters. In the third semester, student can take some electives along with two core courses. In the first year of their summer break, they have to undertake an industrial internship in IT industry. The fourth semester is for their project work. Typically, we encourage students of this program to pursue their projects in industry. The placement cell helps them in placing them suitably in industries for their internship and project work. After going through this program, a graduate of this program can expect to build a satisfying career in the challenging field of Information Technology - as software engineer, analyst and system designer.

Programme Outcomes (POs)

As stated by NBA, POs represent the knowledge, skills and attitudes the students should have acquired at the end of the programme.

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

PSO1: To apply the theoretical concepts of information technology and practical knowledge in analysis, design and development of computing systems and interdisciplinary applications.

PSO2: To work as a socially responsible professional by applying ICT principles in real-world problems.

Programme Educational Objectives (PEOs)

PEO1: To prepare students with application oriented knowledge of core principles in areas of information technology.

PEO2: To prepare students to solve real-world problems using modern tools and research inputs.

PEO3: To prepare students with the necessary theoretical background and technical skills to work professionally as software engineer, system analyst, entrepreneur, software developer, and teaching professionals.

PEO4: To prepare students who will be socially responsible citizen with ethical and leadership qualities and effective interpersonal skills.

Curriculum Structure

The M.Sc(IT) curriculum consists of 3 semesters of course work followed by a one-semester industrial internship. Program structure and course contents are periodically revised to cater need of dynamic IT industry. The program structure consists of core courses and basket of

electives. The distribution of courses for MSc (IT) degree is as under:

Subject area	No. of credits
Programme Core courses	48
Elective courses	11
Internship/project	20
Total credits	**79**

- Total Credits requirement – 79 for graduation.
- Course credit - 59
- Internship/Project credit – 20
- 52% of the total credit is for domain knowledge in IT
- 14% of the total credit is for professional electives
- 9% of the total credit is for Humanities and Social Sciences
- 25% of the total credit is for Internship/Project

Semester wise curriculum structure:

Semester-I		
SC612	Discrete Mathematics	3-1-0-4
IT603	C Programming	3-0-2-4
IT616	Algorithms and Data Structures	3-1-0-4
IT615	Database Management Systems	3-0-2-4
PC613	Communication Skills	3-0-2-4
Semester I Credits: 15-2-6-20		
Semester-II		
IT602	Object Oriented Programming	3-0-2-4
IT632	Software Engineering	3-0-2-4
IT6??	Systems Programming	3-0-2-4
IT694	Computer Networks	3-0-2-4
IT6??	Web Programming	3-0-2-4
Semester II Credits: 15-0-10-20		
Summer-I		
PC649	Summer Internship (4 credits)	Pass/Fail
Semester-III		
IT619	Design of Software Systems	3-0-2-4
IT618	Enterprise Computing	3-0-2-4
	Technical Elective-I	3-0-2-4
	Technical Elective-II	3-0-2-4
	Open Elective-I	3-0-0-3
Semester III Credits: 15-0-8-19		
Semester-IV		
PC641	Project Internship (16 credits)	Pass/Fail

Core Course Descriptions

SC612 Discrete Mathematics (3-1-0-4)

The objective of the course to build mathematical background needed for better understanding of computing techniques studied in various courses of the program. This course begins with quick revision of Logic, Sets, Relations and Functions, and provides a detailed discussion of Basics of counting (Permutations, Combinations, Recurrence relations, Solving Linear recurrence

relations), Discrete Probability (Basic probability theory, Bayes theorem, expected value and variance), and Graph theory (Graph and graph models, graph representations, basic graph problems like traversals, shortest path and Euler paths)

IT603 C Programming (3-0-2-4)

This course introduces basic concepts of computer programming and phases of program development, deployment and testing to solve computational problems. Topics include: problem solving techniques, flow charts, decision tables and C programming. At the end of the course, student will be able to develop logical analytical ability to perceive and solve computational problems; to write and test computer programs developed with C programming language; and to work effectively with various computer software tools like editors, compilers, office automation, imaging, etc.

IT616 Algorithms and Data Structure (3-0-2-4)

Asymptotic analysis: Big O, little o, omega, and theta notation, worst case and average case analysis, and solving recurrences. Algorithm Design Techniques: Brute-force algorithms, Divide-and-conquer, Dynamic programming, Greedy algorithms, Backtracking and Heuristics. ADTs that covered are Lists, Stacks, Queues, Trees, and Graphs. Sorting and Searching, Binary search trees, Hashing, Graph representations, Graph Algorithms (DFS, BFS, Shortest- path (Dijkstra's and Floyd's algorithms), Minimum spanning tree (Prim's and Kruskal's algorithms) and Topological sort.

IT615 Database Management Systems (3-0-2-4)

This course is intended to give a solid background in database design and implementation with the focus on relational model. The course covers data modeling, theory of relational model, Functional Dependencies, and Normalization, Querying relational databases using Relational Algebra and SQL. Students also learn and practice creating stored procedures, accessing databases in host programming languages. The course also introduces Storage and Indexing structures, Query Execution and Transaction Processing concept. During Lab hours, students should practice concepts learned in theory and would be asked to design and implement a database system for a mid-size real life scenario.

PC613 Communication Skills (3-0-2-4)

This course is designed to provide students with (a) the skills to enhance communication – both verbal and written, as well as presentations skills, (b) skills for job interviews (c) self- motivation and measurable goal setting, (d) professional behavior, and (e) principles of consultation as an appropriate tool for relating to others.

IT602 Object Oriented Programming (3-0-2-4)

The objective of this course is to discuss object oriented programming paradigms and implementation of common data structures using OOP language like C++ or Java. Topics include: Objects and Classes, Attributes, Methods, Visibility; Class Relationships, Association, Aggregation, Composition; OOP principles (Abstraction, Information Hiding, Encapsulation, Inheritance, Polymorphism). This course is about programming in Java. Java is the most widely used language for developing open source software systems. With Java, there comes huge library support which reduces the development time and enhances software reuse for faster development.

IT632 Software Engineering (3-0-2-4)

The course intends to teach complete life cycle of software develop. The course covers Software Processes and SDLCs; Requirements Engineering; Software Testing, Verification and Validation; Software Evolution; CASE Tools; Introduction to Software Project Management, Appreciate Software Reliability and Risk Assessment; Software Quality Standards and Quality Assurance.

IT6?? Systems Programming (3-0-2-4)

The purpose of this course is to provide the students with an introduction to system-level programming in a UNIX environment. Students will be introduced with the standard Linux commands, memory management, interacting with the operating system by making system calls for file management, file execution, process control, and interprocess communication, shell scripting, Sockets and using TCP/IP, Shell principles, exec family of functions, naming conventions, and so on. A primary goal of the course then is to train the students in a systems programming context to develop code that is robust.

IT694 Computer Networks (3-0-2-4)

The course explains the evolution of computer and communication networks and

the design principles of modern network architectures. Focus is on application layer protocol design and implementation along with system level concepts and engineering design and implementation issues. A top down approach is used to familiarize students with network application design and progressively define the underlying support needed to build such application. A thorough treatment of TCP/IP set of protocols is done. At the end of the course, a student should be able to design and develop a wide variety of network applications. Students will also be able to analyze and compare network technologies and use the appropriate tools to design network systems. The associated laboratory component is designed to expose students to basic networking hardware and software along with configuration and operation of standard network protocols. They will also design and develop network applications and test network performance.

IT629 Web Programming (3-0-2-4)

The objective of this course is to discuss the structured approaches to identify the needs, interests, and functionality of a webpage using various technologies such as JavaScript, CSS and HTML. This course covers the most current tools available for developing HTML documents and posting pages on the World Wide Web in order to improve the users experience in different perspectives; use of JavaScript libraries (e.g. JQuery) to create dynamic pages; use JavaScript to access and use web services for dynamic content (AJAX, JSON, etc.).

IT619 Design of Software Systems (3-0-2-4)

The objective of the course is to teach good software design practices at architectural level as well as component level. Prime focus is on designing software systems using object oriented principals. The scope of course begins with given software requirements and ends with producing a detailed design in software development life cycle. Emphasis is on learning Unified Modeling Language from the ground; students should be able draw UML diagrams using very basic tools like Dia. Students are encouraged to take a mid-size software design projects, submit detailed design and take up to the implementation. Students also learn and attempt to apply common design patterns.

IT618 Enterprise Computing (3-0-4-5)

Objective of the course is to learn whole array of java technologies for building enterprise applications. The course intends to provide lots of hands, and students are engaged in developing mid-size projects drawn from real world, using J2EE

technologies. Technologies that are to be included are Core Java with Collections, Swing, and JDBC API; HTML, XML, JSP/Servlet. Use of MVC frameworks like Apache Struts for building java based web applications. Students are also exposed to various J2EE patterns.

Internships

Internships should play a major role in accomplishing the objective of project based re- enforcement of concepts learned in various courses. Students of this program are to take following two internships –

1. PC649. Summer Internship in first summer semester for about six weeks (Pass/Fail).
2. PC641. Project Internship - Full time in Final Semester (Pass/Fail).

Students are expected to do these internships at the industry; however, students having inclination towards research can do with some faculty members as well.

Technical Electives:

Technical Elective courses offered for M.Sc.(IT) students are drawn from recent industry practices and research topics. M.Sc.(IT) students are required to take three technical elective courses. Below is typical list of technical electives:

- Coding Theory by Example
- Data Mining and Warehousing
- Human Computer Interface
- Quantitative Analysis
- Optimization
- Management Information Systems
- Games, Simulation and Modeling
- Approaches to Semantic Web
- Introduction to Artificial Intelligence

Open Electives:

Students are required to take one open elective offered in BTech program. It can be from

Science, Management, Business or Social Sciences area.

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