PROGRAMME PROJECT REPORT
Master of Computer Application
(Two Years)
(In Accordance with NEP-2020)

SCHOOL OFCOMPUTER AND INFORMATION SCIENCES
U. P. Rajarshi Tandon Open University
Prayagraj

Contents

1. Master's Degree Programme

The National Education Policy (NEP) 2020 envisions a new vision that enable an individual to study one or more specialized areas of interest at a deep level, and also develop capabilities across a range of disciplines including sciences, social sciences, arts, humanities, languages, as well as professional, technical, and vocational subjects. The NEP 2020 focuses on the formulation of expected learning outcomes for all higher education programmes. It states that "National Higher Education Qualifications Framework (NHEQF)" shall be align with the National Skills Qualifications Framework (NSQF) to ease the integration of vocational education into higher education. It also points out that higher education qualifications leading to a degree/diploma/certificate shall be described by the NHEQF in terms of Outcome Based Education (OBE).

The Program's thrust is to provide the students a sound background in theoretical and skill-oriented courses relevant for productive careers in software industry, corporate sector, Govt. organizations and academia. The program emphasizes providing skill-based environment for teaching and research in the core and emerging areas of software technology to solve mathematical, computing, communications/networking and commercial problems. This Master's Degree Program has been designed with a semester approach in mind. The1 st semester of first year courses are aimed at skills development in computers using various technologies while the second semester of first year is more focused on core courses providing conceptual frame work and the third and forth semester of second year provides the specialization and the project work. A two-year degree (Four-semesters) in Computer Applications will get skills and information not only about Computer and Information Technology but also in communication, organization and management.

One also gets to learn programming languages such as C, C++, Java, SQL, Php, Python, front-end and back-end design etc. Information about various computer applications and latest developments in IT and communication systems is also provided. The Master of Computer Application Programme has been designed to supply trained manpower it ever growing IT and IT Enabled industry.

2. Master of Computer Application Programme

The structure and duration of postgraduate programme of Master's in Computer Applications include following certification:

- Level 9: a MCA (Master of Computer Application) programmee after 2 years (4 semesters) of study;

2.1 Programme Mission & Objectives:

In line with the mission of the University to provide flexible learning opportunities to all, particularly to those who could not join regular colleges or universities owing to social, economic and other constraints, the 2-year Post-Graduate Programme in Computer Application aims at providing holistic and value-based knowledge and guidance to promote scientific temper in everyday life. The program offers a platform to the learners to fulfill the eligible criteria in various jobs in government and private sector.

The Master in Computer Applicaions Programme aims at the following objectives:

The MCA Programme is designed to enhance employability by preparing students for careers in

Computer science and leadership in both the private and public sectors. Students acquire a comprehensive foundation in the fundamentals of computer applications, the environment in which they will function, the analytical tools for intelligent decision-making and problem solving. Specifically:

- Produce knowledgeable and skilled human resources which are employable in IT and ITES.
- Impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or application.
- Produce entrepreneurs who can develop customized solutions for small to large Enterprises.
- To develop academically competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that compassionately foster the scientific temper with a sense of social responsibility.
- To develop students to become globally competent.
- To inculcate Entrepreneurial skills among students

2.2 Relevance of the Programme with Mission and Goals

- ✓ To produce knowledgeable and skilled human resources which are employable in IT industry.
- ✓ To impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or applications.
- ✓ To produce entrepreneurs who can develop customized solutions for small to large enterprises.
- ✓ To develop competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that foster the scientific temper with a sense of social responsibility.
- ✓ To train students to become globally competent and employable.

2.3 Nature of Prospective Target Group of Learners

The Program is targeted to all individuals looking to earn a post graduation degree for employment, further higher education, promotion in career, professional development.

2.4 Appropriateness of Programme to be conducted in ODL mode to acquire specific skills & competence

Learning outcomes after Level 9		
Learning Outcomes	**Elements of the descriptor**	**Level 9 (Master in Computer Application)**
LO 1	Knowledge and understanding	• Advanced knowledge about a specialized field of enquiry with a critical understanding of the emerging developments and issues relating to one or more fields of learning, • Advanced knowledge and understanding of the research

		principles, methods, and techniques applicable to the chosen fields of learning or professional practice, • procedural knowledge required for performing and accomplishing complex and specialized professional tasks relating to teaching, and research and development.
LO 2	Skills required to perform and accomplish tasks	• advanced cognitive and technical skills required for performing and accomplishing complex tasks related to the chosen fields of learning, • advanced cognitive and technical skills required for evaluating research findings and designing and conducting relevant research that contributes to the generation of new knowledge, • specialized cognitive and technical skills relating to a body of knowledge and practice to analyse and synthesize complex information and problems.
LO 3	plication of knowledge and skills	• apply the acquired advanced theoretical and/or technical knowledge about a specialized field of enquiry or professional practice and a range of cognitive and practical skills to identify and analyse problems and issues, including real-life problems, associated with the chosen fields of learning.
LO 4	neric learning outcomes	• listen carefully, read texts and research papers analytically and present complex information in a clear and concise manner to different groups/audiences, • communicate, in a well-structured manner, technical information and explanations, and the findings/ results of the research studies undertaken in the chosen field of study, • meet one's own learning needs relating to the chosen fields of learning, work/vocation, and an area of professional practice, • pursue self-paced and self- directed learning to upgrade knowledge and skills, including research-related skills, required to pursue higher level of education and research.
LO 5	nstitutional, humanistic, ethical and moral values	• embrace and practice constitutional, humanistic, ethical and moral values in one's life, • adopt objective and unbiased actions in all aspects of work related to the chosen fields/subfields of study and professional practice, • participate in actions to address environmental protection and sustainable development issues,
LO 6	nployment ready skills, and entrepreneurship skills and mindset	• adapting to the future of work and responding to the demands of the fast pace of technological developments and innovations that drive shift in employers' demands for skills, particularly with respect to transition towards more technology-assisted work involving the creation of new forms of work and rapidly changing work and production processes. • exercising full personal responsibility for output of own work as well as for group/ team outputs and for managing work that are complex and unpredictable requiring new strategic approaches.

2.5 Instructional Design

2.5.1 2-year MCA.- Master of Computer Application Programme Structure

The University follows the credit system in all its programmes. One credit is equal to 30 hours of learner's study time which is equivalent to 15 lectures in conventional system. To earn a Master's Degree, a learner has to earn 80 credits in minimum four semesters (two years) with 20 credits per semester. For earning 80 credits, a learner has to go through the following Programme Structure:

Programme Structure of Master of Computer Application

Level	**Year**	**Sem**	**Core Course 1**	**Core Course 2**	**Core Course 3**	**Core Course 4**	**Core Course 5**	**Practical Lab**	**Value Added / Elective Course/ Project**	**Total credit**
8	1	1st	4	4	4	4	4	4	4 (Value added)	**28**
		2nd	4	4	4	4	4	4	4 (DCE)	**28**
9	2	3rd	4	4	4	4	4	4	4 (DCE)	**28**
		4th	4	4	4	4	4	4	4 (Project)	**28**
Total credit			**16**	**16**	**16**	**16**	**16**	**16**	**16**	**112**

Explanation of terms used for categorization of courses:

A. **Course 1 to 5 and value added/Elective/Moocs course :** A course, which should compulsorily be studied by a learner as a core requirement is termed as a Core course.

B. **Practical Lab:** Lab based on theory courses for implementing the algorithms discussed in theory papers.

C. **Dissertation(project) Viva-voce/Internship:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work,.

2.5.2 Course curriculum: The details of syllabus is given in Appendix-I

2.5.3 Language of Instruction: English. However, learner can write assignment and give Term End Examination (TEE) either in Hindi or English.

2.5.4 Duration of the Programme

Minimum duration in years: 02 **Maximum duration in years**: 04

2.5.5 Faculty & Support Staff

Professor (1), Assistant Professor/Asst. Professor (contractual) (4) and support staff (3)

2.6 Instructional Delivery Mechanisms

The Open University system is more learner-oriented, and the student is an active participant in the teaching-learning process. Most of the instructions are imparted through distance rather than face-to-face communication.

The University follows a multi-media approach for instruction. It comprises of:

- self-instructional printed material (Self Learning Material)
- audio and video lectures
- face-to-face counselling
- assignments
- laboratory work
- Project work in some courses
- teleconference/web conference
- Web Enabled Academic Support Portal
- e-GYANSANGAM (Open Educational Repository): gyansangam.uprtou.ac.in
- e-GYANARJAN: Its a Learning Management System based on Moodle (gyanarjan.uprtou.ac.in) to aid the learner through web conferencing, sharing of learning resources, counselling classes etc.

2.6.1 Self-Learning Material

The Self Learning Material (SLMs) are prepared in line with the UGC guidelines on preparation of SLMs. The prepared study materials are self-instructional in nature.

The course material is divided into blocks. Each block contains a few units. Lessons, which are called Units, are structured to facilitate self-study. The units of a block have similar nature of contents. The first page of each block indicates the numbers and titles of the units comprising the block. In the first block of each course, we start with course introduction. This is followed by a brief introduction to the block. After the block introduction, emphasis is given on contribution of ancient Indian knowledge into that specific course. Next, each unit begins with an introduction to talk about the contents of the unit. The list of objectives are outlined to expect the learning based outcome after working through the unit. This is followed by the main body of the unit, which is divided into various sections and sub-sections. Each unit is summarized with the main highlights of the contents.

Each unit have several “Check Your Progress” Questions and Terminal Questions /exercises. These questions help the learner to assess his/her understanding of the subject contents. At the end of units, additional references/books/suggested online weblink for MOOCs/Open Educational Resources for additional reading are suggested.

2.6.2 Audio and Video lectures

Apart from SLM, audio and video lectures have been prepared for some courses. The audio-video material is supplementary to print material. The video lectures are available at YouTube channel of university web site www.uprtou.ac.in

2.6.3 Counselling Classes

The face to face (F2F) counselling classes are conducted at head quarter and study centers. The purpose of such a contact class is to answer some of questions and clarify the doubts of learner which may not be possible through any other means of communication. Well experienced counsellors at study centers provide

counselling and guidance to the learner in the courses that (s)he has chosen for study. The counselling sessions for each of the courses will be held at suitable intervals throughout the whole academic session. The time table for counselling classes are displayed at head quarter as well as by the coordinator of study center, however, attending counselling sessions is not compulsory. It is noted that to attend the counselling sessions, learner has to go through the course materials and note down the points to be discussed as it is not a regular class or lectures.

2.6.4 Assignments

The purpose of assignments is to test the comprehension of the learning material that learner receives and also help to get through the courses by providing self-feedback to the learner. The course content given in the SLM will be sufficient for answering the assignments.

Assignments constitute the continuous evaluation component of a course. The assignments are available at the SLM section of the home page of university website. In any case, learner has to submit assignment before appearing in the examination for any course. The assignments of a course carry 30% weightage while 70% weightage is given to the term-end examination (TEE). The marks obtained by learner in the assignments will be counted in the final result. Therefore, It is advised to take assignments seriously. However, there will be no written assignments for Lab courses.

2.6.5 Laboratory Work

Laboratory courses are an integral component of the MCA programme. While designing the curricula for laboratory courses, particular care has been taken to weed out experiments not significant to the present-day state of the discipline. Importance has been given to the utility of an experiment with respect to real life experience, development of experimental skills, and industrial applications. It is planned to phase the laboratory courses during suitable periods (such as summer or autumn vacations) so that in-service persons can take them without difficulty. Laboratory courses worth 4 credits will require full-time presence of the student at the Study Centre for one week continuously. During this time a student has to work for around 60 hours. Around 40 hours would be spent on experimental work and the remaining time will be used for doing calculations, preparations of records, viewing or listening to the video/audio programmes.

2.6.6 Teleconference/Web conference

Teleconference/web conference, using done through ZOOM/webex in form of online special counselling sessions is another medium to impart instruction to and facilitate learning for a distance learner. The students concerned would be informed about the teleconferencing schedule and the place where it is to be conducted by sending bulk SMS.

2.6.7 Web Enabled Academic Support Portal

The University also provide Web Enabled Academic Support Portal to access the course materials, assignments, and other learning resources.

2.6.8 e-GYANSANGAM

The e-GYAMSANGAM (UPRTOU-OER REPOSITORY) is an open access platform for educational resources that rely on the concept of 5Rs namely; Reuse, Revise, Remix, Retain and Redistribute. Uttar Pradesh Rajarshi Tandon Open University in support with Commonwealth Educational Media Centre for Asia initiated the implementation of philosophy behind the NEP-2020 to provide equitable use of technology to support learners (SDG4). This not only ensure inclusive and equitable quality education opportunities but also provide faculty to repurpose high quality open educational resources (OER) such that innovative, interactive and collaborative learning environment is built. UPRTOU believes the philosophy of Antyoday (reaching to last person of the society) and facilitate the learner by providing Self Learning Materials, Lecture Notes, Audio/video Lectures, Assignments, Course materials etc. through face-to-face mode as well as distance mode. This e-GYANSANGAM depository will fulfill the educational facilities through equitable use of technology to the learners.

Objectives

- To provide low-cost access model for learners. To foster the policy of reaching to unreached.
- To break down barriers of affordability and accessibility of educational resources.
- To give faculty the ability to customize course materials for learners.
- To provide equal access to affordable technical, vocational and higher education resources (SDG 4.3).
- To provide ubiquitous access to anyone. This will facilitate the quick availability of educational resources and reduces time.
- To supplement Self Learning Material (SLM).
- To reduce the mentor-mentee gap as depository provide access to number of local access as well as global access to educational resources.

2.6.9 e-GYANARJAN: It's a Learning Management System based on Moodle (gyanarjan.uprtou.ac.in) to aid the learner through web conferencing, sharing of learning resources, counselling classes etc.

2.6.10 Learner Support Service Systems

(a) Study Centre

A Study Centre has following major functions:

(i) Counselling: Counselling is an important aspect of Open University System. Face to face contact-cum-counselling classes for the courses will be provided at the Study Centre. The detailed programme of the contact-cum-counselling sessions will be sent to the learner by the Coordinator of the Study Centre. In these sessions learner will get an opportunity to discuss with the Counsellors his/her problems pertaining to the courses of study.

(ii) Evaluation of Assignments: The evaluation of Tutor Marked Assignments (TMA) will be done by the Counsellors at the Study Centre. The evaluated assignments will be returned to the learner by the Coordinator of Study Centre with tutor comments and marks obtained in TMAs. These comments will help the learner in his/her studies.

(iii) Library: Every Study Centre will have a library having relevant course materials, reference books suggested for supplementary reading prepared for the course(s).

(iv) Information and Advice: The learner will be given relevant information about the courses offered by the University. Facilities are also provided to give him/her guidance in choosing courses.

(v) Interaction with fellow-students: In the Study Centre learner will have an opportunity to interact with fellow students. This may lead to the formation of self-help groups.

(b) Learner Support Services (LSS)

The University has formed an LSS cell at the head quarter. The LSS cell coordinate with the Study Centre to get rid of any problem faced by the learner.

2.7 Procedure for admissions, curriculum transaction and evaluation

2.7.1 Admission Procedure

(a) Admission to Master of Computer Application first year will be made on the basis of the results obtained in an Entrance Examination, conducted by the U. P. Rajarshi Tandon Open University, Prayagraj or other agency as may be decided by the University/State Government.

(b) The eligibility condition for admission in Master of Computer Application is as follows:

i. BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree like PGDCA diploma from UGC recognised University, A- Level from DOEACC with graduation shall be admitted to first semester of two-year MCA program, provided that they have obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

OR

ii. B.Sc./B.Com./B.A./B.E./B.Tech/M.Sc. (except computer science) with or without Mathematics at l0+2 Level or at Graduation Level (obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination). Such candidates have to complete 2 semester equivalent Degree like Diploma/PGDCA diploma from UGC recognised University or A- Level from DOEACC as a bridge course.

2.7.2 Programme Fee:

Rs. 17,000 / year. The fee is deposited through online admission portal only.

2.7.3 Evaluation

The evaluation consists of two components: (1) continuous evaluation through assignments, and (2) term-end examination. Learner must pass both in continuous evaluation as well as in the term-end examination of a course to earn the credits assigned to that course. For each course there shall be one written Terminal Examination. The evaluation of every course shall be in two parts that is 30% internal weightage through assignments and 70% external weightage through terminal exams.

(a) Theory course	Max. Marks
Terminal Examination	70
Assignment	30

Total	100
(b) Practical course:	Max. Marks
Terminal Practical Examination	100

Marks of Terminal Practical Examination shall be awarded as per following scheme:

i.	Write up /theory work	30
ii.	Viva-voce	30
iii.	Execution/Performance/Demonstration	20
iv.	Lab Record	20

The following 10-Point Grading System for evaluating learners' achievement is used for CBCS programmes:

10-Point Grading System in the light of UGC-CBCS Guidelines

Letter Grade	Grade Point	% Range
O (Outstanding)	10	91-100
A+ (Excellent)	9	81-90
A (Very Good)	8	71-80
B+ (Good)	7	61-70
B (Above Average)	6	51-60
C (Average)	5	41-50
P (Pass)	4	36-40
NC (Not Completed)	0	0-35
Ab (Absent)	0	
Q	Qualified	Applicable only for Non-Credit courses
NQ	Not Qualified	

Learner is required to score at least a 'P' grade (36% marks) in both the continuous evaluation (assignments) as well as the term-end examination. In the overall computation also, learner must get at least a 'P' grade in each course to be eligible for the M. Sc. degree.

Computation of CGPA and SGPA

(a) Following formula shall be used for calculation of CGPA and SGPA

For jth semester SGPA (Sj) = Σ (Ci *Gi)/ Σ Ci	where, Ci = number of credits of the ith course in jth semester Gi= grade point scored by the learner in the ith course in jth semester.
CGPA = Σ (Cj *Sj)/ Σ Cj	where, Sj = SGPA of the jth semester Cj = total number of credits in the jth semester

The CGPA and CGPA shall be rounded off up to the two decimal points. (For e.g., if a learner obtained 7.2345, then it will be written as 7.23 or if s(he) obtained 7.23675 then it be will written as 7.24)

CGPA will be converted into percentage according to the following formula:

Equivalent Percentage = CGPA * 9.5

(b) Award of Division

The learner will be awarded division according to the following table:

Division	Classification
1st Division	6.31 or more and less than 10 CGPA
2nd Division	4.73 or more and less than 6.31 CGPA
3rd Division	3.78 or more and less than 4.73 CGPA

2.7.4 Multiple Entry and Multiple Exit options

Currently there is no provision of multiple entry and multiple.

2.8 Requirement of the laboratory support and Library Resources

The practical sessions are held in the science laboratories of the Study Centre. In these labs, the learner will have the facility to use the equipment and consumables relevant to the syllabus. The SLM, supplementary text audio and video material of the various courses of the program is available through the online study portal of the University. The University also have a subscription of National Digital Library to provide the learners with the ability to enhance access to information and knowledge of various courses of the programme.

2.9 Quality assurance mechanism and expected programme outcomes

(a) Quality assurance mechanism: The program structure is developed under the guidance of the Board of studies comprising external expert members of the concerned subjects followed by the School board. The program structure and syllabus is approved by the Academic Council of the University. The course structure and syllabus is reviewed time to time according to the feedback received from the stakeholders and societal needs.

The Centre for Internal Quality Assurance will monitor, improve and enhance effectiveness of the program through the following:

- ✓ Annual academic audit
- ✓ Feedback analysis for quality improvement
- ✓ Regular faculty development programs
- ✓ Standardization of learning resources
- ✓ Periodic revision of program depending upon the changing trends by communicating to the concerned school

(b) Expected programme outcomes (POs)

Knowledge and understanding	PO1	Have an ability to identify, formulate and implement computing solutions.
Skills related to specialization	PO 2	Adapt the skills to implement effective solutions for need based
Application of knowledge and skills	PO 3	Apply the concepts of software engineering while working on big modules and or projects.
	PO 4	Apply the theory and software development concepts to construct computing-based solutions.
Generic learning outcomes	PO 5	Be familiar with current research within various fields of IT and develop skills to learn new technology.
	PO 6	Design and develop computer programs/computer-based systems in the all areas .

APPENDIX-I

Detailed Programme Structure & Syllabus for MCA

AcademicYear:2023-2024

Semester	Course Code	Title of the Course	Max Marks	Credits
First	MCA-101N	Computer Fundamental & Its Organization	100	4
	MCA-102N	Discrete Mathematics	100	4
	MCA-103N	C Programming	100	4
	MCA-104N	Numerical Analysis	100	4
	MCA-105N	Computer Organization	100	4
	MCA-106(P)N	Practical Based on MCA -103 & 104	100	4
	MCA-OBN	Organizational Behavior	100	4
Credit of I semester			**700**	**28**
Second	MCA-107N	Data Structures	100	4
	MCA-108N	Operating System	100	4
	MCA-109N	Software Engineering	100	4
	MCA-110N	C++ and Object Oriented Programming	100	4
	MCA-111N	Data Communication & Computer Network	100	4
	MCA-112(P)N	Practical Based on MCA -107 & MCA-110	100	4
	MCA-E1 Or MCA-E2	Web Technology Or Java Programming		4 Or 4
Credit of II semester			**700**	**28**
Third	MCA-113N	Python Programming	100	4
	MCA-114N	Design and Analysis of Algorithm	100	4
	MCA-115N	Database Management System	100	4
	MCA-116N	Multimedia Technology	100	4
	MCA-117N	Microprocessor and Its Applications	100	4
	MCA-118(P)N	Practical Based on MCA -114 & MCA-115	100	4
	MCA-E3N Or MCA-E4N	Client Server Technology 0r System Analysis and Design		4 Or 4
Credit of III semester			**700**	**28**
Fourth	MCA-E-5N Or MCA-E6N	Information and Network Security OR Data Mining	100	4 Or 4
	MCA-119N	Theory of Computation	100	4
	MCA-120N	Soft Computing	100	4
	MCA-121N	Computer Graphics	100	4
	MCA-122N	Unix and Shell Programming	100	4
	MCA123N	Work/Industrial Training/Project and Comprehensive Viva Voce	200	8
Credit of IV semester			**700**	**28**
Total Max Marks/ Credit			**2800**	**116**

Note: * The learners are required to report at School of Computer & Information Science just after completion of second (II) semester for the approval of synopsis for Project Work/Industrial Training. After the due approval of synopsis in third (III) semester, learner has to complete the Project Work/Industrial Training during fourth semester and submit the Project Work/Industrial training report directly to Coordinator, MCA, School of Computer & Information Science.

Course prerequisites: 10+2		
Programme: MCA	Year: First	Semester: I
Subject: Computer Application		
Course Code: MCA-101N	Course Title: Computer Fundamental & Its Organization	

Course Objectives:

- To demonstrate the knowledge of the basic structure, components, features and generations of computers.
- To describe the concept of Data representation and construct algorithms to solve problems using programming concepts.
- To Compare and contrast features, functioning & types of operating system and computer Architecture.
- To demonstrate architecture, functioning & services of the software.
- To illustrate the emerging trends and technologies in the field of Information Technology.

Course Outcomes:

Demonstrate the knowledge of the basic structure, components, hardware and software of computers.

Credits: 04	Type of Course: Core
Max. Marks: 100	Min. Passing Marks: 36

Unit 1	Computer Basics: Algorithms. A Simple Model of a Computer, Characteristics of Computers. Problem-solving Using Computers.
Unit 2	Data Representation: Representation of Characters in computers, Representation of Integers, Representation of Fractions. Hexadecimal Representation of Numbers, Decimal to Binary Conversion, Error-detecting codes. Input & Output Devices. Description of Computer Input Units, Other Input methods. Computer Output Units Printers. Plotters)
Unit 3	Computer Memory: Memory Cell. Memory Organization, Read Only Memory, Serial Access Memory. Physical Devices Used to Construct Memories. Magnetic Hard Disk, floppy Disk Drives. Compact Disk Read Only Memory, Magnetic Tape Drives.
Unit 4	Processor: Structure of Instructions, Description of a Processor. Machine Language and Instruction set Processors used in desktops and lap tops. Specification of a desktop and Lap top computer currently available in the market (Specifications of Processor. motherboard &chipset, memory. interface & capacity of hard disk & DVD drives, 1/0 ports).
Unit 5	Computer Architecture: Interconnection of Units. Processor to Memory communication. LO to Processor Communication. Interrupt Structures, Multiprogramming. Processor Features, Reduced Instruction Set Computers (RISC), Virtual memory.
Unit 6	Software Concepts: Types of Software. Programming Languages. Software (Its Nature & Qualities). Programming Languages. Operating Systems: History and Evolution. Main functions of OS Multitasking. Multiprocessing. Time Sharing. Real Time Operating System with Examples

Suggested Readings:

SLM of University

Fundamental of Computers – By V.Rajaraman, B.P.B. Publications

2. Fundamental of Computers – By P.K. Sinha

This course can be opted as an elective by the students of following subjects: B.Sc. in Computer Science, B.Sc. in Physics, B.Sc. in Statistics, B.Sc. in Mathematics, BCA

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.,		
Programme: MCA	Year: First	Semester: I
Subject: Computer Application		
Course Code: MCA-102N	Course Title: Discrete Mathematics	
Course Objectives: • To perform operations on discrete structures such as sets, functions, relations. • To apply mathematical arguments using logical connectives and quantifiers. • To identify and prove properties of Algebraic Structures. • To formulate and solve recurrences and recursive functions. • To apply the concept of combinatorics to solve basic problems in discrete mathematics.		
Course Outcomes: CO1. Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions CO2. Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic CO3. Identify and prove properties of Algebraic Structures like Groups, Rings and Fields CO4. Formulate and solve recurrences and recursive functions CO5. Apply the concept of combinatory to solve basic problems in discrete mathematics		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Language of Mathematics and its application	
Unit 1	Mathematical Logic: statements, operations, truth values, tautology and quantifiers.	
Unit 2	Arguments: Rule of Detachment, Validity of a compound statement by using Truth Table, Validity using Simplification Methods, Validity using Rules of Inference, Invalidity of an Argument, Indirect Method of proof and Proof by Counter-Example.	
Unit 3	Boolean Algebra: Boolean Algbera, Principle of Duality, Isomorphic Boolean Algebras, Boolean Algebra as Lattices, Boolean Functions, Disjunctive Normal Form, Conjunctive Normal Form, Minimization of Boolean Functions (Karnaugh Map)	
Unit 4	Switching circuits and logical Circuits: Switching Circuits, Simplification of circuit, Non-Series Parallel Circuits, Relay Circuits, Logic Circuits	
Block 2	Set theory and its application	
Unit 5	Set theory: sets, Subsets, Operations on Sets, Complementation, Intersection and Union, Laws Relating Operations, Distributive Laws and De Morgan's Laws.	
Unit 6	Relation: Relation, binary relations in a Set, Domain and Range of a Relation, Total number of Distinct Relations, Relations as Sets of Ordered Pairs, Types of Relations, Composition of Relations, Equivalence relation in a set, Partition of a Set, Equivalence Class and Quotient set of a set.	
Unit 7	Partitions and Distributions: Equivalence Relations, Equivalence Classes, Properties of Equivalence Classes, Quotient set and Partition.	
Unit 8	Function: Functions, Direct and Inverse image, Inverse Functions, Operations on Functions, Composite of functions, Types of Functions and Connection between Equivalence relation and mapping.	
Block 3	Counting Process	
Unit 9	Mathematical Induction: Principle of Mathematical Induction, Second Principle of Induction and Well ordering property.	

Unit 10	Combinatorics: Basic counting principles, Principle of Disjunctive counting, Principle of Sequential counting and Ordered and Unordered Partitions.
Unit 11	Permutation
Unit 12	Combination
Block 4	Block – 04: Probability theory and application
Unit 13	Binomial theorem: Binomial theorem, General term in a binomial expansion,Middle term in a binomial expansion and Binomial expansion for rational exponents.
Unit 14	Probability: Definition of Probability, Addition law for counting and Product law for counting.
Unit 15	General Counting methods: General Counting method is the extension part of counting process. It discusses Sum and Product Rules and the Pigeonhole Principle.
Unit 16	The Inclusion- Exclusion Principle: inclusion-exclusion principle, Alternative form of the inclusion-exclusion principle and Onto Functions.

Suggested Readings:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", McGraw Hill.
2. B. Kolman, R.C Busby and S.C Ross, "Discrete Mathematics Structures", Prentice Hall.
3. R.P Girimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley.
4. Y.N. Singh, "Discrete Mathematical Structures", Wiley- India.
5. Swapankumar Sarkar, "A Textbook of Discrete Mathematics", S. Chand & Company PVT. LTD.V.
6. Krishnamurthy, "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi.
7. Liptschutz, Seymour, "Discrete Mathematics", McGraw Hill.
8. J.P. Trembely&R.Manohar, "Discrete Mathematical Structure with application to Computer Science", McGraw Hill.

Suggested online courses (MOOCs)

1. NOC:Discrete Mathematics, IIT Ropar, Prof. Prabuchandran K.J, Prof. Sudarshan Iyengar; https://nptel.ac.in/courses/106106183
2. NOC:Discrete Mathematics, IIT Guwahati, Prof. Benny George K, Prof. Sajith Gopalan https://nptel.ac.in/courses/106103205

This course can be opted as an elective by the students of following subjects: B.Sc. in Computer Science, B.Sc. in Physics, B.Sc. in Statistics, B.Sc. in Mathematics, BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.,		
Programme: MCA	Year:1	Semester:1
Subject: Computer Application		
Course Code: MCA-103N	Course Title: C Programming	
Course Objectives: • To describe & understand the problem solving techniques. • To understand the concept of basic terminology used in C programming. • To develop programs in C language by writing, compiling and debugging. • To develop programs involving simple statements, conditional statements, iterative statements, array, strings, functions, recursion, structure and union. • To differentiate between call by value and call by reference, acquire skills of using dynamic memory allocations, use of pointers and basic operations on a file.		
Course Outcomes: CO1. Describe the functional components and fundamental concepts of a digital computer system including number systems. CO2. Construct flowchart and write algorithms for solving basic problem CO3. Write 'C' programs that incorporate use of variables, operators and expressions along with data types. CO4. Write simple programs using the basic elements like control statements, functions, arrays and strings. CO5. Write advanced programs using the concepts of pointers, structures, unions and enumerated data types.		
Credits:4	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	Introduction to algorithms and program design
Unit I	Unit 1: Introduction to Algorithms Problem solving techniques, Algorithm
Unit II	Pseudo-codes and Flowcharts Tools of Algorithm, Pseudo codes, Flowchart
Unit III	Program design principles Introduction to computer programming, Program design principles, Programming techniques, Program Errors
Block 2	Introduction to the 'C' programming language
Unit 1	Unit 1: Introduction History of C Language, Structure of a 'C' program, Creating and Executing a 'C' program
Unit 2	Data Types in 'C' Character Set of 'C' language, Tri graph characters, Tokens, Identifiers, Keywords, Constants, Data types, Variables
Unit 3	Storage Classes Scope and lifetime of variable, Storage classes, Automatic storage class, Register storage class, Static storage class, External storage class
Unit 4	Input and Output Functions Reading a single character, Writing a single character, Formatted Input-Output, Formatted Input, Formatted Output

Block 3:	Operator and Control Structures
Unit 1:	Operators and Expressions Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and decrement operators, Conditional operators, Bitwise operators, Special operators, Operator Precedence and Associativity, lvalue and rvalue, Type casting: Promotion and Demotion of variable types
Unit 2:	Decision Structures in 'C' if statement, if else statement, nested if … else statement, switch statement, goto statment
Unit 3:	Loop Structures in 'C' for statement, while statement, do while statement, break statement, continue statement
Unit 4:	Arrays One dimensional array, Two dimensional array, Multidimensional arrays, Strings, String handling functions, Character functions
Block 4	Advanced Features of C
Unit 1:	Pointers Pointers and Address (&) operator, Pointer declaration and Initialization , Indirection operator, Pointer Arithmetic, Arrays and Pointers, Character strings and Pointers, Array of Pointers, Pointer to Pointer
Unit 2:	Functions Functions, user-defined functions, categories of function, returning non-integer values, function arguments, recursion, arrays as function arguments
Unit 3:	Structures, Unions, enum and typedef Structure definition, Structures within structures, Structures as function arguments, Pointers to structures, Unions, Enumerated data type, Type definition
Unit 4:	File and Memory Management in 'C' Files, File Pointer Variable, Opening a file, Reading and writing to files, File Status Functions, Random Access to files, Command Line Arguments, Memory management
Unit 5:	Preprocessor Directives and Error reporting Macro directives, Conditional directives, Control directives, Error reporting

Suggested Readings:

SLM of University

1. Kanetkar Y., "Let Us C", BPB Publications.
2. E. Balagurusamy, Computer Concepts and Programming in C, McGraw Hill.
3. Yashwant Kanetkar, "Working with C", BPB Publications.
4. E. Balagurusamy, "Programming in ANSI C", TMH.
5. Reema Thareja, Computer Fundamentals and Programming in C, Oxford Publication.
6. Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, Pearson Education.
7. Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Computer Science- A Structured Programming Approach Using C, Cengage Learning.
8. Schildt H., "C- The Complete Reference", McGraw-Hill.
9. Goyal K. K. and Pandey H.M., Trouble Free C", University Science Press
10. Gottfried B., "Schaum's Outlines- Programming in C", McGraw-Hill Publications.

- Suggested digital platform: NPTEL/SWAYAM/MOOCs
  https://nptel.ac.in/courses/106106210

This course can be opted as an elective by the students of following subjects: B.Sc. in Computer Science, B.Sc. in Physics, B.Sc. in Statistics, B.Sc. in Mathematics, BCA

Suggested equivalent online courses (MOOCs) for credit transfer:

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year:1	Semester:1
Subject: Computer Application		
Course Code: MCA-104N	Course Title: Numerical Analysis	
Course Objectives: To develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer.		
Course Outcomes: To inculcate knowledge on algebraic equations solved by Numerical Methods. To apply appropriate numerical methods to solve the problem with most accuracy.		
Credits:4	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Solutions of Non-Linear Equations in one Variable	
Unit I	Review of Calculus, Round off Error, Truncation Error, Some properties of equations, Iteration Methods for finding the roots (zero's) of an equation. Convergence Criterion, Initial Approximation to a Root, Bisection Method,	
Unit II	Unite 2: Fixed Point Iteration Method, Chord Methods for Finding Roots- Regula Falsi Method, Newton Raphson Method. Order of convergence	
Block 2	Solution of System of Linear Equations	
Unit III	Direct Methods- Preliminaries, Method of solution using inverse of matrix. Cramer's rule. Gauss Elimination Method, Gauss- Jordon Reduction Method, LU decomposition method. Crout's method.	
Unit IV	Iterative Method- General Iteration Method, Jacobi's Iteration Method, Gauss- Seidal Iteration Method.	
Block 3:	Interpolation	
Unit V	Definition, Finite Differences: Forward differences, Backward differences, Central differences, Other differences operator, Relation between operators. Interpolation at Equally interval; Newton Gregory formula for forward differences and backward difference .	
Unit VI	Unite 6: Interpolation at Unequally interval Lagrange's interpolation formula. Divided differences, Properties of divided differences, Newton's Divided difference interpolation formula	
Block 4	Numerical Differentiation, Integration and Solutions of Differentiation Equations	
Unit VII	Numerical Differentiation, Numerical Integration; Trapezoidal Rule. Simpson's One Third Rule, Simpson's Three Eight's Rule. Weddle's Rule.	
Unit VIII	Numerical Solution of Ordinary Differential Equations-(first order, second order and simultaneous) by Picard's Iteration Method, Euler's Method, Runge- Kutta Methods- 4^{th} Order.	
Suggested Readings: SLM of University ➢ S. S. Sastry: Introductory Methods Numerical Analysis, Prentice- Hall of India. ➢ C.F. Gerald and P. O. Wheatley: Applied Numerical Analysis, Addison- Wesley, 1998. ➢ Konte and Debour: Numerical Analysis. ➢ Suggested digital platform: NPTEL/SWAYAM/MOOCs https://nptel.ac.in/courses/111107062		
This course can be opted as an elective by the students of following subjects: B.Sc. in Computer Science, B.Sc. in Physics, B.Sc. in Statistics, B.Sc. in Mathematics, BCA		

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: : MCA	Year: First	Semester: I
Subject: Computer Application		
Course Code: MCA-105N	Course Title: Computer Organization	
Course Objectives: To understand the basic structure of a digital computer and to study the operations of internal components.		
Course Outcomes: CO1 Assess basics components of computer hardware. CO2 Understand how Boolean algebra is related to designing computer logic, through simple combinational and sequential logic circuits. CO3 Realize a simple computer with hardware design including data format, instruction format, instruction set, addressing modes, bus structure, input/output, memory, Arithmetic/Logic unit, control unit, and data, instruction and address flow. CO4 Design combinational and sequential logic circuits, flip-flops, counters, shift registers, adders, substractor, multiplexer, demultiplexer, Arithmetic/Logic unit. CO5 Develop concept of memory unit and input/output architecture. CO6 Build basics of Instruction Set Architecture (ISA).		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	Introduction to Digital Electronics
Unit 1	Introduction to number system: binary, octal, hexadecimal, Inter-conversion to different number system.
Unit 2	Boolean algebra and Logic Gates: De Morgan's theorem, Boolean Identity. OR, AND NOT NAND, NOR and Ex OR gates and their Truth Tables, Positive and Negative logic.
Unit 3	Reduction Techniques: Standard representation of Boolean expressions, SOP and POS forms, Combinational and sequential circuits, Minterm and Maxterm expressions, Map reduction techniques, K- tap. Code Conversions: Binary to Gray, BCD to decimal etc.
Unit 4	Binary Arithmetic: Half and Full Adder, Substractor, Multiplexer, Demultiplxer, Decoder, Encoders, Comparators.
Unit 5	Sequential Circuit: Flip Flops: S/R, J/K, D and T Latches, Digital Counters, Registers.
Block 2	Basic building blocks
Unit 6	Building blocks: I/O, Memory, ALU and its components, Control Unit and its functions
Unit 7	Instruction — word, Instruction and Execution cycle, branch, skip, jump and shift instruction, Operation of control. registers; Controlling of arithmetic operation.
Unit 8	Addressing techniques — Direct, Indirect, Immediate, Relative, Indexed addressing and paging. Registers —Indexed, General purpose, Special purpose, overflow, carry, shift, scratch, Memory Buffer register; accumulators; stack pointers; floating point; status information and buffer registers.
Block 3	Memory & I/O
Unit 9	Memory: Main memory, RAM, static and dynamic, ROM, EPROM, EEPROM, EAROM, Cache and Virtual memory.
Unit 10	I/O System: Buses, Interfacing buses, Bus formats- address, data and control, Interfacing keyboard, display, auxiliary storage devices and printers.

Unit 11	Introduction to Microprocessors and microcontrollers; Introduction to 8085 microprocessor, example of few instructions to understand addressing techniques, differences between microprocessors and microcontrollers. Interlocution to different processor families.

Suggested Readings:

1. William Stallings, "Computer Organization and Architecture", 9th Edition, PHI,2012
2. M. Morris Mano, Michael D. Ciletti, "Digital Design", 4th Edition, Pearson Education, 2011.
3. Hennessy J. and Patterson D., "Computer Architecture: A Quantitative Approach", 5th Edition, Morgan Kaufmann, 2011.

Suggested online courses (MOOCs)

1. Digital Computer Organization, IIT Kharagpur by Prof. P.K. Biswas
   https://nptel.ac.in/courses/117105078
2. NOC:Computer architecture and organization, IIT Kharagpur by Prof. Indranil Sengupta, Prof. Kamalika Datta
   https://nptel.ac.in/courses/106105163
3. NOC:Computer Organization and Architecture, IIT Madrasby Prof. V. Kamakoti
   https://nptel.ac.in/courses/106106166
4. Computer Organisation and Architecture, IIT Kanpurby Prof. Bhaskaran Raman
   https://nptel.ac.in/courses/106104073

This course can be opted as an elective by the students of following subjects: B.Sc. in computer science, BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: : MCA	Year:1	Semester:2
Subject: Computer Application		
Course Code: MCA106P (N)	Course Title: Practical Work Based on MCA 103 N and 104 N	
Course Objectives: 1. To write, compile, debug and execute programs in a C programming environment. 2. To learn programs that incorporate use of variables, operators and expressions along with data types. 3. To learn programs for solving problems involving use of decision control structures and loops. 4. To learn programs that involve the use of arrays, structures and user defined functions. 5. To Write programs using file handling operations..		
Course Outcomes: CO1. Write, compile, debug and execute programs in a C programming environment.		
Credits:2	Type of Course: Core	
Category of Course (Please mention category of course; It may have more than one option)	Awareness/ life skills / soft skills/ value-added / employability/ entrepreneurship/ skill development/ MOOCs or OER	
Max. Marks: 100	Min. Passing Marks: 36	
(Syllabi should be framed block wise/unit wise)		
Block		
	• Program to implement conditional statements in C language. • Program to implement switch-case statement in C language • Program to implement looping constructs in C language. • Program to perform basic input-output operations in C language. • Program to implement user defined functions in C language. • Program to implement recursive functions in C language. • Program to implement one-dimensional arrays in C language. • Program to implement two-dimensional arrays in C language. • Program to perform various operations on two-dimensional arrays in C language. • Program to implement multi-dimensional arrays in C language. • Program to implement string manipulation functions in C language. • Program to implement structure in C language. • Program to implement union in C language. • Program to perform file handling operations in C language. • Study of basic matrix operations • To solve linear equation • Solution of Linear equations for Underdetermined and Overdetermined cases. • Determination of Eigen values and Eigen vectors of a Square matrix. • Solution of Difference Equations. • Solution of Difference Equations using Euler Method. • Solution of differential equation using 4th order Runge- Kutta method. • Determination of roots of a polynomial.	
Suggested Text Book Readings: SLM of University 1. Kanetkar Y., “Let Us C”, BPB Publications.		

2. E. Balagurusamy, Computer Concepts and Programming in C, McGraw Hill.
3. Yashwant Kanetkar, “Working with C”, BPB Publications.
4. E. Balagurusamy, “Programming in ANSI C”, TMH.
5. Reema Thareja, Computer Fundamentals and Programming in C, Oxford Publication.
6. Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, Pearson Education.
7. Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Computer Science- A Structured Programming Approach Using C, Cengage Learning.
8. Schildt H., “C- The Complete Reference”, McGraw-Hill.
9. Goyal K. K. and Pandey H.M., Trouble Free C”, University Science Press
10. Gottfried B., “Schaum’s Outlines- Programming in C”, McGraw-Hill Publications.
11. S. S. Sastry: Introductory Methods Numerical Analysis, Prentice- Hall of India.
12. C.F. Gerald and P. O. Wheatley: Applied Numerical Analysis, Addison- Wesley, 1998.

This course can be opted as an elective by the students of following subjects:	
Suggested equivalent online courses (MOOCs) for credit transfer:	
Electronic media and other digital components in the curriculum: Choose any one or more than:e-SLM/ Other electronic and digital contents	
Name of electronic media: e-SLM	Year of incorporation: 2021

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: First	Semester: I
Subject: Computer Application		
Course Code: MCA-OBN	Course Title: Organizational Behavior	
Course Objectives: • To learn the basic concepts of Organizational Behaviour and its applications in contemporary organizations. • To understand how individual, groups and structure have impacts on the organizational effectiveness and efficiency. • To appreciate the theories and models of organizations in the workplace. • To creatively and innovatively engage in solving organizational challenges. • To learn and appreciate different cultures and diversity in the workplace.		
Course Outcomes: • To understand the conceptual framework of the discipline of OB and its practical applications in the organizational set up. • To deeply understand the role of individual, groups and structure in achieving organizational goals effectively and efficiently. • To critically evaluate and analyze various theories and models that contributes in the overall understanding of the discipline. • To develop creative and innovative ideas that could positively shape the organizations. • To accept and embrace in working with different people from different cultural and diverse background in the workplace.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	Basics of Organizational Behavior
Unit 1	Nature of Organizational Behavior- Definition, Nature, Significance of Organizational Behavior, Forces Affecting Organizational Behavior
Unit 2	Evolution of the Concept of Organizational Behavior- Disciplines Contributing to Organizational Behavior, Classical Viewpoint of Human Organizational Behavior, Human Relations Approach, Behavior Science Approach
Unit 3	Model of Organizational Behavior- Management's Assumptions about People, Model of Organizational Behavior, Relevance of OB Models, Management Challenges
Unit 4	Recent trends in Organizational Behavior- Globalization, Information Technology and OB, Changing Workforce, Workplace Values and ethics
Block 2	Basics of Individual Behavior
Unit 5	Types of Individual Behavior- The types of personality, Personality Traits, The Big Five Dimensions, Myers-Briggs Type Indicators
Unit 6	Perception and Behavior- The Perceptual Process, The role of environment, observer and object in perception, Errors in Perception, Perception and Behavior
Unit 7	Learning and Behavior- Learning in Organization, Classical Learning Theory, Social Learning Theory, Behavior Modification
Unit 8	Attitude and Behavior- Concepts of Attitude, Components of Attitude, Attitude Formation, Significance of Attitude in Managing Behavior

Block 3	Motivations and Leadership
Unit 9	Motivation- Concept of Motivation, Need Based Theories, Expectancy Theory, Goal Setting Theory
Unit 10	Motivation: Practical Application- Application of needs based theories: Flexi benefits, Flexitime, Job Redesigning, Application of Expectancy Theory: Goal Alignment, Application of Goal Setting Theory: Management by Objectives
Unit 11	Leadership -Concept and Definition of Leadership, Styles of Leadership, Trait Theory, Behavioral Theories
Unit 12	Leadership: Contingency Perspectives - Path-Goal Theory, Hersey Blanchard Theory, Fiedler Theory, Transitional and Transformational Leadership
BLOCK 4	Group Dynamics and Culture
Unit 13	Groups in Organizations - Concept of Motivation, Group Membership, Group Structure and norms, Group Cohesiveness
Unit 14	Group Performance- Conformity, deviance, Group Processes: Groupthink, Group Shift, Group Decision Making
Unit 15	Transactional Analysis- Transaction as a unit of social interaction, Three ego states: Parents, adult and child, Four life Positions
Unit 16	Organizational Culture - Concept and Definition, Dimensions of Organizational Culture, Development of Organizational Culture, Managing culture, Strong vs Weak Culture
Suggested Readings: 1. Stephen P. Robbins, Organizational Behavior, Pearson Education, 15/e, 2013 2. Subbarao, P, Management and Organizational Behavior, Himalaya Pushing House, 2010 Suggested online courses (MOOCs)	
This course can be opted as an elective by the students of following subjects: B.Sc. in computer science, BCA	
Suggested equivalent online courses (MOOCs) for credit transfer: N.A	

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: First	Semester: II
Subject: Computer Application		
Course Code: MCA-107N	Course Title: Data Structures	
Course Objectives: The objective of the course is to familiarize students with basic data structures and their use in fundamental algorithms.		
Course Outcomes: CO1: Understand basic data structures such as arrays, strings, and linked lists. CO2: Study linear data structures such as stacks and queues and understand their difference. CO3: Describe the hash function and concepts of collision and its resolution methods. CO4: Study tree, heap and graphs along with their basic operations. CO5: Study different techniques for solving problems like sorting and searching		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	BLOCK - 1	
Unit 1	Introduction to data structure: Algorithm, Basic criteria for algorithms, Data type, Data structure, Data representation, linear and nonlinear data structure.	
Unit 2	Basics of algorithm: Algorithm, Basics of complexity of algorithm	
Unit 3	Array: Definition, Representation of array, Single and multi-dimensional array, address calculation (one dimensional, two dimensional, multidimensional), sparse matrices	
Block 2	BIOCK – 2	
Unit 4	Stack: Definition, Operations on stacks, Array representation and implementation of stack; infix, prefix and postfix representation of expression and evaluation multiple stacks, Application of stacks.	
Unit 5	Recursion: Recursive definition and processes, some named problems of recursion, principle of recursion: designing recursive algorithm, how recursion works, tail recursion.	
Unit 6	Queue: Definition, operation on queues, circular queue, dequeue, priority queue, Application of queue.	
Block 3	BLOCK 3	
Unit 7	Linked List: Representation and implementation of single linked list, Operations in the singly linked list, stack and queue as a linked list, circularly linked list, doubly linked list, circularly doubly linked list, Application of linked list: polynomial representation and addition, garbage collection	
Unit 8	Tree: Basic terminology, binary tree, binary tree representation, complete binary tree, extended binary tree, array and linked list representations, traversing binary tree, threaded binary tree, binary search tree, Operations on BST, AVL tree, Operations on AVL tree, B-tree Insertion and deletion in B tree.	
Unit 9	Graph: Basic terminology Graph representation Depth first search, breadth first search, topological sort, connected components, spanning tree, minimum cost spanning tree, Kruskal's and prim's algorithm, Shortest path algorithms: Bellman Ford Algorithm, Dijkstra’s algorithm, Floyd-Warshall algorithm.	
Block 4	BLOCK- 4	
Unit 10	Searching and sorting: Sequential search, binary search, comparison and analysis, Selection sort, Bubble sort, Insertion sort, Heap sort, Quick Sort, Merge sort, Shell sort,	

	radix sort.
Unit 11	Hashing: Hash table, hash function, collision resolution strategies, hash table implementation.
Unit 12	File Structure: Terminology, File organization, Sequential files, Direct File organization, Indexed Sequential file organization.

Suggested Readings:

1. E Horowitz and S. Sahni: Fundamentals of Data Structures in C, Second Edition, Universities Press, Hyderabad.
2. R.L. Kruse: Data Structures & Program Design in C, PHI.

Suggested online courses (MOOCs)

1. Programming and Data Structure, IIT Kharagpur by Dr. P.P. Chakraborty https://nptel.ac.in/courses/106105085
2. NOC:Programming and Data structures (PDS), IIT Madras by Dr. N S. Narayanaswamy https://nptel.ac.in/courses/106106130
3. NOC:Programming, Data Structures and Algorithms, IIT Madras by Prof. Hema A Murthy, Dr. N S. Narayanaswamy, Prof. Shankar Balachandran https://nptel.ac.in/courses/106106127
4. Data Structures And Algorithms, IIT Delhi by Prof. Naveen Garg https://nptel.ac.in/courses/106102064

This course can be opted as an elective by the students of following subjects: B.Sc. in computer science, B.Sc. in Statistics, BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA (Master of Computer Application)	Year: First	Semester: II
Subject: Computer Application		
Course Code: MCA-108 N	Course Title: Operating System	
Course Objectives: The course will provide an introduction to Operating Systems (OS), their design and implementation. We will discuss the goals of an OS, and some successful and not-so- successful OS designs. We will also discuss the following OS services in detail: thread scheduling, security, process management, memory management, virtual memory, file system.		
Course Outcomes: CO1 Analyze & classify different types of operating system CO2 Understand the working of Operating system CO3 Understand the Memory Management policies. CO4 Interpret concepts of input/output, storage and file management.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	An Overview and Process Management	
Unit 1	Introduction: Basic definitions, Batch processing, Multi-programming. Time sharing, multiprocessing; Structure and Functions of Operating System	
Unit 2	Process and thread: Process, Process states, State Transitions, Process Control Block, Context Switching, concept of thread, comparison between process and thread, Thread model, thread usage, implementing thread in kernel and user space.	
Unit 3	Process Scheduling: Scheduler, Scheduling criteria, Preemptive and non-preemptive scheduling, Process Scheduling,Process scheduling algorithms.	
Unit 4	Concurrent Process: Process Interaction, Shared Data and Critical Section, Mutual Exclusion, Synchronization, Classical Problems of Synchronization, Semaphores, Monitors.	
Block 2	Memory Management and Unix Case Study	
Unit 5	UNIT 5: Deadlock: Concept of deadlock, necessary condition for deadlock, resource allocation graph, deadlock prevention, deadlock avoidance, Banker's algorithm, Deadlock detection, deadlock recovery.	
Unit 6	UNIT 6: Memory management: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses Contiguous and non-contiguous memory allocation, Paging, Segmentation, Virtual Memory, Demand Paging, Page fault,Page replacement algorithms, thrashing.	
Unit 7	UNIT 7: Secondary memory management: Free Space management, Disk Structure, Disk Scheduling, Formatting, Swap space Management.	
Unit 8	UNIT 8: Case Study of UNIX	

Suggested Readings:

1. Silberschatz, Galvin, Gagne, Operating System Concepts, 8th Edition, Wiley,2008
2. Andrew S. Tanenbaum, Albert S. Woodhull, Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall,2006.
3. William Stallings, Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
4. Charles Patrick Crowley, Operating Systems-A Design-oriented Approach. 1996

Suggested online courses (MOOCs) 1. NOC:Operating System Fundamentals, IIT Kharagpur by Prof. Santanu Chattopadhyay https://nptel.ac.in/courses/106105214 2. NOC:Introduction to Operating Systems, IIT Madras by Prof. Chester Rebeiro https://nptel.ac.in/courses/106106144 3. Operating Systems, IIT Delhi by Prof. Sorav Bansal https://nptel.ac.in/courses/106102132
This course can be opted as an elective by the students of following subjects: B.Sc. (Computer Science), BCA and MCA
Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: First	Semester: II
Subject: Computer Science/Application		
Course Code: MCA-109N	Course Title: Software Engineering	
Course Objectives: Provide the current software engineering techniques and examine the software life-cycle, including software specification, design implementation, testing and maintenance. It presents software engineering methodologies for the development of Quality, cost-effective, schedule meeting software.		
Course Outcomes: CO1 Describe software engineering layered technology and process framework. CO2 Introduces theories, models, and techniques that provide a basis for the software development life cycle. CO3 Introduces software testing approaches including verification and validation, static analysis, reviews, inspections, and audits. CO4 Understanding of the role of project management including planning, scheduling, risk management, etc. CO5 Work as an individual and/or in team to develop and deliver quality software.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Unit 1	Software Engineering Fundamentals: Definition of Software, Software characteristics, Software Applications. Software Process: Software Process Models - Waterfall model, prototyping model, spiral model, incremental model, concurrent development model. Project management Concepts: The Management Spectrum - The People, The Product, The Process, The Project.	
Unit 2	Software Process and Project Metrics : Measures , Metrics and Indicators , Software measurement Size -Oriented Metrics , Function - Oriented Metrics , Extended Function point metrics Software Project Planning : Project Planning Objectives , Software Project Estimation , Decomposition Techniques - Problem Based Estimation Process Based Estimation ,Empirical Estimation Models- The COCOMO Model Risk Analysis and Management: Software risks, Risk identification, Risk Projection, Risk Refinement, Risk Mitigation , Monitoring and Management.	
Unit 3	Software Quality Assurance: Basic concepts- Quality, Quality Control, Quality Assurance, Cost of Quality, Software Quality Assurance (SQA), Formal Technical Review Software Configuration Management: Baselines, Software Configuration Items, The SCM Process, Version Control, Change Control, Configuration Audit, Status Reporting. Analysis Concepts and Principles: Requirements Elicitation for Software, Analysis Principles. The Information Domain, Modeling, Partitioning, Essential and Implementation Views, Specification: Specification Principles, Representation, The Software Requirement Specification (SRS)	
Unit 4	Design Concepts and Principles: Design Principles, Design Concepts — Abstraction, Refinement, Modularity, Software Architecture, Control Hierarchy, Structural Partitioning, Data Structure. Software Procedure, Structure, Information Hiding, Effective Modular Design- Cohesion, Coupling Software Testing: Testing Objectives & principles, Unit Testing, Integration Testing (Top-Down Integration, Bottom. Up Integration, Regression Testing, Smoke Testing), Validation Testing (Alpha and Beta Testing), System Testing (Recovery Testing, Security Testing, Stress Testing,	

	Performance Testing).
Unit 5	Reengineering: Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering CASE Tools: What is CASE, Building Blocks of CASE, A Taxonomy of CASE Tools, Integrated CASE Environments, The integration Architecture, The CASE Repository.

Suggested Readings:

1. Mall, Rajib. Fundamentals of software engineering. PHI Learning Pvt. Ltd., 2018.
2. R.S. Pressman, Software Engineering – A Practitioner's Approach, 6th Edition, TMH, 2013.
3. Ian Sommerville, Software Engineering, 8th Edition, Addison Wesley, 2009.
4. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing, 2010.

Suggested online courses (MOOCs)

1. NOC:Software Engineering, IIT Kharagpur by Prof. Rajib Mall
   https://nptel.ac.in/courses/106105182
2. Software Engineering, IIT Bombay by Prof. Rushikesh K Joshi, Prof. Umesh Bellur, Prof. N.L. Sarda
   https://nptel.ac.in/courses/106101061

This course can be opted as an elective by the students of following subjects: BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: First	Semester: II
Subject: Computer Application		
Course Code: MCA-110N	Course Title: C++ and Object-oriented programming	
Course Objectives: Understanding and practical mastery of object-oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism.		
Course Outcomes: CO1 Develops a sound approach to problem solving using a middle level programming language. CO2 Apply techniques like recursion and iteration are learnt to solve a problem. CO3 Build programming concepts like pointers, structures.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	BLOCK - 1	
Unit 1	Principles of object-oriented programming: Object oricnted programming paradigm, Comparison with procedural programming, Basic concepts of object-oriented programming, benefits of O0P, object-oriented Languages, advantage of C++.	
Unit 2	Object Orient Programming System: Class, inheritance, abstraction, encapsulation and information hiding, polymorphism, overloading.	
Unit 3	Advanced concept: Dynamism (Dynamic typing., dynamic binding, late binding, dynamic loading). Structuring programs, reusability, organizing object-oriented project,	
Block 2	BIOCK - 2	
Unit 4	Overview of C++: Tokens, keywords, identifiers and constants basic data types, user-defined and derived Data types, type compatibility, reference, variables type Casting, operator precedence, control structures, structure, function.	
Unit 5	Classes and objects: Class specification, class objects, accessing class members, scope resolution operator, data hiding, empty classes, Pointers within a class, passing objects as arguments, returning objects from functions, friend Functions and friend classes, constant parameters and member functions, structures and Classes, static members.	
Unit 6	Object initialization and cleanup: Constructors destructor, constructor overloading. order of construction and destruction, Constructors with default arguments, nameless objects, dynamic initialization through Constructors, constructors with dynamic operations, constant objects and constructor, static Data members with constructors and destructors, nested classes.	
Block 3	BLOCK - 3	
Unit 7	Operator overloading and type conversion: Defining operator overloading, overloading unary operators, overloading binary operators, overloading binary operators using friends, manipulation of strings using Operators, rules for overloading operators. type conversions.	
Unit 8	Inheritance: extending classes: Deriving derived classes, single multilevel, multiple, hierarchical, hybrid inheritance, Constructors & destructors in derived classes, constructors invocation and data members Initialization, virtual base classes, abstract classes, delegation.	
Block 4	BLOCK- 4	
Unit 9	Pointers, virtual functions and polymorphism: Pointers to objects, this pointer. pointers to derived classes, virtual functions, Implementation of run-time polymorphism, pure	

	virtual functions.
Unit 10	Working with files: Classes for file stream operations. opening and closing a file, file pointers and their Manipulations, sequential input and output operations, error handling during file Operations, command line arguments.
Unit 11	Object Oriented Modeling: Need of object-oriented Modeling, Simulation of real-life problems using OOP concept: Example, Representation of problem using object and class diagrams at design level.

Suggested Readings:

1. The C++ Programming Language by Bjarne Stroustrup, 2013.
2. Programming: Principles and Practice Using C++ by Bjarne Stroustrup, 2014
3. The C Programming Language (Ansi C Version) by Brian W. Kernighan and Dennis M. Ritchie, 1990.
4. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, 2015
5. Oriented Object-Oriented Programming with C++ by Balaguruswamy, TMH

Suggested online courses (MOOCs)

1. NOC:An Introduction To Programming Through C++, IIT Bombay by Prof. Abhiram G Ranade https://nptel.ac.in/courses/106101208
2. Programming in Modern C++, IIT Kharagpur By Prof. Partha Pratim Das https://onlinecourses.nptel.ac.in/noc23_cs50/preview

This course can be opted as an elective by the students of following subjects: BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: First	Semester: II
Subject: Computer Application		
Course Code: MCA-111N	Course Title: Data Communication and Computer Networks	
Course Objectives: Develop basic concepts of data communication, layered model, protocols and interworking between computer networks and switching components in telecommunication systems. Provide students an overview of security issues related to data communication in networks and knowledge about different networking tools.		
Course Outcomes: CO1: Understand different networking protocol suites and layering model of a network. CO2: Understand the knowledge of network management and communication switching techniques. CO3: Develops an extensive knowledge of network management, internet devices and their functions. CO4: Explain real time use of different network operating tools and identify basic security threats.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Computer Networks Basics	
	Introduction: Layered network architecture, Review of ISO-OSI Model. Data Communication techniques: Pulse code Modulation, (PCM), Data modems, Multiplexing techniques –Frequency-Division, Time-Division, Time-Division Transmission Media-Wires, Cables, Radio, Links, Fiber-Optic Links. Asynchronous Transfer Mode (ATM); Cell Format, Layovers in ATM, Class 1,2,3,4 Traffic Random Access Data Networks, Concept of Random Access, Pure ALOHA; Throughput Characteristics Slotted ALOHA, Throughputs for Finite and Infinite, Population S- ALOHAS. MARKOV Chain Model for S- ALOHAS. Throughputs for Finite and Infinite, Population S- ALOHAS. MARKOV Chain Model for S-ALOHA.	
Block 2	Data Link layer	
	Local Area Networks (LANs): IEEE 802.4 and 802.5 Protocols. Performance of Ethernet and Tokenring protocols, FDDI Protocol, Distributed Queues Dual Bus (DQDB) Protocol. Data Link Protocols: Stop and Wait Protocols: Noise Free and Noisy Channels Performance and Efficiency, Verification of protocols using Finite State Marching. HDLC Data Link Protocol.	
Block 3	Network & Transport Layer	
	Network Layer Protocols: Design issue: Virtual circuits and Datagram. Integrated Services Digital Network: Interfaces, Devices, Channel Structure. Dead Locks and their avoidance Network Layer in ATM, Internetworking: Bridges, Routers and Gateways, Internet Architecture and Addressing. Transport Layer Protocols: Design issues: Quality of Services, Primitives Connection Management: Addressing, Connection Establishment and Releases, Use of Timers, Flow Control and Buffering, Multiplexing, Crash Recovery.	
Block 2	Upper Layer Protocols	

	Routing Algorithms: Optimality Principle, Shortest Path Routing- Dijkstra, Bellman – Ford and Floyd- War shall Algorithm. Elements of TCP/IP Protocol: User Datagram Protocol Connection Management, Finite State Machine. Session Layer Protocols: Dialog Management, Synchronization, OSI Session Primitives Connection Establishment, Presentation and Application Layer Protocols: Presentation Concepts NMP- Abstract Syntax Notation-1 (ASN-1), Structure of Management, Management Information Base.

Suggested Readings:

1. HBehrouz A. Forouzan, Data Communications and Networking, McGraw Hill , 2006
2. A.S. Tanenbaum, Computer Networks, PHI , 2002

Suggested online courses (MOOCs)

1. Data Communication, IIT Kharagpur by Prof. Ajit Pal
   https://nptel.ac.in/courses/106105082
2. NOC:Computer Networks and Internet Protocol, IIT Kharagpur by Prof. Soumya Kanti Ghosh,
3. Prof. Sandip Chakraborty
   https://nptel.ac.in/courses/106105183
4. NOC:Advanced Computer Networks, IIT Indore, IIT Gandhi nagar by Prof. Neminath Hubballi, Prof. Sameer Kulkarni
   https://nptel.ac.in/courses/106106243

This course can be opted as an elective by the students of following subjects: BCA, MCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.

Programme: MCA	Year: First	Semester: II

Subject: Computer Application

Course Code: MCA-112P N	Course Title: Practical based on MCA-107 N and 110(Data Structures and C++)

Course Objectives:
To enhance programming skills while improving their practical knowledge in data structures.
To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes:
CO1 Implement the abstract data type and reusability of a particular data structure.
CO2 Implement linear data structures such as stacks, queues using array and linked list.
CO3 Understand and implements non-linear data structures such as trees, graphs.
CO4 Implement various kinds of searching, sorting and traversal techniques and know when to choose which technique.

Credits: 04	Type of Course: Practical Lab
Max. Marks: 100	Min. Passing Marks: 36

List of Practical in Data Structures Lab with C++:

1. Implementation of Stacks, Queues (using both arrays and linked lists).
2. Implement a program to evaluate a given postfix expression using stacks.
3. Implement the following operations on singly and circular linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Implementation of operations on binary tree (delete entire tree, copy entire tree, mirror image, level order, search for a node etc.)
5. Implementation of the following operations on binary search tree (BST): (a) Minimum key (b) Maximum key (c) Search for a given key (d) Delete a node with given key
6. Implementation of graph traversals by applying: (a) BFS (b) DFS
7. Implement the following algorithms to find out a minimum spanning tree of a simple connected undirected graph: (a) Prim‟s algorithm (b) Kruskal‟s algorithm
8. Implement Dijkstra‟s algorithm for solving single source shortest path problem.
9. Implementation of recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers: i) Linear search ii) Binary search
10. Implement the following sorting algorithms: a) Bubble sort b) Selection sort c) Insertion sort (d) Merge sort (e) Quick sort (f) Heap sort
11. Write a C++ program to illustrate the concept of class with method overloading.
12. Write a C++ Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util)
13. Write a C++ program to illustrate the concept of Single level and Multi level Inheritance.
14. Write a C++ program to demonstrate the Interfaces & Abstract Classes.
15. Write a C++ program to implement the concept of exception handling.

Suggested Readings:

1. Virtual Lab on Data Structure: https://ds1-iiith.vlabs.ac.in/

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: First	Semester: II
Subject: Computer Application		
Course Code: MCA-E1	Course Title: Web Technology	
Course Objectives: To introduce the fundamentals of Internet, and the principles of web design. To construct basic websites using HTML and Cascading Style Sheets. To build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms. To develop modern interactive web applications using PHP, XML and MySQL.		
Course Outcomes: Co1:Describe the concepts of World Wide Web, and the requirements of effective web design. Co2: Develop web pages using the HTML and CSS features with different layouts as per need of applications. Co3:Use the JavaScript to develop the dynamic web pages. Co4:Construct simple web pages in PHP and to represent data in XML format Co5:Use server side scripting with PHP to generate the web pages dynamically using the database connectivityCO5 Design and implementation programs of JSP.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	MCA-E1 Web Technology	
Unit 1	UNIT- I History of the Internet and World Wide Web - HTML 4 protocols HTTP. SMTP, POP3. MIME, IMAP. Introduction to JAVA Scripts - Object Based Scripting for the web. Structures - Functions - Arrays - Objects.	
Unit 2	UNIT- II Introduction - Object refers, Collectors all and Children. Dynamic style, Dynamic position, frames. navigator, Event Model - On check - On load - Onenor - Mouse rel - Form process - Event Bubblers - Filters - Transport with the Filter - Creating Images - Adding shadows - Creating Gradients - Creating, Motion with Blur - Data Binding - Simple Data Binding - Moving with a record set - Sorting table data - Binding of an Image and table.	
Unit 3	UNIT- III Database, Relational Database model - Overview, SQL - ASP - Working of ASP - Objects - File System Objects - Session tracking and cookies - ADO - Access a Database from. ASP - Serer side Active-X Components - Web Resources - XML - Structure in Data -Name spaces - DTD vocabularies DOM methods.	
Unit 4	UNIT -IV Introduction -Servlet; Overview Architecture handling HTTP Request - Get and post request - redirecting request — multitier application, JS'V Overview Objects— scripting— Standard Actions — Directives. Brief survey of Web 2.0 technologies introduction to Semantic web and other current technologies	
Suggested Readings: 1. Ralph Moseley and M. T. Savaliya, Developing Web Applications, Wiley-India Private Limited, 2011. 2. 2. Robert W.Sebesta, Programming the World Wide Web, 7th edition, Pearson Education, 2013. Suggested online courses (MOOCs) 1.		

This course can be opted as an elective by the students of following subjects: MCA		
Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: First	Semester: II
Subject: Computer Application		
Course Code: MCA-E2	Course Title: Java Programming	
Course Objectives: This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.		
Course Outcomes: CO1 Use the characteristics of an object-oriented programming language JAVA in a program. CO2 Apply JAVA features to program design and implementation. CO3 Design and implementation programs of Java Script, Applets, Event Handling, AWT Programming, and Interface. CO4 Implementation of Packages, Swing, and Servlet. CO5 Design and implementation programs of JSP.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	Object Oriented Methodology and Java
Unit 1	Object Oriented Programming: Paradigms of Programming languages, Evolution of Object-Oriented Methodology, Basic Concepts of OO Approach, Comparison of object oriented and procedure - oriented Approaches, Benefits of OOPS, Applications of OOPS. Classes and objects, Abstraction and Encapsulation, Inheritance, Method overriding and Polymorphism.
Unit 2	Java Language Basics: Introduction to Java, Primitive Data Type and Variables, Java Operators.
Unit 3	Expressions Statements and Arrays: Expressions, Statements, Control Statements, Selection Statements, Iterative Statements, Jump statements, Arrays.
Block 2	Object oriented concepts and Exceptions Handling
Unit 4	Class and objects: Class Fundamentals, Introducing Methods, this Keyword, Using objects as Parameters, Method overloading, Garbage collection, the ffinalize () Method.
Unit 5	Inheritance and Polymorphism: Inheritance Basics, Access, Multilevel, inheritance, Method overriding Abstract classes, Polymorphism, Final Keyword.
Unit 6	Packages and interfaces: Package, Accessibility of Packages, using Package members, Interfaces, Implementing interfaces, interface and Abstract classes, Extends and Implements together.
Unit 7	Exceptions Handling: Exception, Handling of Exception, Types of Exceptions, Throwing, Exceptions, writing Exception subclasses.
Block 3	Multithreading, I/O, and Strings Handling
Unit 8	Multithreaded Programming: Multithreading, The Main thread, JAVA Thread Model, Thread Priorities, Synchronization in JAVA, Inter thread Communication.
Unit 9	I/O In Java: I/O Basics, Streams and stream, Classes, the predefined streams, Reading from and writing to console, reading and writing files, the transient and volatile Modifiers, using instance of Native Methods.
Unit 10	Strings and Characters: Fundamental of Characters and Strings, the String class, String operations, Data Conversion using value of () Methods, Strings Buffer and Methods.
Unit 11	Exploring Java I/O: Java I/O classes and interfaces, Stream classes, Text streams, Stream Tokenizer, Serialization, Buffered stream, print stream, Random Access file.

Block 4	Graphics and user interfaces
Unit 12	Applets: The applet class, Applet architecture, An applet Skeleton: Initialization and Termination, Handling events, HTML Applet TAG.
Unit 13	Graphics and user interfaces: Graphics contests and Graphics objects, user interface components, Building user interface with AWT, Swing - Based GUI, Layouts and layouts and layout Manager, Container.
Unit 14	Networking Features: Socket overview, reserved parts and proxy servers, Internet Addressing: Domain Naming Services (DNS), Java and The Net: URL, TCP/IP Sockets, Datagrams.
Suggested Readings: 1. Java: The Complete Reference Hebert Schildt, Mc Graw Hill 2. Object-Oriented Programming with C++ and Java Debasis Samanta, Prentice Hall India. Suggested online courses (MOOCs) 1. NOC:Programming in Java, IIT Kharagpur by Prof. Debasis Samanta: https://nptel.ac.in/courses/106105191	
This course can be opted as an elective by the students of following subjects: MCA	
Suggested equivalent online courses (MOOCs) for credit transfer: N.A	

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: III
Subject: Computer Application		
Course Code: MCA-113N	Course Title: Python Programming	
Course Objectives: To acquire programming skills in core Python. To explore the use of data structures, strings, text files, lists and dictionaries. To acquire Object Oriented Skills in Python. To understand to solve the problems with Python database, Python multithreading. 5. To work with Django framework, Numpy and other libraries..		
Course Outcomes: CO1. Understand and comprehend the Basics of Python programming CO2. Describe and explain the use of the built-in data structures list, sets, tuples and dictionary. CO3. Make use of functions, modules and its applications. CO4. Demonstrate the principles of OOPs and identify real-world applications using OOPs, files and exception handling provided by Python.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	BASICS OF PYTHON	
Unit 1	Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Python IDLE.	
Unit 2	Tokens and Statements: Variables, Constants, Assignment, Multiple Assignment, Keywords, Punctuators, Identifiers, Input-Output, Indentation, Statements, Comments, Single Comment and Multiline Comment.	
Unit 3	Data Types, Operators & Expressions: Types – Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Operators precedence, Expressions and order of evaluations Control Flow- if, if-else, if-elif-else, for, while, break, continue, pass .	
Block 2	DATA STRUCTURE IN PYTHON	
Unit 4	UNIT – 4: Data Structures: Stack & Queue, Lists – Operations, Slicing, Methods; Tuples – Operations, Methods , Sets– Operations , Methods, Dictionaries– Operations , Methods, Sequences– Operations, Methods. Comprehensions– Operations , Methods.	
Unit 5	Functions – Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables.	
Unit 6	Modules &Packages: Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages.	
Block 3	OOPS IN PYTHON	
Unit 7	BLOCK 3: Object-Oriented Programming OOP in Python: Classes, ' self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.	
Unit 8	Exception Handling :Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined	

	Exceptions
Unit 9	Python Libraries: Brief Tour of the Standard Library – Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression.
Unit 10	GUI Programming and Testing : Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.
Block 4	MACHINE LEARNING IN PYTHON
Unit 11	Machine Learning Using Python :Machine Learning Basics, Features and Labels, Supervised and Unsupervised Learning.
Unit 12	Regression and Classification in Machine Learning: Simple Linear Regression, Multiple Regression, Data Collection for Machine Learning, Classification – Features and Types.
Suggested Readings: 1. Kenneth A. Lambert, Martin, Juneja "Fundamentals of Python", Cengage Learning. 2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson. 3. Learning Python, Mark Lutz, Orielly. 4. Harsh Bhasin, “Python for Beginners”, New Age International. 5. Ashok Namdev Kamthane , Programming and Problem Solving with Python, TMH . 6. Allen Downey, Learning with Python, Dreamtech. Suggested online courses (MOOCs) https://nptel.ac.in/courses/106106145	
This course can be opted as an elective by the students of following subjects: MCA	
Suggested equivalent online courses (MOOCs) for credit transfer: N.A	

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme MCA	Year: Second	Semester: III
Subject: Computer Application		
Course Code: MCA-114N	Course Title: Design And Analysis Of Algorithm	
Course Objectives: ➢ Analyze the asymptotic performance of algorithms. ➢ Write rigorous correctness proofs for algorithms. ➢ Demonstrate a familiarity with major algorithms and data structures. ➢ Explain important algorithmic design paradigms and methods of analysis. ➢ Discuss efficient algorithms in common engineering design situations.		
Course Outcomes: CO1 Understand that various problem solving categories exist such as; iterative technique, divide and conquer, dynamic programming, greedy algorithms. CO2 Analyze the strengths and weaknesses of an algorithm theoretically as well as practically. CO3 Identify and apply an appropriate technique to design an efficient algorithm for simple problems. CO4 Demonstrate correctness and efficiency of the algorithm. CO5 Apply various searching and sorting algorithms.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Introduction and Design Strategies-I	
Unit 1	Introduction: Algorithm, Psuedo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Growth of functions: Asymptotic Notation, Recurrences: substitution method, master method.	
Unit 2	Divide and Conquer: General method, applications-Binary search, Finding the maximum and minimum, Quick sort, Heapsort, Strassen's Matrix Multiplication.	
Unit 3	Sorting in Linear Time: Lower bounds for sorting, Counting sort, Radix sort, Bucket sort, Medians and Order Statistics, Minimum and maximum.	
Block 2	Algorithm Design Strategies-II	
Unit 4	Greedy method: General method, applications- Knapsack problem, Job sequencing with deadlines, optimal two way merge patterns, Huffman codes, Minimum cost spanning trees: Prims and Kruskal's algorithm, Single source shortest paths: The Bellman-Ford algorithm, Dijkstra's algorithm.	
Unit 5	Dynamic Programming: General method, applications, capital budgeting problem, Multistage graphs, Matrix chain multiplication, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.	
Block 3	Algorithm design strategies & Completeness	
Unit 6	Graph Algorithms: Introduction, representation of graphs, Breadth first search, depth first search, topological sort, strongly connected component, flow networks, ford-fulkerson method.	
Unit 7	Backtracking: General method, applications, 8-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.	
Unit 8	Branch-And-Bound: The method, travelling salesperson problem, 15 puzzle problem.	
Unit 9	NP-Hard and NP-Complete problems: Basic concepts, non deterministic algorithms, NP - Hard and NP Complete classes, satisfiability problem, reducibility.	
Suggested Readings: 1. Cormen, Leiserson, Rivest,and Stein, "Introduction to Algorithms", MIT Press ,Third Edition,		

2009.

2. Dasgupta, Papadimitrou and Vazirani, “Algorithms”, McGraw-Hill Education, 2006. Horowitz, Sahni, and Rajasekaran, “Computer Algorithms” Silicon Press, 2007

Suggested online courses (MOOCs)

1. NOC:Design and Analysis of Algorithms, Chennai Mathematical Institute By Prof. Madhavan Mukund
   https://nptel.ac.in/courses/106106131
2. NOC:Introduction to algorithms and analysis, IIT Kharagpur by Prof. Sourav Mukhopadhyay
   https://nptel.ac.in/courses/106105164
3. Design and Analysis of Algorithms, IIT Bombay By Prof. Abhiram Ranade
   https://archive.nptel.ac.in/courses/106/101/106101060/#

This course can be opted as an elective by the students of following subjects: MCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: III
Subject: Computer Application		
Course Code: MCA-115N	Course Title: Data Base Management System	
Course Objectives: ➢ Explain data models, conceptualize and depict a database system using ER diagram. ➢ Provide understanding of the internal storage structures in a physical DB design. ➢ Impart fundamental concepts of transaction processing techniques.		
Course Outcomes: CO1 Students can explain the role of a database management system, basic database concepts, including the structure and operation of the relational data model. CO2 Apply logical database design principles, including E-R/EE-R diagrams, conversion of ER diagrams to relations. CO3 Describe the concepts of integrity constraints, relational algebra, relational domain & tuple calculus, data normalization. CO4 Construct simple and moderately advanced database queries using Structured Query Language (SQL). CO5 Understand the concept of a database transaction including concurrency control, backup and recovery, and data object locking.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Basic concepts of DBMS	
Unit 1	Introduction: Database Management System, Examples, Characteristics of the Database Approach, Advantage of using a Database Approach. Database System concepts and Architecture, Data Models, Schemes and Instances, DBMS Architecture and Data independence, Database Languages, Procedural and Non-procedural languages and Interfaces. Database System Environment, Classification of Database Management Systems.	
Unit 2	ER Model: Database Modeling using the ER Model., Using High-Level conceptual Data Models for Database design, an example Database Application, Entity types, Entity Sets, Attributes and keys, Relationships, Relationship types, roles and Structural Constraints., Week Entity types, Refining the ER Design for the Company Database, ER Diagrams, naming conventions and design Issues, Conversion of ER Diagram to tables.	
Unit 3	Relational Data Model: Basic Relational data model Concepts, Relational Databases and Relational Database Schemas, Relational Model Constraints, update Operations and Dealing with Constraint Violations	
Block 2	Query Language and Database Design Concepts	
Unit 4	Relational Algebra: Relational Model Concepts, Relational concepts and Relational Database Schemes, Update Operation and Dealing with Constraints Violations, Relational Database Design, Using ER-to-Relational Mapping.	
Unit 5	Structured Query language: Data definition, Constraints and Schema changes in SQL 2, Basic Quires in SQL, More Complex SQL Quires, Insert, Delete and Update Statements in SQL, views (Virtual Tables) in SQL, Specifying general constraints as Assertion features of SQL. Integrity constraints, Triggers, Functional dependencies.	
Unit 6	Functional Dependency Theory: Functional Dependencies and Normalization for	

	Relational Database, Informal Design Guidelines for Schemes, Functional Dependencies.
Unit 7	Normalization: Normal Forms based on Primary keys, General Definitions of Second and Third Normal forms, Boyce Codd Normal form, Relational Database Design Algorithms and Further Dependencies, Algorithms for Relational Database Schema Design, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.
Block 3	Transaction Management & Emerging Databases
Unit 8	Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concept, Desirable properties of Transactions, Scheduling and Recoverability, Serializability of Scheduling, Transaction Support in SQL, Concurrency control techniques, Concurrency techniques for concurrency control, concurrency control based on timestamp based protocol, validation based protocol, deadlock handling, Database Recovery Techniques based on Immediate Update, Failure classification, Shadow Paging, Log based recovery, failure with loss of Nonvolatile Storage.
Unit 9	Emerging Trends in DBMS: Emerging Trends in DBMS: Introduction to object-oriented Database Management System, Introduction to client/Server Database, Introduction to Distributed Database, Introduction to Knowledge Databases.

Suggested Readings:

1. R Elmasri, S Navathe, Fundamentals of Database Systems, 6th edition, Addison-Wesley, 2010.
2. R Ramakrishnan, J Gehrke, Database Management Systems, 3rd Ed., McGraw-Hill, 2002.
3. A Silberschatz, H Korth and S Sudarshan, Database System Concepts, 6th Ed., McGraw-Hill, 2010.

Suggested online courses (MOOCs)

1. NOC: Data Base Management System, IIT Kharagpur by Prof. Partha Pratim Das Prof. Samiran Chattopadhyay Prof. Kausik Datta https://nptel.ac.in/courses/106105175
2. NOC:Introduction to Database Systems, IIT Madras by Prof. P.Sreenivasa Kumar https://nptel.ac.in/courses/106106220
3. NOC:Fundamentals of Database Systems (Course sponsored by Aricent), IIT Kanpur By Dr. Arnab Bhattacharya https://nptel.ac.in/courses/106104135

This course can be opted as an elective by the students of following subjects: B.Sc. in Computer Science, BCA, MCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: III
Subject: Computer Application		
Course Code: MCA-116N	Course Title: Multimedia Technology	
Course Objectives: In the present scenario, Multimedia and web design technology play an important role in the field of education, agriculture, product launch, science and technology, corporate development and enhanced business opportunities. With the increasing variety and range of hardware and software used for Multimedia and Web-Site Design, the demand for the manpower in these fields has escalated. This course has been envisaged with an objective to develop specialized manpower required for these activities.		
Course Outcomes: CO1 Define and discuss the Introduction to Multimedia, Identify the multimedia components, Multimedia Authoring and Tools. CO2 Understand the various multimedia software and tools for customized graphic, video and audio designs. CO3 Understand the hardware requirement and Classification multimedia software. CO4 Understand the Graphics and Image Data Representation, Color in Image & Video, Fundamental Concept in Video, Audio. · CO5 Understand analog and digital conversion process. CO6 Understand the audio digitization, audio file format and audio software, digital video standards, formats and technology. CO7 Understand the various techniques for Multimedia Data Compression, Image Compression Standards, Basic Video Compression, MPEG Coding Scheme.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Introduction to Multimedia and Its Components	
Unit 1	Multimedia Technology: Meaning & scope of Multimedia; Elements of Multimedia; Creating multimedia applications; Multimedia file & I/O functions; Multimedia data structures; Multimedia file formats; Multimedia Protocols	
Unit 2	Multimedia Audio: Digital sound; Audio compression & decompression; Companding: ADPCM compression; MPEG audio compression; True Speech; Special effects and Digital Signal Processing: Audio synthesis; FM synthesis: Sound blaster card; Special effect processors on sound cards; Wave table synthesis; MIDI functions; Speech synthesis & Recognition	
Unit 3	Multimedia Video: Representation of Digital video; Video capture: Frame grabbing; Full motion video; Live video in a window; Video processor; Video compression & decompression; Standards for video compression & decompression; Playback acceleration methods	
BLOCK-2	Multimedia Animation, Authoring Tools and Internet	
Unit 4	Creating Multimedia Animation: Icon animation; Bit-map animation; Real-time vs Frame by Frame animation; Object modeling in 3D animation; Motion control in 3D animation; Transparency; Texture. Shadows, Anti-aliasing; Human modeling & Animation; Automatic motion control	
Unit 5	Multimedia Authoring Tools: Project editor; Topic editor; Hot-spot editor; Developing a multimedia title; Multimedia text authoring systems; Usage of authoring tools	
Unit 6	Multimedia on LANs & Internet: Multimedia on LAN; Fast modems & Digital	

	networks for multimedia; High speed digital networks; Video conferencing techniques; Multimedia interactive applications on Internet: Future Directions.

Suggested Readings:

1. "Li, Ze-Nian, Mark S. Drew, and Jiangchuan Liu. Fundamentals of multimedia. Upper Saddle River (NJ) Pearson Prentice Hall, 2004.
2. Jeffcoate, Judith. Multimedia in practice: technology and applications. Prentice-Hall, Inc., 1995.
3. Vaughan, Tay. Multimedia: Making it work. Tata McGraw-Hill Education, 2006.
4. Melliar-Smith, Peter Michael, and Louise E. Moser. "Multimedia Networking: Technology, Management and Applications. Hershey, PA Idea Group, 2002.

Suggested online courses (MOOCs)

1. Multimedia processing, IIT Kharagpur by Prof. Somnath Sengupta
   https://nptel.ac.in/courses/117105083
2. CIT-003: Web Based Technologies and Multimedia Applications
   By Prof. P. V. Suresh | Indira Gandhi National Open University
   https://onlinecourses.swayam2.ac.in/nou20_cs05/preview

This course can be opted as an elective by the students of following subjects: B.Sc. (Computer Science) and BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: III
Subject: Computer Application		
Course Code: MCA-117N	Course Title: Microprocessor and its Application	
Course Objectives: To study fundamentals of microprocessor and microcontroller systems. 2. To study architecture of microprocessor & to understand the concept of memory organization, stack memory, Assembly language programming. 3. To study different interrupt techniques. 4. To study interfacing of microprocessor & microcontroller with different peripheral devices..		
Course Outcomes: • CO1: recall and apply a basic concept of digital fundamentals to Microprocessor based personal computer system. • CO2: identify a detailed s/w & h/w structure of the Microprocessor. • CO3: illustrate how the different peripherals (8255, 8253 etc.) are interfaced with Microprocessor. • CO4: distinguish and analyze the properties of Microprocessors & Microcontrollers. • CO5: analyze the data transfer information through serial & parallel ports.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	Microprocessor and its Applications
Unit 1	Introduction of Microcomputer System: CPU, I/Odevices, clock, memory, bussed architecture, tristatelogic, address bus, data bus and control bus. sequence, Initiallization control words ICW1, ICW2, ICW3, ICW4, Operation Comtrol Words(OCWs), Fully nested mode, EOI mode, Poll command, Reading status registers, Special fully nested mode, Cascade mode.
Unit 2	Semiconductor Memories: Development of semiconductor memory, internal structure anddecoding, memory read and write timing diagrams,MROM, ROM, EPROM, EEPROM, DRAM,
Unit 3	Architecture of 8-bit Microprocessor:Intel 8085Amicroprocessor, Pin description and internal architecture.
Unit 4	Operation and Control of Microprocessor: Timingand control unit, op-code fetch machine cycle, Memoryread/write machine cycles, I/O read/write machinecycles, interrupt acknowledge machine cycle, state-transition diagram
Unit 5	Instruction Set:Addressing modes; Data transfer,arithmetic, logical, branch, stack and machine controlgroups of instruction set, macro RTL and micro RTLflow chart of few typical instructions; Unspecified flagsand instructions.
Unit 6	Assembly Language Programming: Assemblerdirectives, simple examples; Subroutines, parameterpassing to subroutines.
Unit VII	Interfacing: Interfacing of memory chips, addressallocation technique and decoding; Interfacing of I/Odevices, LEDs and toggle-switches as examples,memory mapped and isolated I/O structure;Input/Outputtechniques: CPU initiated unconditionaland conditional I/O transfer, device initiated interrupt I/Otransfer.
Unit VIII	Interrupts:Interrupt structure of 8085Amicroprocessor, processing of vectored and non-vectored interrupts, latency time and response time;Handling multiple interrupts
Unit IX	Programmable Peripheral Interface: Intel 8255, pinconfiguration, internal structure of a port bit, modes ofoperation, bit SET/RESET feature, programming; ADC and DAC

	chips and their interfacing.
Unit X	Programmable Interval Timer: Intel 8253, pinconfiguration, internal block diagram of counter andmodes of operation, counter read methods,programming, READ-BACK command of Intel 8254.
Unit XI	Programmable Interrupt Controller 8253/8254: Pin configuration, Timer or counter, Internal structure, Interfacing with system, Mode (0,1,2,3,4,5), Reading timer, Read back command feature.
Unit XII	Programmable Interrupt Controller 8259A: Priority interrupt structure, Intel 8259, Pin configuration, Functional Block Diagram, Interrupt.

Suggested Readings:

1. J.L. Antonakos, An Introduction to the Intel Family of Microprocessors, Pearson, 1999.
2. Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.
3. M.A. Mazidi & J.C. Mazidi Microcontroller and Embedded systems using Assembly & C. (2/e), Pearson Education, 2007

Suggested online courses (MOOCs)

https://nptel.ac.in/courses/106108100

https://nptel.ac.in/courses/108107029

This course can be opted as an elective by the students of following subjects: B.Sc. (Computer Science) and BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.

Programme: MCA	Year: second	Semester: III
Subject: Computer Application		
Course Code: MCA-118PN	Course Title: Practical Based on MCA 114N and 115 N	

Course Objectives:

- To enhance programming skills while improving their practical knowledge in data structures.
- To strengthen the practical ability to apply suitable data structure for real time applications
- Provide working on existing database systems, designing of database, creating relational database, analysis of table design.
- Practice various DDL commands in SQL
- Write simple and complex queries in SQL
- Familiarize PL/SQL

Course Outcomes:

CO1 Design and implement a database schema for a given problem
CO2 Populate and query a database using SQL and PL/SQL
CO3 Implement the abstract data type and reusability of a particular data structure.
CO4Implement linear data structures such as stacks, queues using array and linked list.
CO5 Understand and implements non-linear data structures such as trees, graphs.
CO6 Implement various kinds of searching, sorting and traversal techniques and know when to choose which technique

Credits: 04	Type of Course: Practical Lab
Max. Marks: 100	Min. Passing Marks: 36

List of Practical in Lab:

1. Implementation of Stacks, Queues (using both arrays and linked lists).
2. Implement a program to evaluate a given postfix expression using stacks.
3. Implement the following operations on singly and circular linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Implementation of operations on binary tree (delete entire tree, copy entire tree, mirror image, level order, search for a node etc.)
5. Implementation of the following operations on binary search tree (BST): (a) Minimum key (b) Maximum key (c) Search for a given key (d) Delete a node with given key
6. Implementation of graph traversals by applying: (a) BFS (b) DFS
7. Implement the following algorithms to find out a minimum spanning tree of a simple connected undirected graph: (a) Prim‟s algorithm (b) Kruskal‟s algorithm
8. Implement Dijkstra‟s algorithm for solving single source shortest path problem.
9. Implementation of recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers: i) Linear search ii) Binary search
10. Implement the following sorting algorithms: a) Bubble sort b) Selection sort c) Insertion sort (d) Merge sort (e) Quick sort (f) Heap sort

Creation of a database (exercising the commands for creation)

1. Simple to complex condition query creation using SQL Plus.
2. Implementation of DDL commands of SQL with suitable examples: Create table, Alter table

and Drop Table

3. Implementation of DML commands of SQL with suitable examples: Insert, Update and Delete
4. Implementation of different types of function with suitable examples: Number function, Aggregate Function, Character Function, Conversion Function and Date Function
5. Implementation of different types of operators in SQL: Arithmetic Operators, Logical Operators, Comparison Operator, Special Operator and Set Operation.
6. Implementation of different types of Joins: Inner Join, Outer Join and Natural Join etc.
7. Study and Implementation of Group By, having clause, Order by clause and Indexing.
8. Implementation of Sub queries and Views.
9. Usage of triggers and stored procedures.
10. Creation of forms for student information, library information, payroll etc.
11. Writing PL/SQL procedures for data validation.

Suggested Readings:

1. https://www.cdlsiet.ac.in/wp-content/uploads/2022/03/DBMS-LAB-MANUAL.pdf
2. https://mrcet.com/pdf/Lab%20Manuals/CSE%20II-II%20SEM.pdf
3. Virtual Lab on Data Structure: https://ds1-iiith.vlabs.ac.in/

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: III
Subject: Computer Application		
Course Code: MCA-E3N	Course Title: Client Server Technology	
Course Objectives: To understand the basic concepts of Client/Server computing and explore the components of Client/Server communications. To obtain a working knowledge of the internet (as the underlying Web infrastructure) and the HTTP protocol, which is the driver behind all main web services.		
Course Outcomes: CO1: Understand the Client/Server technology and its advantages CO2: Understand the role of Client and Server CO3: Acquire the knowledge on hardware and software for Client/Server technology CO4: Understand the knowledge on HTML,Java Script,ASP.Net,ADO.Net,AJAX CO5: Learn and use client-server based software development tools.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Introduction to Client-Server Computing	
Unit 1	Block 1: Unit 1: Introduction to Client-Server Computing Introduction to Client-Server Architecture, Client-Server computing and its uses, historical development, downsizing and client server computing, mainframe computing, client-server technology and heterogeneous computing, advantages of client server computing.	
Unit 2	Unit 2: Distributed Computing Distributed Computing, File Server versus Client/Server Database, Computing platforms, Microprocessor integration and client server computing, implementations and scalability.	
Unit 3	Unit 3: Designing Client-Server Applications Fundamentals of client server design, division of labor, Transition to client-server programming; Interaction of client and server communication Techniques and protocols, implementing client server applications.	
Block 2	Introduction to ASP.NET	
Unit 4	Unit 4: Introduction to .NET Framework Introduction, The Origin of .Net Technology, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS), Microsoft Intermediate Language (MSIL), Just-In –Time Compilation, Framework Base Classes.	
Unit 5	Unit 5: Traditional ASP Basics Introduction to ASP, How ASP Works, ASP Objects, Installing IIS on Windows 7 & Windows 8, Sample Programs, Importance's of Form tag and how it works	
Unit 6	Unit 6: ASP.NET Introduction & Controls ASP.NET Introduction, First ASP.NET Application, Auto Postback Property, Event Handler, Parameters, Dynamically intializing Controls, IsPostBack property of Page class, ListControls, Comparison between HtmlControls and WebControls, Control Properties and Methods, FileUpload Control	
Block 3	Working with Forms and Controls	

Unit VII	Unit 7: Working with Forms and Controls Life Cycle of ASP.NET Page, Creating an ASP.NET Web Application Project, Creating Web Forms, Using Server Controls, Using Code-Behind Pages, Web Server Controls, Using Validation controls usage of skins and themes.
Unit VIII	Unit 8: ADO.Net Introduction to ADO.NET, .NET Framework data providers, Data Binding, Connecting to the Database, Accessing Data with DataSets, Displaying a DataSet in a List-Bound Control, Using Multiple Tables, Accessing Data with DataReaders, Disconnected operations with Data tables and Data sets, Connection pooling, Working with LINQ.
Unit IX	Unit 9: ASP.NET State Management Application and Session Variables, Cookies, Storing Session Variables in a Database, Cleaning the session state, Types of Assemblies, Private vs. Shared assemblies, Creating and placing strongly named assemblies.
Unit X	Unit 10: Configuration Windows configuration, .net configuration, cashing, Types of Caching, SQL Cache Invalidation
Block 4	Client Side and Server Side Login Services
Unit XI	Unit 11: HTML & JavaScript Understanding HTML Form Tag and elements within it, Javascript using Sample Programs, Working with CSS, Use Themes to Customize a Site,Web based security, ASP.NET authentication service, managing user,asp.net login controls, authorizing users.
Unit XII	Unit 12: ASP.Net Web Services Introduction to web services, creating web services, invoking web services,
Unit XIII	Unit 13: AJAX Introduction to AJAX, AJAX.NET, Script Manager, Update Panel, Update Progress, Timer, AJAX Control Toolkit, server side support for AJAX, AJAX client support.
	Unit 14: Developing a small application using ASP.NET for any case study.
Suggested Readings: Suggested online courses (MOOCs)	
This course can be opted as an elective by the students of following subjects: B.Sc. (Computer Science) and BCA	
Suggested equivalent online courses (MOOCs) for credit transfer: N.A.	

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: III
Subject: Computer Application		
Course Code: MCA-E4N	Course Title: SYSTEM ANALYSIS AND DESIGN	
Course Objectives: The objective of this course is to provide adequate understanding of systems concept, system analysis, and systems design, which would help them in having efficient and workable information system for management.		
Course Outcomes: • To provide an understanding the role of Hardware and Software for realizing organizational Objectives and automation. • To provide an understanding of the role of systems analyst and software development firms for their role in distributing meaningful ERP modules and other business intelligent system. • To provide an understanding of the role of system analysis and design within various systems development stages. • To develop an awareness of the different approaches that might be taken to systems design. • To understand the activities of the management and systems analyst, and in the overall development of system. • To develop an understanding of Testing software and complying the various software quality parameters. • To develop an understanding of how to migrate old data within newly developed system with the help of various techniques		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	System Concept, life cycle models
Unit 1	System Concept – An Introduction
Unit 2	The system development life cycle.
Unit 3	Life cycle models
Unit 4	the role of the system analyst
Unit 1	Block – 2: System analysis System Planning
Unit 2	information gathering
Unit 3	tools of structured analysis
Unit 4	feasibility study
Block – 3	System Design
Unit 1	System design and design methodologies
Unit 2	input/output and form design
Unit 3	file organization
Unit 4	data base design
Block – 4	System implementation
Unit 1	System testing
Unit 2	Implementation and project scheduling
Unit 3	hardware and software selection
Unit 4	security and disaster recovery

Suggested Readings: 1. System Analysis and Design Methods, Whitten, Bentaly and Barlow, Galgotia Publication. 2. System Analysis and Design Elias M. Award, Galgotia Publication 3. Modern System Analysis and Design, Jeffrey A. Hofer Joey F. George Joseph S. Valacich Addison Weseley Suggested online courses (MOOCs) https://nptel.ac.in/courses/106108102
This course can be opted as an elective by the students of following subjects: B.Sc. (Computer Science) and BCA
Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: IV
Subject: Computer Application		
Course Code: MCA-E5N	Course Title: Information and Network Security	
Course Objectives: This course develops a basic understanding of the algorithms used to protect users online and to understand some of the design choices behind these algorithms. Our aim is to develop a workable knowledge of the mathematics used in cryptology in this course. The course emphasizes giving a basic understanding of previous attacks on cryptosystems with the aim of preventing future attacks.		
Course Outcomes: CO1 Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory. CO2 Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication CO3 Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes CO4 Apply different digital signature algorithms to achieve authentication and create secure applications CO5 Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP. CO6 Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	Information security and Symmetric Ciphers
Unit 1	Introduction: History, what is Information Security; Characteristics of Information; Information Security Model; Components of an Information Security; Aspects of Information security: Security attacks, Security Mechanism, and Security Services (X.800), Model for Network Security.
Unit 2	Classical Encryption Techniques: Historical background, symmetric cipher model, Substitution techniques, Transposition techniques, steganography.
Unit 3	Block ciphers and DES: Block cipher principles, Data encryption standard, strength of DES, differential and cryptanalysis, block cipher design principles, block cipher mode of operation.
Unit 4	Confidentiality Using Symmetric Ciphers: Placement of encryption function, traffic confidentiality, key distribution, random number generation.
Block 2	Public key Encryption and Hash Functions
Unit 5	Introduction to Number Theory: Prime numbers, Fermat's and Euler's theorem, discrete logarithm
Unit 6	Public Key Cryptography: Public-Key Cryptography Principles, RSA, Key Management: Diffi-Hellman key exchange.
Unit 7	Message Authentication and Hash Functions: Authentication requirements, Authentication Functions, Message Authentication codes, Hash Functions, SHA-1, MD5.
Unit	Digital Signatures: Digital signatures, Authentication protocols, Digital Signature standard

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Block 3	Network Security Applications
Unit 9	Authentication Applications: Kerberos Motivation, X.509 authentication service
Unit 10	Electronic Mail Security: PGP: PGP Notation, PGP Operational Description, S/MIME
Unit 11	IP Security: IP Security Overview, IP Security Architecture, Authentication Header
Unit 12	Web Security: Web Security Threats, Web Traffic Security Approaches, Overview of Secure Socket Layer and Transport Layer Security, Overview of Secure Electronic Transaction
Block 4	Intruders and Viruses
Unit 13	Intruders: Intruders, Intrusion Techniques, Password Protection, Password Selection Strategies, Intrusion Detection,
Unit 14	Malicious Programs: Malicious Programs, Nature of Viruses, Types of Viruses, Macro Viruses, Antivirus Approaches
Unit 15	Firewall: Firewall Characteristics, Types of Firewalls, Firewall Configuration

Suggested Readings:

1. Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.
2. B. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill.
3. W. Stallings, "Cryptography and Network Security", Pearson Education.

Suggested online courses (MOOCs)

1. NOC:Cryptography And Network Security, IIT Kharagpur by Prof. Sourav Mukhopadhyay
   https://nptel.ac.in/courses/106105162
2. Cryptography and Network Security, IIT Kharagpur by Dr. Debdeep Mukhopadhyay
   https://nptel.ac.in/courses/106105031

This course can be opted as an elective by the students of following subjects: MCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: IV
Subject: Computer Application		
Course Code: MCA-E6N	Course Title: Data Mining	
Course Objectives:		
Course Outcomes:		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	
Unit 1	Block 1: Data pre-processing and Data ware housing Unit 1: Processing and visualizing data Data types, data quality, data pre-processing, measures of similarity, visualization.
Unit 2	Unit 2: Data warehousing Introduction to DATA Warehousing, Integration with Data Mining, Data-Mart, Concept of Data-Warehousing, Multi-Dimensional Database Structures. Client/Server Computing Model & Data Warehousing.
Unit 3	Unit 3: DATA Warehousing DATA Warehousing. Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Technical considerations & Implementation considerations of data warehouses, 3-level architecture of data warehousing
Block 2	Data Mining and its Techniques
Unit 4	Unit 4: Introduction to Data Mining Basic Data Mining Tasks, Data Mining Issues, Data Mining Metrics, Data Mining from a Database Perspective, Data Mining Definitions
Unit 5	Unit 5: Data Mining Techniques Discovery of association rule, clustering, Classification, deviation detection
Unit 6	Unit 6: Specialized Data mining Techniques Neural Network, Genetic Algorithm, Rough sets
Block 3	Data-Mining Techniques in Detail
Unit 7	Unit 7: Descriptive Analytics – Cluster Analysis Definition, Clustering Algorithms – Partitioning, Hierarchical, Density Based, Grid Based, Model Based, Constraint Based Cluster Analysis Outlier Analysis – Density Based and Distance Based
Unit 8	Unit 8: Predictive Analytics – Classification and Prediction Definition, Decision Tree Induction, Lazy Learners - Bayesian Classification, Rule Based Classification, Classification by Back-propagation and Support Vector Machines.
Unit 9	Unit 9: Mining Frequent Patterns, Associations and Correlations Basic Concepts, Frequent Item-set Mining Algorithms, Mining Various Kinds of Association, Rules – Multilevel and Multidimensional, Association Rule Mining Vs Correlation Analysis
Block 4:	Advance Data Mining Techniques
Unit 10	Unit 10: Web Mining Web mining, Web content mining, Web structure mining, Web users mining
Unit 11	Unit 11: Text mining Unstructured text, Episode Rule Discovery for Text, Hierarchy of Categories, Text-Clustering.

Unit 12	Unit 12: Spatial Mining Spatial Mining Task, spatial mining clustering, Spatial Mining trends
Suggested Readings: Suggested online courses (MOOCs) https://nptel.ac.in/courses/106105174	
This course can be opted as an elective by the students of following subjects: MCA	
Suggested equivalent online courses (MOOCs) for credit transfer: N.A.	

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: IV
Subject: Computer Application		
Course Code: MCA-119N	Course Title: Theory of Computation	
Course Objectives: ➢ Introduce concepts in automata theory and theory of computation. ➢ Identify different formal language classes and their relationships. ➢ Design grammars and recognizers for different formal languages.		
Course Outcomes: CO1 Describe the mathematical model of machines. CO2 Familiarize students with the concept of formal language and corresponding automaton. CO3 Introduces the concept of ambiguity, derivations and parse tree in grammar.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Regular Expression and Finite Automata	
Unit 1	Alphabet, Strings and Languages: Set, Relations, Alphabet, Strings, Languages, Finite Representation of Languages, Chomasky Hierarchy	
Unit 2	Finite Automata: Finite State Systems, Basic Definitions Non-Deterministic finite automata (NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA, Finite automata with epsilon transitions, Removal of epsilon transitions.	
Unit 3	Regular Expressions: Regular Expressions-Definition, Algebraic Laws of RE,Finite Automata and Regular expressions, Conversion from RE to FA, Conversion from FA to RE, Arden's Theorem.	
Unit 4	Introduction to Machines: Concept of basic Machine, Properties and limitations of FSM.Moore and mealy Machines, Equivalence of Moore and Mealy machines. Minimization of DFA.	
Unit 5	Block 2 Context Free Grammar	
Block 2	Properties of Regular Language: The Pumping Lemma for Regular Sets, Applications of the pumping lemma, Closure properties of regular sets.	
Unit 6	Context Free Grammar: Context Free Grammar (CFG)-Formal definition, sentential forms, leftmost and rightmost derivations, the language of CFG.	
Unit 7	Normal Forms: Simplifications of CFG's- Removal of Useless Symbols, Removal of epsilon and Unit Production, Normal Forms-CNF and GNF.	
Unit 8	Context Free Languages (CFL): Closure Properties of CFL, Decision Properties of CFL,Application of CFG,Pumping Lemma for CFL.	
Block 3	Block 3 Pushdown Automata and Turing Machine	
Unit 9	Push Down Automata: Formal Definition of Pushdown Automata, Pushdown Automata accepted by final state and empty state, Equivalence between CFG and PDA.	
Unit 10	Turing Machine: Turing Machine (TM) –Formal Definition and behavior, Transitiondiagram, Instantaneous Description, Language of a TM,Variants of TM, Universal Turing Machine, Halting Problem, Church Thesis.	
Unit 11	Undecidability: Recursive enumerable, Undecidable Problem About Turing Machines, Unsolvable Problems.	
Suggested Readings: 1. Hopcroft and Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 3rd edition, 2006		

2. Linz, Peter, and Susan H. Rodger. An introduction to formal languages and automata. Jones & Bartlett Learning, 2022.

Suggested online courses (MOOCs)

1. NOC:Introduction to Automata, Languages and Computation, IIT Kharagpur by Prof. Sourav Mukhopadhyay
   https://nptel.ac.in/courses/106105196
2. Formal Languages and Automata Theory, IIT Guwahati by Dr. Diganta Goswami, Dr. K.V. Krishna
   https://nptel.ac.in/courses/111103016
3. Theory of Automata, Formal Languages and Computation, IIT Madras by Prof. Kamala Krithivasan
   https://nptel.ac.in/courses/106106049
4. NOC:Theory of Computation, IIT Kanpur by Prof. Raghunath Tewari
   https://nptel.ac.in/courses/106104148

This course can be opted as an elective by the students of following subjects: BCA, MCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: IV
Subject: Computer Application		
Course Code: MCA -120N	Course Title: Soft Computing	
Course Objectives: Expose students to Neural Network, Fuzzy Logic and Genetic Algorithms, which are the major building blocks of Intelligent Systems.		
Course Outcomes: CO1–Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience. CO2 –Understand how neural networks learn from available examples and generalize to form appropriate rules for inference systems. CO3 –Provide the mathematical background for carrying out the optimization associated with neural network learning. CO4 –Apply genetic algorithms and other random search procedures for finding global optimum of optimization problems.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Artificial Intelligence & Soft Computing: Introduction of Artificial Intelligence, Problem domain of AI, AI techniques, Rule based system, monotonic reasoning, non-monotonic reasoning, Uncertainty reasoning & Inference, Bayesian theory and dependency network, Limitation of AI, Soft computing paradigms, pattern classification, association and mapping, Pattern recognition techniques.	
Block 2	Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems.	
Block 3	Neural Network: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA, Deep Learning: Convolution Neural Network, Recurrent Neural Network.	
Block 4	Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications &advances in GA, Differences & similarities between GA & other traditional method.	

Suggested Readings:

Text Books

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. S. Rajasekaran and G.A.VijaylakshmiPai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.

3. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
4. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley,N.Y.,1989.
5. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
6. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996.

Suggested online courses (MOOCs)

1. NOC:Introduction to Soft Computing, IIT Kharagpur by Prof. Debasis Samanta https://nptel.ac.in/courses/106105173

This course can be opted as an elective by the students of following subjects: M.Sc. (Statistics) and M.Sc. (Mathematics)

Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: VI
Subject: Computer Application		
Course Code: MCA-121N	Course Title: Computer Graphics	
Course Objectives: Computer graphics is one of the fundamental aspects of any computing system. Its primary role is to render the digital content (0's and 1's) in a human-comprehensible form on the computer screen. This course introduces various object representation techniques followed by the pipeline stages of modeling transformation, 3D to 2D viewing transformation, clipping and hidden surface removal and scan conversion (rendering). It briefly introduces the present-day graphics hardware (I/O devices, GPU).		
Course Outcomes: CO1 Demonstrate an understanding of contemporary graphics hardware. CO2 Draw graphics using line & polygon and ability to perform operations on computer graphics. CO3 Understand and demonstrate geometrical transformations, Segment, Windowing and Clipping, Interaction. CO4 Understand and demonstrate 2D & 3D image processing techniques. CO5 Understand and demonstrate Hidden Surfaces & Lines; Light, Colour & Shading; Curves and Fractals		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Raster Graphics and Clipping	
Unit 1	Unit 1: Introduction to Computer Graphics: What is Computer Graphics?, Application of Computer Graphics, Presentation Graphics, Painting and Drawing, Photo Editing, Scientific Visualization, Image Processing, Digital Art, Education, training, Entertainment and CAD Simulation, Animation and Games, Graphics Hardware, Input and Output Devices, Touch Panel, Light Pens, Graphic Tablets, Plotters, Film Recorders, Display Devices, Refreshing Display Devices: Raster-Scan, Random-Scan, Plasma Panel and LCD panels	
Unit 2	Unit 2: Graphics Primitives: Points and Lines, Line-drawing Algorithms: DDA Algorithm, Bresenham's line Algorithm, Circle-generating Algorithm: Properties of Circles, Midpoint Circle of Algorithm, Polygon Filling Algorithm: Scan-Line	
Unit 3	Unit 3: 2-D Viewing and Clipping: Point Clipping, Line Clipping: Cohen-Sutherland Line Clippings, Cyrus-Beck Line Clipping Algorithm, Polygon Clipping: Sutherland Hodgman Algorithm, Windowing Transformation	
Block 2	Transformations	
Unit 4	Unit 4: 2-D and 3-D Transformations: Basic Transformations: Translation, Rotation, Scaling, Shear, Composite Transformations: Rotations about a point, Reflection about a line, Homogeneous Coordinate Systems, 3-D Transformations	
Unit 5	Unit 5: Viewing Transformation: Projections: Parallel Projection, Orthographic & Oblique Projections, Isometric Projections, Perspective Projections	
Block 3	Modeling & Rendering	
Unit 6	Unit 6: Curves and Surfaces: Polygon Representation Methods: Polygon Surfaces, Polygon Tables, Plane Equations, Polygon Meshes, Bezier Curves and Surfaces: Bezier Curves, Properties of Bezier Curves, Bezier Surfaces, Surface of	

	Revolution
Unit 7	Unit 7: Visible – Surface Detection: Depth Buffer Method, Scan-Line Method, Area-Subdivision Method
Unit 8	Unit 8: Polygon Rendering and Ray Tracing Methods: Illumination Model: Ambient Reflection, Diffuse Reflection, Specular Reflection, Shading: Gouraud Shading, Phong Shading, Ray Tracing: Basic Ray-Tracing Algorithm

Suggested Readings:

1. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles and Practice, Second Edition in C, Pearson Education, 2003.
2. D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 2nd Edition, 2004.
3. Edward Angel, Interactive Computer Graphics A Top-Down Approach with OpenGL 5th Edition, Addison-Wesley, 2008.
4. Prabat K Andleigh and KiranThakrar, "Multimedia Systems and Design", PHI, 2003.

Suggested online courses (MOOCs)

1. Computer Graphics, IIT Madras by Prof. Sukhendu Das https://nptel.ac.in/courses/106106090
2. Introduction to Computer Graphics, IIT Delhi by Prof. Prem K Kalra https://nptel.ac.in/courses/106102065
3. NOC:Computer Graphics, IIT Guwahati by Prof. Samit Bhattacharya https://nptel.ac.in/courses/106103224

This course can be opted as an elective by the students of following subjects: B.Sc. (Computer Science) and BCA

Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: VI
Subject: Computer Application		
Course Code: MCA-122N	Course Title: UNIX Shell Programming	
Course Objectives: • Understand the UNIX operating system and its memory management, input/output processing, internal and external commands. • Learn the File Systems and Process Management of UNIX. • Learn and explore the use of operating system utilities such as text editors. • Understand Shell Scripting and Shell Programming.		
Course Outcomes: 1. Identify and use UNIX utilities to create and manage simple file processing operations, 2. Organize directory structures with appropriate security. 3. Effectively use the UNIX system. 4. Monitor system performance and lean the shell scripts. 5. Use the shell scripts in designing a programs for engineering problems.		
Credits: 04	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	Introduction to Unix Operating System	
Unit 1	Introduction to Unix Operating System Unix introduction - Basic Features, advantages, Basic Architecture of Unix system, Kernel, Types of shells: Bourne shell, C Shell, korn shell, unix commands	
Unit 2	Working with Files and Directories Unix file system, creating files, Listing Files and Directories, masking file permissions, directory permissions, removing a file forcibly, Mkdir, ls, pwd and cd,echo and cat,wc,ls –l, other useful variations of ls, tput command, control instructions in shell.	
Unit 3	Unix File system-Boot block, super block, Inode table, data blocks, How Unix access files, storage files, Disk related commands: checking disk free space, dfsapce, du, ulimit.	
Unit 4	Essential Commands of Unix Password, cal, banner, touch, file, links with DOS, Commands for files and directories, cd, ls, cp, md, rm, mkdir, rmdir, more, less, creating and viewing files, using cat, file comparisons, file compression commands, unix manual page, setting PATH, System startup and shut-down.	
Block 2	Redirection, vi editor, processes in UNIX	
Unit 5:	IO redirection and piping Standard streams: standard input, standard output, standard error, operator >, piping, commonly used filter: cat, pg, more, head, tail, grep, sort, nl, pr, wc, tee, uniq, tr, cut, paste, lpr, examples using streams and filters	
Unit 6:	Vi editor Introduction to vi editor,modes, status line commands, Opening & modifying a file, Saving a file and exiting vim, Search and Replace, undoing changes, yanking, Accessing multiple files, Window Commands, Interacting with system, Macros, vim configuration basics, syntax of ex commands, Addresses, Address symbols, options	
Unit 7:	Understanding Processes in UNIX Processes in Unix, process fundamentals, connecting processes with pipes, Redirecting input output, manual help, Background processing, killing processes, managing multiple processes, changing process priority, scheduling of processes: at, batch, crontab command	

Block 3	Shell programming in Unix
Unit 8	Unit 8: Basics of Shell programming Basic of shell programming, various types of shells, shell programming in bash, Shell variables, shell keywords, assigning values to variables, unchanging variables, positional parameters, passing command line arguments, arithmetic in shell scripts, read, echo,
Unit 9	Decision Control Structures Decision statements, if, else, elif, test command, nested if-else, forms of if, use of logical operators, case control structure.
Unit 10	Loop control structures looping statements: while, until, for, reading from a file, using with command line arguments, nested loops, break statement, continue statement
Block 4:	Shell scripting in Unix
Unit 11	sed editor: overview, uses of sed, sed operation, standard operations, pattern addressing, regular expressions, line information, I/O processing, yanking, putting, branching commands, multiline input processing
Unit 12	Bash scripting-I Bash scripting:Variables- variable assignment and variable scope, Operators, Command Line Arguments, Setting Values of Positional Parameters, Using Shift on Positional Parameters
Unit 13	Bash scripting-II Control Flow Statements-Decision, loops and case statements, Arithmetic in Shell Script, Array, File and String Tests
Unit 14	gawk programming: overview, command line syntax, standard options, Built in variables, operators, variable and array assignment, escape sequences, patterns and procedures, functions, file inclusion, output redirections, printf formats.
Unit 15	List of Practical Assignments: 1. Execution of various file/directory handling commands. 2. Simple shell script for basic arithmetic and logical calculations. 3. Shell scripts to check various attributes of files and directories. 4. Shell scripts to perform various operations on given strings. 5. Shell scripts to explore system variables such as PATH, HOME etc. 6. Shell scripts to check and list attributes of processes. 7. Execution of various system administrative commands. 8. Use seed instruction to process /etc/password file. 9. Write a shell script to display list of users currently logged in. 10. Write a shell script to delete all the temporary files. 11. Write a shell script to search an element from an array using binary searching. 12. Write script to print the message “Hello” on the Console. 13. Write script to perform following basic math operation as : i) Take input from keyboard ii) Take input as command line parameter 14. Write script to display current date, time, username and current directory. 15. Write shell script to show various system configurations like: a) Currently logged user and his long name b) Current shell c) Your home directory d) Your operating system type

Suggested Readings:

1. Yashavant P. Kanetkar “Unix Shell Programming”, BPB Publications.
2. Venkatesh Murthy, “Introduction to Unix &Shell”, Pearson Edu.
3. Forouzan, “Unix & Shell Programming”, Cengage Learning.
4. Sumitab Das,”Unix Concept & Application”, TMH.
5. Venkateshwavle,”Linux Programming Tools Unveil`ed”, BS Publication.

6. Richard Peterson,"Unix Complete Reference",TMH.
Suggested online courses (MOOCs)
This course can be opted as an elective by the students of following subjects: B.Sc. (Computer Science) and BCA
Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Course prerequisites: Bachelor degree in concerned B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or six month or one year diploma course in computer or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).OR Passed BCA/ Bachelor Degree in Computer Science, Electronics, Electrical, Mechanical ,Civil Engineering equivalent Degree.		
Programme: MCA	Year: Second	Semester: IV
Subject: Computer Application		
Course Code: MCA-123N	Course Title: Dissertation with viva voce	
Course Objectives: ➢ To facilitate the learner to independently formulate and solve a social, philosophical, commercial, or technological problem and present the results in written and oral form. ➢ To render learners to real-life problems. ➢ To provide opportunities for learners to interact with people and present them confidently.		
Course Outcomes: CO1 Investigate and evaluate a research topic relevant to environment and society. CO2 Learn systematic discovery and critical review of appropriate and relevant information sources. CO3 Apply qualitative and/or quantitative evaluation processes to original data. CO4 Communicate research concepts and contexts clearly and effectively both in writing and orally		
Credits: 08	Type of Course: Research	
Max. Marks: 200	Min. Passing Marks: 72	