

Regulations and Curriculum for  
**Master of Computer Applications (MCA)**

**Version 2025.01**

# Regulations and Curriculum for

## Master of Computer Applications (MCA)

### Choice Based Credit System (CBCS)

Applicable to the batch admitted from AY 2025-26 and onwards

Effective from AY 2025-26



Deemed to be University under Section 3 of UGC Act, 1956)  
(Placed under Category 'A' by MHRD, Govt. of India, Accredited with 'A+' Grade by NAAC)  
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## VISION

*To build a humane society through excellence in education and healthcare*

## MISSION

*To develop*

*Nitte (Deemed to be University)*

*As a centre of excellence imparting quality education,  
Generating competent, skilled manpower to face the scientific and social  
challenges with a high degree of credibility, integrity,  
ethical standards and social concern*

# **MCA SYLLABUS**

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Effective from  
Academic Year  
2025-26

Applicable to the batch admitted from AY 2025-26 and onwards

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**Version 2025.01**

**With Scheme of Teaching & Examination**

**REGULATIONS: 2025.01**  
**for**  
**Master of Computer Applications Program**  
**UNDER OUTCOME BASED EDUCATION (OBE)**  
**AND**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**  
Applicable to the batch admitted from AY 2025-26 and onwards.

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**Regulations for Master of Computer Applications (MCA)**  
**Nitte (Deemed to be University)**

## **PREAMBLE**

Nitte (Deemed to be University) currently offers two-year MCA. The program is recognized by the AICTE and offered at NMAM Institute of Technology, Nitte & Nitte Meenakshi Institute of Technology, Off Campus Centers of Nitte (Deemed to be University) at Nitte and Bangalore respectively.

MCA is an educational program in Computer Applications leading to the award of Degree. It involves events/ activities, comprising of lecturers/ tutorials/ laboratory work/ field work, outreach activities/ project work/ vocational training/ viva/ seminars /internship/ assignments/ presentation/ quiz/ self-study, etc., or a combination of some of these. The core subjects of this program are designed to introduce students to the various areas of Computer Science and Engineering. The departmental laboratories provide good work ambiance with state-of-the-art computing facilities to enable the students to carry out projects and acquire expertise in emerging technologies. The students are offered special inputs in aptitude, soft skills, and overall personality development regularly to enhance their employability.

## **INTRODUCTION**

Regulations for the MCA program under Nitte (Deemed to be University) govern the policies and procedures including selection, admission, imparting of instructions, conduct of examinations, evaluation and certification of candidate's performance and all amendments thereto, leading to the award of MCA degree. The regulations shall come into effect from the academic year 2025-26 and are applicable to the batch admitted from 2025-26 and onwards. This set of regulations shall be binding on all the candidates undergoing the said program.

## 1. KEY INFORMATION

Program Title	Master of Computer Applications
Short Description	Two-year, Four Semester Choice Based Credit System (CBCS) type of postgraduate program as per NEP 2020, with English as medium of Instruction
Program Code	NMAMIT: 22CMPA20D2
	NMIT: 22CMPA14D3
Revision version	2025.01 These regulations may be modified from time to time as mandated by the policies of the University. Revisions are to be recommended by the Board of Studies for Computer Applications and approved by the Academic Council.
Effective from	01-08-2025
Approvals	Approved in the 61 <sup>st</sup> Academic Council meeting of NITTE (Deemed to be University), held on 13-06-2025 and vide Notification Ref: N(DU)/REG/AC/2024-25/1395 dated 02.07.2025.
Program offered at	1. NMAM Institute of Technology, N(DU) Off -Campus Centre, Nitte, 574110, Karkala Taluk  2. Nitte Meenakshi Institute of Technology N(DU) Off -Campus Centre, Bangalore P.B.No.6429, Yelahanka, Bangalore - 560064
Grievance and dispute resolution	All disputes arising from this set of regulations shall be addressed to the Board of Computer Applications. The decision of the Board of Computer Applications is final and binding on all parties concerned. Further, any legal disputes arising out of this set of regulations shall be limited to jurisdiction of Courts of Mangalore only.



## 2. ELIGIBILITY FOR ADMISSION

### 2.1 Entry requirements

Admission options	Entry requirements
Admission into two-year MCA Program	<p>Passed BCA/ Bachelor's degree in Computer Science Engineering or equivalent Degree. OR Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 level or at Graduation Level (with additional bridge courses as per the norms of the concerned University).</p> <p>Obtained at least 50% marks in the qualifying Examination.</p>

\* Eligibility will be determined by the University based on evaluation of equivalency of qualification.

\* The candidates should have appeared for NUCAT Entrance Examination conducted by Nitte (Deemed to be University).

### 2.2 Qualifications from foreign countries

Candidates with qualifications from educational institutions outside of India, may be admitted to the program(s) subject to establishment of equivalence by the university. The Program Committee will evaluate and establish the eligibility of such candidates.

## 3. COURSE

A “Course” is defined as a unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. Often referred to as a “subject” or “paper”, a course has identified course outcomes, modules / units of study, specified teaching-learning methods and assessment schemes. A course may be designed to include lectures, tutorials, practical, laboratory work, field work, project work, internship experiences, seminars, self-study components, online learning modules etc. in any combination of some of these.

### 3.1 Types of Courses

**The following types of courses are included in the MCA Program:**

**3.1.1 Professional Core Courses (PCC):** These are the professional Core Courses, relevant to the chosen specialization/ branch. The core courses shall be compulsorily studied by students, and it is mandatory to complete them to fulfill the requirements of a Program.

**3.1.2 Professional Elective Courses (PEC):** These are Professional Electives, relevant to the chosen specialization/branch. It shall be supportive to the discipline providing extended scope/enabling exposure to some to other discipline /domain and nurturing student proficiency skills.

**3.1.3 Seminar (SEM):** Each student has to present the seminar on a specific topic chosen from the relevant field /list provided by the department under the supervision of a faculty coordinator.

**3.1.4 Internship (INT):** The internship (a form of experimental learning) program is a workplace based professional learning experience that offers

supervised exposure to real life work experience in an area related to field of study or career interest. An internship may be undertaken at a workplace such as industry/ R&D organization / Government organization, or any other reputed organization / institution recognized for the purpose by the University. The internship program not only helps fresh pass-outs in gaining professional know-how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions.

**3.1.5 Project Work (PROJ):** Provide experiential learning opportunities for students. Students are required individually, or in a small group, select and complete a project that may include review, design, development, curation, analysis, etc., with application of skills and knowledge relevant to area of study. Mini-project and Project work carried out at the parent institution, or any university / Government recognized organization/ Industry without affecting the regular class work are such courses.

**3.1.6 Research Methodology (RM):** Helps to understand the meaning, objectives and characteristics of research. Undergoing the course enables a student to select and define research problems. It helps students understand research designs, methods and also ethics in research and publications. The course also provides information on Intellectual property rights.

**3.1.7 Mandatory Non-Credit Course (MNC):** This course is mandatory for the students who have completed their bachelor's degree program in non-computer disciplines.

Typically, MCA program has the following component of courses.

SN	Category	Minimum Credits to be earned for the MCA degree
1	Core Courses (PCC)	57 (43+14 Lab)
2	Elective Courses (PEC) (Specializations)	15
3	Research Methodology (RM)	03
4	Seminar (SEM)	02
5	Mini Project (PROJ)	04
6	Internship (INT)	04
7	Major Project (PROJ)	15
	TOTAL	100

#### 4. ACADEMIC YEAR

Refers to the sessions of two consecutive semesters (odd followed by an even) including periods of vacation.

## 5. COURSE REGISTRATION

The faculty advisors will guide the students in registering for courses. Course Registration refers to formal registration for the Courses of a semester by every student under the supervision of a faculty advisor (also called Mentor, Counselor etc.,) in each semester for the Institution to maintain proper record.

## 6. CREDITS

Refers to a unit by which the Course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of lecture or two hours of laboratory/ practical courses/ tutorials/ field work per week etc.

Credit Limits	Regular Semester
Minimum credits per Semester	16
Maximum credits per Semester	28

## 7. REGISTRATION FOR ELECTIVES

- 7.1 Elective options will be offered based on the specialization a student would like to pursue.
- 7.2 A student must take every course available in the specialization they have chosen.
- 7.3 Registration to elective options(specializations) will be on first-come first-serve basis.
- 7.4 Registration will be subject to minimum and maximum enrolment requirements specified by the department. Typically, the minimum enrolment requirement is 15.
- 7.5 If a course option is not offered due to lack of minimum enrolments, students who pre-register for it will be transferred to other course options, based on their preference, subject to availability.

## 8. REQUIREMENTS FOR PROGRESSION

- 8.1 A student may progress from Semester 1 to 2, from Semester 3 to 4 irrespective of the grades obtained in the courses of these odd Semesters.
- 8.2 A student may carry over not more than 4 courses from 1<sup>st</sup> & 2<sup>nd</sup> Semester (put together) to progress to 3<sup>rd</sup> semester.

## 9. PROGRAM STRUCTURE

I SEMESTER														
Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL#	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1.	PCC	25MCA101	Data Structures with Algorithms	MCA	3	0	0		2	3	50	50	100	3
2.	PCC	25MCA102	Advanced Database Systems	MCA	3	0	0		2	3	50	50	100	3
3.	PCC	25MCA103	Data Communication and Networks	MCA	3	0	0		2	3	50	50	100	3
4.	PCC	25MCA104	Mathematical Foundation for Computer Applications	MCA	3	1	0		2	3	50	50	100	4
5.	PCC	25MCA105	Research Methodology and Publication Ethics	MCA	3	0	0		1	3	50	50	100	3
6.	PCC	25MCA106	Advanced Operating Systems with UNIX	MCA	3	1	0		2	3	50	50	100	4
7.	PCC	25MCA107	Data Structures with Algorithms Lab	MCA	0	0	4		2	3	50	50	100	2
8.	PCC	25MCA108	Advanced Database Systems Lab	MCA	0	0	4		2	3	50	50	100	2
9.	PCC	25MCA109	Data Communication and Networks Lab	MCA	0	0	4		2	3	50	50	100	2
Total					18	2	12	-	-	27	450	450	900	26
# Supervised Learning (SL): Additional Academic activities beyond class hours					-	-	-	-	17					
Learning hours per week					18	2	12	-	17					
Total notional learning hours (L+T+P+J+SL)			Per week		49									
			Per semester		49*16= 784									

### Bridge Course\*

Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL#	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
10.	MNC	25MCA110	Fundamentals of Programming – Bridge Course*	MCA	0	0	4			--	50	--	50	0

\*The bridge course 25MCA110, Fundamentals of Programming is a mandatory noncredit Bridge Course only for the students who have completed their Bachelor's degree program in non-computer disciplines.

II SEMESTER														
Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL#	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1.	PCC	25MCA201	Enterprise Java	MCA	3	0	0		2	3	50	50	100	3
2.	PCC	25MCA202	Advanced Web Technology	MCA	3	0	0		2	3	50	50	100	3
3.	PCC	25MCA203	Software Engineering and Testing	MCA	3	1	0		2	3	50	50	100	4
4.	PCC	25MCA204	Data Warehousing and Data Mining	MCA	3	1	0		2	3	50	50	100	4
5.	PCC	25MCA205	Professional Communication Skills	HUM	1	1	0		2	3	50	50	100	2
6	PEC	FSD*	25MCA211	MCA	3	0	0		2	3	50	50	100	3
		DS**	25MCA221											
		IT***	25MCA231											
7	PEC	FSD*	25MCA212	MCA	3	0	0		2	3	50	50	100	3
		DS**	25MCA222											
		IT***	25MCA232											
8.	PCC	25MCA206	Enterprise Java Lab	MCA	0	0	4		2	3	50	50	100	2
9.	PCC	25MCA207	Advanced Web Technology Lab	MCA	0	0	4		2	3	50	50	100	2
10.	SEM	25MCA208	Technical Seminar and Report Writing	MCA	0	0	4		1	--	50	--	50	2
Total					19	3	12	-	-	27	500	450	950	28
# Supervised Learning (SL): Additional Academic activities beyond class hours					-	-	-	-	19					
Learning hours per week					19	3	12	-	19					
Total notional learning hours (L+T+P+J+SL)			Per week		53									
			Per semester		53*16=848									

## Audit Course

Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL#	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
10.	AU	25MCAAU21/ 25MCAAU22	Online Course / Introduction Japanese Language	Any	2	0	2			--	50	--	50	0

\* Specialization with Full Stack Development

\*\* Specialization with Data Science

\*\*\* Specialization with Information Technology

**Elective/Specialization Tracks :**

Full Stack Development	
Code	Subject
25MCA211	Full Stack Development using Django
25MCA212	Web Development Using Ruby on Rails & PostgreSQL

Data Science	
Code	Subject
25MCA221	Applied Data Science and Analytics
25MCA222	Digital Image Processing and Pattern Recognition

Information Technology	
Code	Subject
25MCA231	Mobile Application Development using Android and Flutter
25MCA232	Block Chain Technology

III SEMESTER														
Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL#	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1.	PCC	25MCA301	Full Stack Web Development using MERN	MCA	3	0	0		2	3	50	50	100	3
2.	PCC	25MCA302	Artificial Intelligence and Machine Learning	MCA	3	0	0		1	3	50	50	100	3

3.	PCC		25MCA303	Cloud Computing and Big Data Analytics	MCA	3	1	0		1	3	50	50	100	4
4	PEC	FSD*	25MCA311	React Native and Kotlin for Mobile Application Development	MCA	3	0	0		1	3	50	50	100	3
		DS**	25MCA321	Health Care Analytics											
		IT***	25MCA331	Industrial and Medical IoT											
5	PEC	FSD*	25MCA312	Angular and Spring Boot	MCA	3	0	0		1	3	50	50	100	3
		DS**	25MCA322	Generative AI and Prompt Engineering											
		IT***	25MCA332	.NET Framework and C#											
6	PEC	FSD*	25MCA313	UI/UX Design & Product Management	MCA	3	0	0		2	3	50	50	100	3
		DS**	25MCA323	Natural Language Processing											
		IT***	25MCA333	Digital and Social Media Marketing											
7.	PCC		25MCA305	Full Stack Web Development using MERN Lab	MCA	0	0	4		2	3	50	50	100	2
8.	PCC		25MCA306	Artificial Intelligence and Machine Learning Lab	MCA	0	0	4		2	3	50	50	100	2
9.	PRJ		25MCA307	Mini Project	MCA	0	0	0	12		3	50	50	100	4
Total						18	1	8	12	-	27	450	450	900	27
# Supervised Learning (SL): Additional Academic activities beyond class hours						-	-	-	-	12					
Learning hours per week						18	1	08	12	12					
Total notional learning hours (L+T+P+J+SL)				Per week		51									
				Per semester		51*16 = 816									

\* Specialization with Full Stack Development

\*\* Specialization with Data Science

\*\*\* Specialization with Information Technology

### Elective/Specialization Tracks :

Full Stack Development	
Code	Subject
25MCA311	React Native and Kotlin for Mobile Application Development
25MCA312	Angular and Spring Boot
25MCA313	UI/UX Design & Product Management

Data Science	
Code	Subject
25MCA321	Health Care Analytics
25MCA322	Generative AI and Prompt Engineering
25MCA323	Natural Language Processing

Information Technology	
Code	Subject
25MCA331	Industrial and Medical IoT
25MCA332	.NET Framework and C#
25MCA333	Digital and Social Media Marketing

IV SEMESTER												
Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours	SL#	Examination					Credits
							Duration in Hours	CIE Marks	SEE Marks		Total Marks	
									Evaluation	Viva Voce		
1.	INT	25MCA401	Industry Internship*	MCA	Full Time (4 weeks) * 160 hours	-	3	50	--	50	100	4
2.	PRJ	25MCA402	Major Project**	MCA	Full Time (15 weeks) ** 600 Hours	-	3	100	100	100	300	15
Total						-	06	150	100	150	400	19
# Supervised Learning (SL): Additional Academic activities beyond class hours						-						
Total notional learning hours (L+T+P+J+SL)			Per Semester		160+600 = 760							

\* The internship should be completed before the commencement of the major project in the fourth semester. Total of 160 hours. The internship can also be done during the vacation period of the first or second semester.

\*\*The Major Project should be carried out preferably in the industry for a minimum duration of 15 weeks with total 600 Learning hours.

Note: PCC: Professional Core Course, PEC: Professional Elective Course  
 L – Lecture, T – Tutorial, P- Practical, SL# – Supervised Learning  
 CIE: Continuous Internal Evaluation  
 SEE: Semester End Examination.



## 10. ATTENDANCE

- 10.1 MCA is a full-time program.
- 10.2 Students are not permitted to enroll in any other program offered by this or other University without prior permission.
- 10.3 All students must attend every lecture, tutorial and practical classes. To account for approved leave of absence (e.g. representing the University in sports, games or athletics, placement activities, NCC/NSS activities etc.) and/or any other such contingencies like medical emergencies etc., the attendance requirement shall be a minimum of 85% of the classes conducted.
- 10.4 A candidate having shortage of attendance in one or more subjects shall have to repeat those courses. Such students shall re-register for the same subjects in the subsequent semester/ academic year. Semesters are subjected to maximum permissible credits.
- 10.5 A candidate, who does not satisfy the attendance requirement mentioned as above, in minimum number of credit requirement shall not be eligible to appear for the examination of that semester and not promoted to higher semester. The candidate shall be required to repeat that semester along with regular students later.
- 10.6 If a candidate, for any reason, discontinues the course in the middle, he/she may be permitted to register to continue the course along with subsequent batch, subject to the condition that he/she shall complete the class work, lab work and seminar including the submission of dissertation within maximum stipulated period. Such candidate is not eligible to be considered for the award of rank.
- 10.7 The Head of the Department shall notify regularly, the list of such candidates who fall short of attendance. The list of the candidates falling short of attendance shall be sent to the Principal with a copy to Controller of Examinations.

## 11. ABSENCE DURING THE SEMESTER

- 11.1 **Leave of Absence:** If the period of leave is more than two days and less than three weeks, prior application for leave shall have to be submitted to the Head of the Department concerned, with the recommendation of the Faculty-Advisor stating fully the reasons for the leave request along with supporting documents. It will be the responsibility of the student to intimate the course instructors, Head of the Department and also Chief Warden of the hostel, regarding his/her absence before availing leave.
- 11.2 **Absence during Mid-Semester Examinations:** A student who has been absent from a Mid-Semester Examination (MSE) due to illness and other contingencies may give a request for additional MSE within two working days of such absence to the office of the respective Head of the Department (HOD) with necessary supporting documents and certification from authorized personnel. The HOD may consider such requests depending on the merits of

the case and may permit an additional Mid-Semester Examination for the concerned student.

- 11.3 **Absence during Semester End Examination:** In case of absence for a Semester End Examination, on medical grounds or other special circumstances the student can apply for 'I' grade in that course with necessary supporting documents and certifications by authorized personnel to the Controller of Examination through Chairman of The Department. The Controller of Examination may consider the request depending on the merits of the case and permit the make-up Semester End Examination for the concerned student. The student may subsequently complete all course requirements within the date stipulated by DPGC (which may be extended till first week of next semester under special circumstances) and 'I' grade will then be converted to an appropriate letter grade. If such an application for the 'I' grade is not made by the student, then a letter grade will be awarded based on his in-semester performance.

## **12. WITHDRAWAL FROM THE PROGRAM**

### **12.1 Temporary Withdrawal**

A student who has been admitted to a Postgraduate Degree program of the College may be permitted to withdraw temporarily, for a period of one semester or more on the grounds of prolonged illness or grave calamity in the family etc. The student should abide by the applicable rules and regulations of the college/University at the time of Temporary Withdrawal.

### **12.2 Permanent Withdrawal**

Any student who withdraws admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account. Once the admission for the year is closed, the following conditions govern withdrawal of admissions: a) A student who wants to leave the College for good, will be permitted to do so (and can take Transfer Certificate from the College, if needed), only after remitting the Tuition fees as applicable for all the remaining semesters and clearing all other dues, if any. b) Those students who have received any scholarship, stipend or other forms of assistance from the College shall repay all such amounts in addition to those mentioned in (a) above. The decision of the Principal of the Institute regarding withdrawal of a student is final and binding.

## **13. EVALUATION**

### **13.1 Course Evaluation**

For all courses evaluation will be based on both formative assessment (Continuous Internal Evaluation, CIE) and summative assessment (Semester End Evaluation, SEE). CIE and SEE will carry 50 % and 50% respectively, to enable each course to be evaluated for 100 marks, irrespective of its credits. Weightage for CIE and SEE will be 50% each.

### 13.2 Continuous Internal Evaluation (CIE)

CIE refers to the evaluation of students' achievement in the learning process. The course instructor will perform the Continuous Internal Evaluation (CIE) for 50 marks which includes tests, homework, problem solving, group discussion, quiz, mini-project and seminar throughout the semester, with weightage for the different components being fixed at the University level as follows.

- |   |   |          |
|---|---|----------|
| 1. Quizzes, tutorials, assignments, etc., | - | 20 marks |
| 2. Mid Semester Examination               | - | 30 marks |

An additional MSE may be conducted for those students absent for valid reasons/ with prior permission.

For those students who could not score minimum required CIE marks (25 marks), an additional MSE may be conducted, however the maximum CIE marks shall be restricted to 25 out of 50.

### 13.3 Semester End Examinations (SEE)

Refers to examination conducted at the University level covering the entire Course Syllabus. The Syllabi is modularized and SEE questions are selected from each module, with a choice confined to the concerned module only. SEE is also termed as university examination.

13.4 **For Technical Seminar and Fundamentals of Programming**, the evaluation will be based on formative assessment (Continuous Internal Evaluation) only.

13.5 **For the major project, the dissertation** will be evaluated by two examiners, one of the examiners shall be the guide of the candidate and the other examiner shall be preferably an external expert in the area of the dissertation being evaluated. The evaluation of the dissertation shall be made independently by each examiner.

- Examiners shall evaluate the dissertation normally within a period of not more than two weeks from the date of receipt of dissertation through email.
- The examiners shall independently submit the marks for the dissertation during the viva-voce examination date.
- Sum of marks awarded by the two examiners shall be the final evaluation marks for the dissertation.
- Viva-Voce examination of the candidate shall be conducted, if the dissertation work and the reports are accepted by the external examiner.
- If the external examiner finds that the dissertation work is not up to the expected standard and the minimum passing marks cannot be awarded, the dissertation shall not be accepted for SEE.
- If the dissertation is rejected during the Project work, then the second examiner (external) will be appointed by the COE against whom the candidate has to re-present the same dissertation. The decision of the Second Examiner (external) will be final.
- If the second examiner (external) accepts the dissertation, then the viva-voce examination of the candidate shall be conducted as per the norms. If the

second examiner (external) rejects the dissertation, then the student has to take an extension for a minimum period of 3 months and re-work on the project. After the completion of the extension period, viva-voce examination of the candidate shall be conducted as per the norms, if the dissertation work is accepted by the external examiner.

- h) Viva-voce examination of the candidate shall be conducted jointly by the external examiner and internal examiner/guide at a mutually convenient date.
- i) The relative weightages for the evaluation of dissertation and the performance at the viva-voce shall be as per the scheme of teaching and examination.
- j) The marks awarded by both the examiners at the viva-voce examination shall be sent jointly to the office of the Controller of Examination immediately after the examination.
- k) The candidates who fail to submit the dissertation work within the stipulated time have to apply for the extension of the Project duration through the Guide and the head of the department to the office of the Controller of Examination. Such candidate is not eligible to be considered for the award of rank.

#### **14. THE TRANSITIONAL GRADES**

'I', 'W' and 'X' would be awarded in the following cases. These would be converted into one or the other of the letter grades (O to F) after the student completes the course requirements.

14.1 **Grade "I":** To a student having attendance  $\geq 85\%$  and CIE  $\geq 70\%$ , in a course, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:

- i. Illness or accident, which disabled him/her from attending SEE.
- ii. A calamity in the family at the time of SEE, which required the student to be away from the College.
- iii. However, the committee chaired by the Principal is authorized to relax the requirement of CIE  $\geq 70\%$  if the student is hospitalized or advised to have long term rest after discharge from the hospital by the Doctor.
- iv. Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Make up Examinations within 2 working days of that examination for which he or she is absent, failing which they will not be given permission.

14.2 **Grade "W":** To a student having satisfactory attendance at classes but withdrawing from that course before the prescribed date in a semester as per faculty advice.

14.3 **Grade "X":** To a student having attendance  $\geq 85\%$  and CIE  $\geq 70\%$ , in a course but SEE performance could result in a 'F' grade in the course. (No "F" grade awarded in this case, but student's performance record will be maintained separately).

14.4 The Make Up Examination facility would be available to students who may have missed attending the SEE of one or more courses in a semester for valid reasons and given the 'I' grade. Also, students having the 'X' grade shall also be eligible to take advantage of this facility. The makeup examination would be held as per dates notified in the Academic Calendar. However, it should be made possible to hold a make-up examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of SEE would be the same as the normal SEE.

- Make Up examination will be conducted for the candidates who has a CIE  $\geq 35$  marks and may have missed to attend the SEE covering the entire course syllabus. The standard of the Make Up Examination is same as that of the SEE.
- All the 'W' grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/summer semester and fulfill the passing standards for their CIE and (CIE+SEE).
- The suggested passing standards are CIE to have  $\geq 50\%$  and CIE+SEE to have a grade better or at least equal to C. For maintaining high standards, the students scoring less than 50% in CIE are advised to withdraw and to re-register for the course when offered next. The letter grade 'W' to be entered in the grade card against the subject and not to be taken into account while calculating SGPA & CGPA

#### 14.5 **SUMMER / FAST TRACK SEMESTER:**

- i) The students who have satisfied CIE and attendance requirements for the course/s and obtained an F grade in SEE are permitted to appear directly in ensuing examination/s as backlog paper/s. The students need not re-register for such course/s in the summer / fast track semester. In case the student wishes to improve CIE he/she has to re-register for the summer / regular semester as and when offered next.
- ii) The student who obtains required attendance and CIE in the summer semester, but obtains an 'F' grade in SEE; is permitted to appear for SEE subsequently as backlog course/s. The student need not repeat the course for Attendance and CIE.
- iii) The course/s for which the student does not possess satisfactory attendance and CIE score shall be marked as 'N' on the grade sheet. Such students are not permitted to SEE for the courses marked as 'N' on the grade sheet. The students have to re-register only for course/s marked as 'N' in the summer /subsequent semester whenever that course is offered and obtain the required CIE and attendance. Subsequently, they are eligible to appear for SEE in such course/s.

- iv) Courses with Transitional Grades viz “W”, “T” and “X” are also eligible to register in the summer semester in case they wish to improve their score in CIE.
- v) All courses may not be offered in the summer semester. It is the discretion of the University to offer the courses based on the availability of resources. The institutes shall notify timetable for the summer semester well in advance.
- vi) Summer semester is optional; it is for the student to make the best use of the opportunity.
- vii) A student is permitted to register for maximum of 16 credits in the Summer / fast track semester.
- viii) A student has to choose those courses which are offered by the Institution in a given summer semester.
- ix) In the summer semester, each course needs to be offered for the required number of lectures/ tutorial/ laboratory hours as prescribed in the syllabus.

14.6 **SUPPLEMENTARY EXAMINATION:** Refers to the examination conducted to assist slow learners and/or failed students through make up courses for duration of 8 weeks. This comprises of both the CIE & SEE and will be conducted after the completion of First year MCA even semester.

## 15. QUALIFYING STANDARD

Sessional (CIE): Score:  $\geq 50\%$  ( $\geq 25$  marks)

Terminal (SEE): Score:  $\geq 40\%$  ( $\geq 20$  marks)

### **For securing a final Pass:**

Total 50 % of the Course maximum marks (100) i.e., sum of the CIE and SEE marks prescribed for the Course is desired.

## 16. GRADING SYSTEM: ABSOLUTE GRADING

The performance of a candidate in a course shall be evaluated according to a Letter Grading System, based on both CIE and SEE. The letter grades (O, A+, A, B+, B, C and F) indicate the level of academic achievement assessed on a 10-point scale (0 to 10) (See Table below).

### Letter grade system and corresponding marks range

Marks Range (%)	Grade Point	Letter Grade	Descriptor		CGPA	Classification
90 & above	10	O	Outstanding		7.00- & above	First Class with Distinction
80-89	9	A+	Excellent			
70-79	8	A	Very Good			
60-69	7	B+	Good		6.00-6.99	First Class
55-59	6	B	Above Average		5.00-5.99	Second Class
50-54	5	C	Average			
Below 50	0	F	Fails		<b>CGPA &lt; 5.00</b>	Fails
Absent	0	F	Ab			

- 16.1 A candidate shall be considered to have completed a course successfully and earned the credits assigned, if he/she secures an acceptable letter grade in the range O to C.
- 16.2 The letter grade 'F' in any course implies failure in that course and no credit is earned.
- 16.3 A candidate having satisfactory attendance at classes and meeting the passing standard at CIE in a course but remained absent from SEE shall be awarded 'I' grade in that course. No credit is earned in such a case.
- 16.4 Grade point averages: The overall performance of a candidate will be indicated by Grade Point Average (GPA).
- 16.5 Semester Grade Point Average (SGPA) is computed as follows.

$$SGPA = \frac{[\sum(CourseCredit) \times (GradePoint)]}{[\sum(CourseCredit)]}$$

All courses of the semester for which a letter grade has been awarded, including F, will be included in this calculation.

- 16.6 Cumulative Grade Point Average (CGPA) is computed as follows.

$$CGPA = \frac{[\sum(CourseCredit) \times (GradePoint)]}{[\sum(CourseCredit)]}$$

All courses of the all the semesters for which a letter grade has been awarded, excluding F, will be included in this calculation.



16.7 **Grade Card:** Based on the secured letter grades, grade points, SGPA and CGPA, a grade card for each semester shall be issued. On specific request on paying prescribed fee, a transcript indicating the performance in all semesters may be issued.

16.8 **Conversions of Grades into Percentage and Class Equivalence**

Conversion formula for the conversion of CGPA into percentage is given below:

Percentage of marks secured, 'P' = CGPA Earned  $\times$  10

Illustration: for A CGPA of 8.18:

$$\text{'P'} = \text{CGPA Earned } 8.18 \times 10 = 81.8 \%$$

## 17. AWARD OF CLASS

- 17.1 The candidate, who has passed all the courses prescribed, shall be declared to have passed the program
- 17.2 A candidate who secures  $\text{CGPA} \geq 7.00$  and above shall be declared to have passed in 'First Class with Distinction'.
- 17.3 A candidate who secures  $\text{CGPA} \geq 6.00$  or more but less than 7.00 shall be declared to have passed in 'First Class'.
- 17.4 A candidate who secures  $\text{CGPA} \geq 5.00$  or more but less than 6.00 shall be declared to have passed in 'Second Class'.
- 17.5 An attempt means the appearance of a candidate in one or more courses either in part or full in a particular re-examination including supplementary semester's examinations.
- 17.6 A candidate who fails in the main examination and passes one or more subjects/courses or all subjects/courses in the supplementary examination, such candidate's attempts shall be considered as multiple attempts.
- 17.7 If a candidate submits application for appearing for the regular examination but does not appear for any of the courses/subjects in the regular University examination, he can appear for supplementary examination provided other conditions such as attendance requirement, internal assessment marks, etc. are fulfilled and his appearing in the supplementary examination shall be considered as the first attempt.

## 18. MERIT CERTIFICATES AND UNIVERSITY GOLD MEDALS

Merit Certificates and University Gold Medals will be awarded on the basis of overall CGPA.

- 18.1 Only those candidates who have completed the MCA Program and fulfilled all the requirements in the minimum number of years prescribed (i.e., 2 years for master's degree) and who have passed each semester in the first attempt is eligible for the award of Merit Certificates and /or University Gold Medals.
- 18.2 Award of University Gold Medals, if any, are governed by the specific selection criteria that may be formulated by the University for such Medals / Awards



- 18.3 Candidates with W, N, I, X and F grades and passes the courses in the supplementary examinations are not eligible for the award of Gold Medal or Merit Certificate.

## **19. RULES FOR GRACE MARKS**

- 19.1 Grace marks up to 1% of the maximum total marks of the courses for which he/she is eligible and have registered (non-credit courses excluded) in the examination or 10 marks whichever is less shall be awarded to the failed course(s), (with a restriction of a maximum of 5 marks per course) provided on the award of such grace marks the candidate passes in that course(s).

## **20. CHALLENGE EVALUATION**

If a student is not satisfied with the marks allotted to him/her in the semester end examinations, he/she could apply for challenge evaluation within the prescribed time specified. In such cases the answer papers will be valued by the DPGC committee and marks secured by the students in the challenge evaluation will be final.

## **21. AWARD OF DEGREE REQUIREMENTS**

The Degree requirements of a student for the MCA Degree program are as follows:

- 21.1 The maximum duration for a student to comply with the Degree requirements is 8 semesters from the date of first registration for his first semester.
- 21.2 A student shall be declared to have completed the Degree of Master of Computer Applications, provided the student has undergone the stipulated course work as per the regulations and has earned the prescribed credits, as per the scheme of teaching and examination of the program.
- 21.3 A student shall be declared successful at the end of the program for the award of Degree only on obtaining  $CGPA \geq 5.00$ , with none of the courses remaining with F grade.
- 21.4 In case the CGPA falls below 5.00, the student shall be permitted to appear again for SEE for required number of courses (other than seminar, practical, internship and project) subject to the provision of University, to make up  $CGPA \geq 5.0$ . The student should reject the SEE results of previous attempt and obtain written permission from the Controller of Examinations to reappear to the subsequent SEE.

## **22. TERMINATION FROM THE PROGRAM/READMISSION**

A student shall be required to leave the college without the award of the degree, under the following circumstances:

- i. Failing to complete the degree requirements in double the duration of the program.
- ii. Based on the disciplinary actions suggested by the Academic Council/Governing Council

### 23. GRADUATION REQUIREMENTS AND CONVOCATION

- 23.1 A student shall be declared to be eligible for the award of the Degree if he has Fulfilled Degree Requirements
- 23.2 No Dues to the College, Departments, Hostels, Library Central Computer Centre and any other center
- 23.3 No disciplinary action pending against him.
- 23.4 The award of the Degree must be recommended by the Academic council and approved by Governing Council of Nitte (DU)
- 23.5 **Convocation:** Degree will be awarded in person to the students who have graduated during the preceding academic year. Degrees will be awarded in absentia to such students who are unable to attend the convocation. Students are required to apply for the convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements within the specified date in order to arrange for the award of the degree during convocation.

### 24. CONDUCT AND DISCIPLINE:

- 24.1 Students shall conduct themselves within and outside the premises of the Institute, in a manner befitting the students of an Institution of National Importance.
- 24.2 As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned, any form of ragging will be severely dealt with.
- 24.3 The following acts of omission/ or commission shall constitute gross Violation of the code of conduct and are liable to invoke disciplinary measures:
  - a. Ragging
  - b. Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.
  - c. Willful damage or stealthy removal of any property /belongings of the Institute /Hostel or of fellow students/ citizens
  - d. Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
  - e. Mutilation or unauthorized possession of Library books.
  - f. Noisy and unseemly behavior, disturbing studies of fellow Students.
  - g. Hacking in computer systems (such as entering into other Person's area without prior permission, manipulation and/or Damage of computer hardware and software or any other Cybercrime etc.,).
  - h. Plagiarism of any nature.
  - i. Any other act of gross indiscipline as decided by the University from time to time.
  - j. Smoking in College Campus and use of any tobacco products.
  - k. Unauthorized fund raising and promoting sales
- 24.4 Commensurate with the gravity of offense, the punishment may be: reprimand, expulsion from the hostel, debarment from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to

appropriate law enforcement authorities or the judiciary, as required by the circumstances.

- i) For an offence committed in
  - a. A hostel
  - b. A department or in a classroom
  - c. Elsewhere,
 the Chief Warden, the Head of the Department and the Dean (Students Welfare), respectively, shall have the authority to reprimand or impose fine.
- ii) All cases involving punishment shall be reported to the Head of the institution.

24.5 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examination.

- **Note:** Students are required to be inside the examination hall 20 minutes before the commencement of examination. This is applicable for all examinations (Semester end/Supplementary/makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

## 25. PROGRAM OUTCOMES

By the end of the program the student will be able to acquire:

- 25.1 **PO1 (Foundation Knowledge):** Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
- 25.2 **PO2 (Problem Analysis):** Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.
- 25.3 **PO3 (Development of Solutions):** Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
- 25.4 **PO4 (Modern Tool Usage):** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
- 25.5 **PO5 (Individual and Teamwork):** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
- 25.6 **PO6 (Project Management and Finance):** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
- 25.7 **PO7 (Ethics):** Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
- 25.8 **PO8 (Life-long learning):** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

## **26. PROGRAM SPECIFIC OUTCOMES**

- 26.1 To empower the students to exemplify themselves in the field of Information Technology ensuring credibility, integrity and ethical standards.
- 26.2 Adopt research practices and trending technologies such as Artificial Intelligence and Machine Learning, Internet of Things, Cloud Computing and Data Analytics to solve real world problems.

DATA STRUCTURES WITH ALGORITHMS			
Course Code	25MCA101	Course Type	PCC
Teaching Hours/Week (L: T: P: S)	3:0:0:0	Credits	03
Total Teaching Hours	40	CIE + SEE Marks	50+50
Teaching Department: Master of Computer Applications			
Course Objectives:			
1.	Explain the fundamental concepts of data structures, including primitive and non-primitive data structures, abstract data types, and the basics of algorithm analysis with asymptotic notations		
2.	Implement and manipulate arrays, linked lists, stacks, and queues using C programming to perform operations such as insertion, deletion, traversal, and searching efficiently.		
3.	Apply recursion and stack-based techniques for problem-solving, including evaluating postfix expressions, infix-to-postfix conversion, and solving problems like factorial, Fibonacci, and Tower of Hanoi.		
4.	Analyze and implement binary trees and graphs, perform various tree traversal techniques, and apply graph algorithms such as BFS, DFS, Prim's, Kruskal's, and Dijkstra's algorithms for real-world applications.		
5.	Develop and compare sorting algorithms like Bubble Sort, Quick Sort, Merge Sort, and Shell Sort, and implement searching algorithms including Sequential Search, Binary Search, and Interpolation Search to optimize data retrieval.		
UNIT-I			
Introduction			04 Hours
Introduction to data structure, Primitive and Non-Primitive Data Structures, Abstract data type, Arrays, Pointers			
Algorithm Analysis			04 Hours
Fundamentals of Algorithm Design and Analysis, Analysis Framework, Time Complexity and Space Complexity, Asymptotic Notations: Big O, Omega ( $\Omega$ ), Theta ( $\Theta$ ). Basic efficiency classes,			
UNIT-II			
Lists			08 Hours
Introduction to Linked lists, Types of linked lists, C implementation of Singly Linked Lists, Doubly linked lists, Circular lists.			
UNIT-III			
Stack			06 Hours
Definition and Primitive operations, Representing and implementing stack using Arrays and Linked Lists, Applications of stacks: Evaluating a postfix expression, converting an expression from infix to postfix, Recursion: definition and processes, Implementation of recursion program in C, Examples (Factorial function, Multiplication of natural numbers, Fibonacci sequence, Binary search, Towers of Hanoi problem).			
Queues			02 Hours
Definition and Primitive operations, Implementation of ordinary queues and circular queues using Arrays and Linked lists			
UNIT-IV			
Binary trees			05 Hours

Basic Terminology, Operations on binary trees, Applications of binary trees. Binary tree representation: Node representation of binary tree, Array representation of binary trees, Binary tree traversals and related properties, Threaded binary trees.

<b>Graphs</b>	<b>03 Hours</b>
Definitions, Representation: Adjacency Matrix, Adjacency List, Graph Traversal Techniques: BFS, DFS. Application of graphs - Greedy Technique, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.	

### UNIT-V

<b>Sorting</b>	<b>05 Hours</b>
Exchange Sort: Bubble Sort, Selection Sort, Quick Sort. Divide-and-Conquer: Merge sort. Decrease-and-Conquer - Insertion Sort, Shell sort. Time Complexity Comparison.	

<b>Searching</b>	<b>03 Hours</b>
Sequential search, Indexed sequential search, Binary search, Interpolation Search.	

**Course Outcomes:** At the end of the course student will be able to

1.	Explain the fundamental concepts of Data Structures and the basics of Algorithm Analysis.
2.	Implement Linear Data Structures such as Arrays, Linked lists.
3.	Apply and Implement Recursive and Non-Recursive Techniques.
4.	Analyze and Implement Binary Trees and Graphs
5.	Develop, Implement and Compare different Searching and Sorting Techniques.

### Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	PSO	PSO
↓ Course Outcomes									1	2
25MCA101.1	3	3	-	-	-	-	-	-	3	2
25MCA101.2	3	3	3	2	3	-	-	-	3	2
25MCA101.3	3	3	3	3	3	-	-	-	3	2
25MCA101.4	3	3	3	3	3	-	-	-	3	2
25MCA101.5	3	3	3	3	3	-	-	-	3	2

**1: Low 2: Medium 3: High**

### TEXTBOOKS:

1.	Yedidyah Langsam and Moshe J Augenstein and Aaron M Tenenbaum: Data Structures using C and C++, 2 <sup>nd</sup> Edition, Pearson Education Asia
2.	Reema Thareja – "Data Structures Using C", 2 <sup>nd</sup> Edition, Oxford University press
3.	Jean-Paul Tremblay: An Introduction to Data Structures with applications, Tata McGraw Hill
4.	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2 <sup>nd</sup> Edition, Universities Press.
5.	Introduction to the Design and Analysis of Algorithms. Anany Levitin, Pearson Education, 2 <sup>nd</sup> Edition.
6.	Horowitz E., Sahani S., Rajashekharan S: Computer Algorithm, Galgotia Publications.

### REFERENCE BOOKS:

1.	Robert L Kruse : Data Structures and Program Design , 3 <sup>rd</sup> Edition, Prentice – Hall of India.
2.	Mark Allen Weiss : Data Structures and Algorithm Analysis in C, 2 <sup>nd</sup> Edition, Pearson Education Asia.
3.	Yashavant Kanetkar – "Data Structures Through C", BPB Publications.

ADVANCED DATABASE SYSTEMS				
Course Code		25MCA102	Course Type	PCC
Teaching Hours/Week (L: T: P:S)		3:0:0:0	Credits	03
Total Teaching Hours		40	CIE + SEE Marks	50+50
Teaching Department: Master of Computer Applications				
Course Objectives:				
1.	Understand the importance of database management systems and have thorough understanding of terminologies used.			
2.	Implement concepts of relational model using SQL.			
3.	Use the features of PL/SQL to write procedural programs.			
4.	Design the databases and to use different levels of normalization.			
5.	Understand the working of NoSQL, and implement features of MongoDB.			
UNIT-I				
Essentials of Databases and ER Modeling				08 Hours
Introduction, Characteristics of Database approach, Advantage of using DBMS approach, Disadvantages of DBMS. Data Models, Three Schema Architecture, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design.				
UNIT-II				
SQL - The Relational Database Standard :				08 Hours
SQL Data Definition and Data Types, Specifying basic constraints in SQL, DDL, DML, DQL statements in SQL, Aggregate functions, Sub-queries and Co-related sub-queries, LIKE, Inner and Outer Joins, Views in SQL.				
UNIT-III				
Procedural Programming with MySQL:				08 Hours
Introduction stored programs, Writing procedural code, COMMIT, ROLLBACK and save points, Implicit and explicit locking, Stored Procedures, Stored functions, Triggers, Cursors.				
UNIT-IV				
Structured Database Design and Transaction Processing				08 Hours
Informal Design Guidelines for Relation Schema's, Functional Dependencies, Normal Forms (1NF, 2NF and 3NF), Closure sets, Decomposition. Introduction to Transaction Processing, Transaction States, Desirable Properties of Transactions.				
UNIT-V				
Foundations of NoSQL and MongoDB				08 Hours
Introduction to NoSQL, Types of NoSQL databases, Advantages of NoSQL, Comparison of SQL and NoSQL. What is MongoDB? Why MongoDB? Using JSON, Creating or generating unique key, Support for dynamic queries, Terms used in RDMS and MongoDB, Data types in MongoDB, MongoDB Query Language: Inserting, updating and deleting documents, Retrieving documents, Dealing with Null values, Count, Limit, Sort and Skip methods.				
Course Outcomes: At the end of the course student will be able to				
1.	Analyze the characteristics of database systems and apply Entity-Relationship (ER) modeling to design structured databases.			



2.	Construct and manipulate relational databases using SQL statements, including constraints, joins, views, and aggregate functions.
3.	Develop stored procedures, functions, triggers, and cursors in MySQL to implement procedural database programming.
4.	Evaluate functional dependencies and apply normalization techniques to design efficient and consistent relational schemas.
5.	Differentiate between SQL and NoSQL databases, and demonstrate the ability to perform CRUD operations in MongoDB using JSON-based queries.

### Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	PSO	PSO
↓ Course Outcomes									1	2
<b>25MCA102.1</b>	3	-	3	2	3	2	-	3	3	-
<b>25MCA102.2</b>	3	-	3	3	2	3	-	3	3	-
<b>25MCA102.3</b>	3	-	2	3	2	3	-	3	3	-
<b>25MCA102.4</b>	3	-	2	3	2	3	-	3	3	-
<b>25MCA102.5</b>	3	-	3	3	3	3	-	3	3	-

**1: Low 2: Medium 3: High**

### TEXTBOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, 7<sup>th</sup> Edition 2016
2. Joel Murach: Murach's MySQL, 4<sup>th</sup> Edition 2023
3. Seema Acharya, Subhashini Chellappan, "Big Data Analytics", 2<sup>nd</sup> Edition, Wiley, 2016

### REFERENCE BOOKS

1. Silberschatz, Korth and Sudarshan: Database Systems Concepts, 6<sup>th</sup> Edition, McGraw-Hill
2. Raghu Ramakrishnan and Johannes Gehrke : Database Management Systems, 6<sup>th</sup> Edition, McGraw-Hill
3. Ivan Bayross : Commercial Application Development using Oracle Developer 2000

### E Books / MOOCs/ NPTEL

1. NOC : Fundamentals of Database Systems(Course sponsored by Aricent), IIT Kanpur, Dr. Arnab Bhattacharya : <https://nptel.ac.in/courses/106104135>
2. MySQL® Notes for Professionals book: <https://www.goalkicker.com/MySQLBook/>
3. Learning MongoDB: [https://www.dbooks.org/learning-mongodb-5605980453/#google\\_vignette](https://www.dbooks.org/learning-mongodb-5605980453/#google_vignette)
4. Oracle PL/SQL Language Pocket Reference, 5th Edition: A Guide to Oracle's PL/SQL Language Fundamentals.  
<https://www.pdfdrive.com/oracle-plsql-language-pocket-reference-5th-edition-a-guide-to-oracles-plsql-language-fundamentals-d167357800.html>



DATA COMMUNICATION AND COMPUTER NETWORKS				
Course Code:		25MCA103	Course Type:	PCC
Teaching Hours/Week (L: T: P: S)		3:0:0:0	Credits:	03
Total Teaching Hours:		40	CIE + SEE Marks:	50+50
Teaching Department: Master of Computer Applications				
Course Objectives: This Course will enable students to				
1.	To introduce fundamental concepts of data communication, networking architectures, protocols, encoding techniques, and error detection mechanisms for reliable enterprise communication.			
2.	To provide an understanding of data link control mechanisms, flow control, error handling techniques, and key network services like email, DNS, and HTTP for efficient and reliable communication.			
3.	To explore transport layer services and protocols, focusing on process-to-process communication, flow and error control, congestion control, and key transport protocols such as UDP, TCP, and SCTP.			
4.	To understand congestion control techniques, traffic management strategies, and congestion handling mechanisms in packet-switched networks, including TCP and Datagram Congestion Control Protocol (DCCP).			
5.	To introduce security protocols, cryptographic algorithms, and multimedia information processing techniques, including data compression and image/video coding for secure and efficient communication.			
UNIT-I				
Introduction:				02 Hours
Data Communication and Networking for today’s Enterprise, A communication Model, Data Communication, Network Types: LAN, WAN, Internet, Internet Architecture.				
Networks Protocols and Architecture:				02 Hours
The Need for a protocol Architecture, A simple protocol Architecture, TCP/IP Protocol Architecture : The TCP/IP layers.				
Data Encoding and Communication Interfaces:				04 Hours
Digital Data & Signals: NRZ, Manchester, Multilevel binary, Biphasic, Modulation rate, Differential Encoding, Scrambling Techniques, Analog & Digital Signal Encoding: Modulation Techniques, Pulse Code Modulation, Delta Modulation, Types of errors, Error Detection & Correction: Parity Check, CRC, Forward error correction.				
UNIT-II				
Data Link Control:				04 Hours
Flow Control: Stop and Wait Sliding Window Flow Control; Error Control: Stop and Wait ARQ, GO-Back-N ARQ, Selective-Reject ARQ; High-level Data Link Control: Basic Characteristics, Frame Structure.				
Application Layer:				04 Hours

SMTP, MIME- Internet Mail Architecture, POP, IMAP, Internet Directory Services- DNS, The DNS Database, DNS operations, Web Access and HTTP: HTTP Overview, Messages, Request Message, Response Messages, Entities.

### UNIT-III

#### The Transport Layer:

**08 Hours**

Transport Layer Services: Process-to-Process Communication, Addressing: Port Numbers, Encapsulation and Decapsulation, Multiplexing and Demultiplexing, Flow control, Error control, Combination of flow control and error control, Congestion control, Connectionless and connection-Oriented protocol.

Transport Layer Protocols: Services, Port Numbers, UDP services, TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, SCTP, SCTP services, SCTP Features, Packet format, An SCTP Association, Flow Control and error control.

### UNIT-IV

#### Network layer:

**08 Hours**

Network layer design issues: Store and Forward packet Switching, Services Provided to the Transport Layer, Implementation of Connection less Service, Implementation of Connection-Oriented Service, Comparison of Virtual Circuit and Datagram Subnets; Routing algorithms: The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing.

### UNIT-V

#### Congestion Control:

**08 Hours**

Effects of congestion, Congestion Control, Traffic Management, Congestion Control in Packet Switching Networks, TCP Congestion control, Datagram Congestion Control Protocol

**Course Outcomes:** At the end of the course student will be able to

1.	<b>Demonstrate</b> an understanding of network models, protocols, data encoding, and error correction techniques to analyze and optimize communication systems.
2.	<b>Analyze and apply</b> data link control protocols, error control mechanisms, and network services like DNS, email, and HTTP to enhance data communication efficiency..
3.	<b>Analyze and apply</b> transport layer mechanisms, including flow control, error handling, congestion management, and transport protocols (UDP, TCP, SCTP) for efficient data communication.
4.	<b>Analyze</b> network layer design issues, including packet switching and service implementations, and apply various routing algorithms to evaluate their efficiency and scalability in network communication.
5.	<b>Analyze and apply</b> congestion control strategies in network communication, including traffic management, TCP congestion control, and DCCP, to optimize network performance.

#### Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	PSO	PSO
↓ Course Outcomes									1	2
25MCA103.1	2	3	2	-	-	-	-	3	1	-
25MCA103.2	2	3	2	-	-	-	-	3	1	-
25MCA103.3	2	2	2	-	-	-	-	3	1	-
25MCA103.4	2	3	2	-	-	-	-	3	1	-
25MCA103.5	2	3	2	-	-	-	-	3	1	-

<b>1: Low 2: Medium 3: High</b>	
<b>TEXTBOOKS:</b>	
1.	William Stallings: Data and Computer Communication, 10 <sup>th</sup> Edition, Pearson Education, 2022
2.	Forouzan B. A., Data Communications and Networking (6e), Tata McGraw Hill 2022.
3.	Computer Networks, Andrew S. Tanenbaum & David J. Wetherall.
<b>REFERENCE BOOKS:</b>	
1.	James F. Kurose & Keith W. Ross – Computer Networking: A Top-Down Approach (8 <sup>th</sup> Edition, Pearson)
2.	Douglas E. Comer – Internetworking with TCP/IP: Principles, Protocols, and Architecture
3.	Larry Peterson & Bruce Davie – Computer Networks: A Systems Approach (6 <sup>th</sup> Edition, Morgan Kaufmann)
<b>E Books / MOOCs/ NPTEL:</b>	
1.	<b>NPTEL-</b> <a href="https://onlinecourses.nptel.ac.in/noc25_cs15/preview">https://onlinecourses.nptel.ac.in/noc25_cs15/preview</a>
2.	<a href="https://freecomputerbooks.com/An-Introduction-to-Computer-Networks-by-Peter-Dordal.html">https://freecomputerbooks.com/An-Introduction-to-Computer-Networks-by-Peter-Dordal.html</a>
3.	NPTEL - <a href="https://onlinecourses.nptel.ac.in/noc25_cs15/preview">https://onlinecourses.nptel.ac.in/noc25_cs15/preview</a>

MATHEMATICAL FOUNDATION FOR COMPUTER APPLICATIONS			
Course Code	25MCA104	Course Type	PCC
Teaching Hours/Week (L: T: P: S)	3:1:0:0	Credits	04
Total Teaching Hours	50	CIE + SEE Marks	50+50
Teaching Department: Master of Computer Applications			
Course Objectives:			
1.	Understand operations on set theory, Solve example problems on set operations		
2.	Understand and solve problems on addition subtraction and multiplication of matrices.		
3.	Solve problems on eigen values and eigen vectors		
4.	Find mean, variance and covariance of two discrete and continuous random variable		
5.	Solve problems related to Graphs		
UNIT-I			
Set theory and operations on sets			05 Hours
Introduction, Venn Diagrams, subsets, The size of a set, power sets, cartesian products, Using set notations with quantifiers, Truth sets and quantifies			
Operations on sets : Introduction, set identities, generalizes unions and intersections, computer representations of sets			
Cardinality, Matrices, Eigen values and eigen vectors			05 Hours
Cardinality : Introduction, countable sets, an uncountable set			
Inclusion - exclusion principle : Introduction, the principle of inclusion exclusion			
Matrices : Introduction, matrix arithmetic, transposes and powers of matrices, Zero-one matrices			
Eigen values and eigen vectors :			
Finding Eigen values and Eigen vectors : Introduction, Procedure to find Eigen values, Procedure to find Eigen Vectors			
UNIT-II			
Propositional Logic, Applications of Propositional Logic			05 Hours
Propositional Logic : Introduction, Propositions, Conditional statements, Converse, Contrapositive and Inverse statements, Biconditional statements, Truth tables of Compound propositions, Precedence of logical operators, logic and bit operations			
Applications of Propositional Logic :			
Introduction, Translating English sentences, System Specifications, Logic Circuits, Logic Puzzles			
Propositional Equivalences, Predicates and Quantifiers			05 Hours
Propositional Equivalences :			
Introduction, Logical Equivalences, Using De Morgan's Laws, Constructing new logical equivalences, Propositional satisfiability, solving satisfiability problems			
Predicates and Quantifiers :			
Introduction, Predicates, Preconditions and post conditions, Quantifiers : Universal quantifier and existential quantifiers and uniqueness quantifiers			
UNIT-III			
Relations and their Properties, n-ary Relations and their Applications			05 Hours
Relations and their Properties :			
Functions as relations, relations on a set, properties of relations, combining relations			
n-ary Relations and their Applications :			
Introduction, n-ary relations, databases and relations, operations on n-ary relations, SQL			
Representing Relations, Closures of Relations, Equivalence relations			05 Hours

<b>Representing Relations</b> : Introduction, representing relations using Matrices, representing using diagrams																																																																		
<b>Closures of Relations</b> : Introduction, closures, paths in directed graphs, transitive closures, Warshall’s algorithm.																																																																		
<b>Equivalence relations</b> : Introduction, Equivalence relations, equivalence classes, equivalence classes and partitions																																																																		
<b>UNIT-IV</b>																																																																		
<b>The concept of probability, The axioms of probability</b>										<b>05 Hours</b>																																																								
<b>The concept of probability</b> : Introduction, Sample space and events																																																																		
<b>The axioms of probability</b> : Introduction, Properties of Probability, Bayes' Theorem, Basics of Probability, Concept of random variable																																																																		
<b>Probability Distributions</b>										<b>05 Hours</b>																																																								
<b>Discrete probability distributions</b> : Introduction, Probability distribution for discrete random variable, expected values, Mean, variance and co-variance																																																																		
<b>Continuous probability distributions</b> : Introduction, Probability density function, expected values, Mean, variance and co-variance Binomial and normal distribution																																																																		
<b>UNIT-V</b>																																																																		
<b>Graph Models Graph Terminology and Special Types of Graphs</b>										<b>05 Hours</b>																																																								
Introduction, Basic Terminology, some special simple graphs, Bipartite Graphs, Bipartite Graphs and matchings, some applications of special types of graphs, new graphs from old																																																																		
<b>Representing Graphs and Graph Isomorphism, Euler and Hamilton Paths</b>										<b>05 Hours</b>																																																								
<b>Representing Graphs and Graph Isomorphism</b> : Introduction, Representing Graphs, Adjacency Matrices, Incidence Matrices, Isomorphism of graphs, Determining whether two simple graphs are isomorphic																																																																		
<b>Euler and Hamilton Paths</b> : Introduction, Euler paths and circuits, Hamilton paths and circuits, Applications of Hamilton Circuits																																																																		
<b>Course Outcomes:</b> At the end of the course student will be able to																																																																		
1.	Solve problems effectively on set operations.																																																																	
2.	Illustrate and solve problems on addition subtraction and multiplication of matrices.																																																																	
3.	Outline translation of sentences based on mathematical logic and solve problems related to applications of mathematical logic.																																																																	
4.	Find mean, variance and covariance of discrete and continuous random variable.																																																																	
5.	Demonstrate and solve problems related to Graphs.																																																																	
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>																																																																		
<table><tr><td><b>Program Outcomes→</b></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td><b>PSO</b></td><td><b>PSO</b></td></tr><tr><td><b>↓ Course Outcomes</b></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td>2</td></tr><tr><td><b>25MCA104.1</b></td><td>3</td><td>3</td><td>3</td><td>3</td><td>1</td><td>1</td><td>3</td><td>3</td><td>3</td><td>2</td></tr><tr><td><b>25MCA104.2</b></td><td>3</td><td>3</td><td>3</td><td>3</td><td>1</td><td>1</td><td>3</td><td>3</td><td>3</td><td>3</td></tr><tr><td><b>25MCA104.3</b></td><td>3</td><td>3</td><td>3</td><td>3</td><td>1</td><td>1</td><td>3</td><td>3</td><td>3</td><td>3</td></tr></table>												<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	<b>PSO</b>	<b>PSO</b>	<b>↓ Course Outcomes</b>									1	2	<b>25MCA104.1</b>	3	3	3	3	1	1	3	3	3	2	<b>25MCA104.2</b>	3	3	3	3	1	1	3	3	3	3	<b>25MCA104.3</b>	3	3	3	3	1	1	3	3	3	3
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	<b>PSO</b>	<b>PSO</b>																																																								
<b>↓ Course Outcomes</b>									1	2																																																								
<b>25MCA104.1</b>	3	3	3	3	1	1	3	3	3	2																																																								
<b>25MCA104.2</b>	3	3	3	3	1	1	3	3	3	3																																																								
<b>25MCA104.3</b>	3	3	3	3	1	1	3	3	3	3																																																								

	<b>25MCA104.4</b>	3	3	3	3	1	1	3	3	3	3
	<b>25MCA104.5</b>	3	3	3	3	1	1	3	3	3	2
<b>1: Low 2: Medium 3: High</b>											
<b>TEXTBOOKS:</b>											
<b>1.</b>	Kenneth H Rosen, “Discrete Mathematics and its Applications”, McGraw Hill Publications, 8 <sup>th</sup> Edition, 2021.										
<b>2.</b>	Wolpole Myers Ye “Probability and Statistics for engineers and Scientist” Pearson Education, 9 <sup>th</sup> Edition, 2024										
<b>REFERENCE BOOKS:</b>											
<b>1.</b>	Richard A Johnson and C.B Gupta “Probability and statistics for engineers” Pearson Education, 9 <sup>th</sup> Edition.										
<b>2.</b>	J.K Sharma “Discrete Mathematics”, Mac Millian Publishers India, 4 <sup>th</sup> Edition, 2022.										
<b>E Books / MOOCs/ NPTEL</b>											
<b>1.</b>	H. Pishro-Nik, "Introduction to probability, statistics, and random processes", available at <a href="https://www.probabilitycourse.com">https://www.probabilitycourse.com</a> , Kappa Research LLC, 2014.										

RESEARCH METHODOLOGY AND PUBLICATION ETHICS				
Course Code		25MCA105	Course Type	PCC
Teaching Hours/Week (L:T:P:S)		3:0:0:0	Credits	03
Total Teaching Hours		40	CIE + SEE Marks	50+50
Teaching Department: Master of Computer Applications				
Course Objectives:				
1.	To understand the Meaning, Objectives and Characteristics of research			
2.	To understand how to select and define the research problem effectively.			
3.	To explore Research design and methodologies and data collection techniques			
4.	To analyze ethical considerations, research integrity, and plagiarism detection.			
5.	To understand Intellectual Property Rights and scientific publication practices.			
UNIT - I				
Introduction to Research :				08 Hours
Meaning, Objectives and Characteristics of research, Research methods Vs Methodology, Types of research, Descriptive Vs. Analytical, Applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical, Research process, Criteria of good research, Importance of AI and ML in Research Analysis.				
UNIT – II				
Research Problem Identification & Literature Review :				08 Hours
Developing a research plan. Defining and Selecting a Research Problem - Necessity of defining the problem -Techniques involved in defining the problem - Importance of literature review in defining a problem - Survey of literature - Primary and secondary sources ,Use of Digital Libraries, Google Scholar and AI-based Research Assistance (ChatGPT, Zotero,Mendeley)				
UNIT – III				
Research design, Data Collection & Analysis:				08 Hours
Research design, Basic Principles, Need of research design, Features of good design, Important concepts relating to research design.				
Sampling design, Steps in sampling design, Sampling Techniques, Characteristics of a good sample design, Types of sample designs, Measurement and scaling techniques, Methods of data collection, Collection of primary data, Data collection instruments, Statistical Tools for Data Analysis.				
Unit – IV				
Ethics in Research & Scientific Writing:				08 Hours
Philosophy and Ethics, Scientific Conduct: Ethics: definition, moral philosophy, nature of moral judgments and reactions. Scientific Conduct Ethics with respect to science and research, Plagiarism and Detection Tools (Turnitin ,Grammarly), Intellectual Honesty and Research Integrity, Scientific Paper Writing, Journal Selection, and Peer Review Process.				
Unit - V				
Intellectual Property Rights & Research Publications:				08 Hours
Intellectual Property Rights(IPR) : Patent ,Copyrights, Trademarks ,and Trade Secrets. IPR Laws in India and International Context (TRIPS Agreement), Open Access Vs Paid Journals, Predatory Journals Awareness. Research Funding, Grant Proposal Writing and Patent Filing Process.				
Course Outcomes: At the end of the course student will be able to				
1.	Outline the Meaning, Objectives and Characteristics of research.			

2.	Demonstrate how to select and define a research problem with a literature review.
3.	Design appropriate research methodologies and analyze data effectively.
4.	Assess ethical considerations, plagiarism detection and research integrity.
5.	Demonstrate knowledge of intellectual property rights and scientific publishing

**Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes**

Program Outcomes→	1	2	3	4	5	6	7	8	PSO	PSO
↓ Course Outcomes									1	2
25MCA105.1	3	2	1	1	-	-	-	2	2	1
25MCA105.2	2	3	2	3	-	-	-	2	3	2
25MCA105.3	2	2	3	3	-	-	-	2	3	3
25MCA105.4	-	-	-	-	-	-	3	2	2	3
25MCA105.5	-	-	-	-	-	3	2	3	3	2

**1: Low 2: Medium 3: High**

**TEXT BOOKS:**

1.	Kothari, C. R., 1990. Research Methodology : Methods and Techniques. New Age International. 418 p.
2.	Dipankar Deb • Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”, ISSN 1868- 4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13- 2946-3 ISBN 978-981-13-2947-0 (eBook), <a href="https://doi.org/10.1007/978-981-13-2947-0">https://doi.org/10.1007/978-981-13-2947-0</a>

**REFERENCE BOOKS:**

1.	Sinha, S. C. and Dhiman, A. K., 2002. Research Methodology, EssEss Publications. 2 volumes.
2.	Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An Introduction to Research Methodology, RB SA Publishers.
3.	Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi
4.	Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
5.	Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6.	Coley, S. M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
7.	Intellectual Property Rights in the Global Economy : Keith Eugene Maskus, Institute for International Economics, Washington, DC, 2000
8.	Subbarau N R – Handbook on Intellectual Property Law and Practice-S Viswanathan Printers and Publishing Private Limited. 1998



ADVANCED OPERATING SYSTEMS WITH UNIX			
Course Code	25MCA106	Course Type	PCC
Teaching Hours/Week (L: T: P:S)	3:1:0:0	Credits	04
Total Teaching Hours	50	CIE + SEE Marks	50+50
Teaching Department: MCA			
Course Objectives:			
1.	Understand Advanced Operating System Concepts		
2.	Gain In-Depth Knowledge of UNIX Internals		
3.	Analyze Distributed and Multiprocessor OS Mechanisms		
4.	Learn Security and Performance Optimization Techniques		
5.	Explore Emerging Trends in Operating Systems		
UNIT-I			
Fundamentals of Advanced Operating Systems:			05 Hours
Overview of Advanced Operating Systems. Types of Advanced OS: Distributed, Multiprocessor, Real-Time, Cloud-Based.			
Operating System Structure:			06 Hours
Process Synchronization & Communication (IPC, Semaphores, Monitors, Message Passing), Deadlock Detection, Avoidance, and Recovery, Case Study: Real-World Advanced Operating Systems (Unix, Linux,Android).			
UNIT-II			
UNIX Operating System Internals:			10 Hours
Evolution & Architecture of UNIX, Process Management in UNIX (Fork, Exec, Signals), File System in UNIX (Structure, Inodes, System Calls) .Memory Management & Virtual Memory in UNIX, UNIX System Performance & Optimization			
UNIT-III			
Distributed Operating Systems:			11 Hours
Introduction to Distributed Systems and Their Architecture, Distributed Process Scheduling & Load Balancing, Distributed File Systems (NFS, HDFS) & Remote Procedure Calls (RPC), Synchronization in Distributed Systems			
UNIT-IV			
Security and Performance in UNIX & Advanced OS			10 Hours
Security Mechanisms in UNIX (Access Control, Firewalls, Authentication), Intrusion Detection & Prevention, Malware Protection, Performance Optimization Techniques in UNIX, Resource Management & Scheduling in Multi-core Systems			
UNIT-V			
Emerging Trends and Case Studies in Operating Systems			08 Hours
Cloud-based & Virtualized Operating Systems (Docker, Kubernetes), Real-Time Operating Systems (RTOS) & Embedded OS, AI and Machine Learning Integration in OS.			
Course Outcomes: At the end of the course student will be able to			
1.	Demonstrate a Strong Understanding of Advanced OS Architectures.		

2.	Analyze and Work with UNIX Operating System Internals.
3.	Develop an Understanding of Distributed and Multiprocessor Systems.
4.	Apply Security and Performance Optimization Techniques in UNIX.
5.	Evaluate Emerging Trends and Future Directions in Operating Systems.

**Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes**

Program Outcomes→	1	2	3	4	5	6	7	8	PSO	PSO
↓ Course Outcomes									1	2
<b>25MCA106.1</b>	3	3	2	2	-	-	-	2	3	3
<b>25MCA106.2</b>	3	3	3	3	-	-	-	2	3	2
<b>25MCA106.3</b>	3	3	2	3	-	-	-	3	3	2
<b>25MCA106.4</b>	3	3	3	2	2	-	-	2	3	2
<b>25MCA106.5</b>	3	3	3	3	2	2	2	3	3	2

**1: Low 2: Medium 3: High**

**TEXTBOOKS:**

1. Mukesh Singhal, Niranjana G. Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill -2017
2. Robert Love, Linux System Programming, 2nd edition, 2013
3. Andrew S. Tanenbaum, Modern Operating Systems, 4<sup>th</sup> Edition, Pearson, 2014
4. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Pearson, 2019

**REFERENCE BOOKS**

1. Abraham Silberschatz, Operating System Concepts, 10th Edition, Wiley
1. UNIX: The Complete Reference: Kenneth Rosen et al, Osborne/McGraw Hill, 2010
2. Maurice J. Bach, *The Design of the UNIX Operating System*, Pearson
3. Simson Garfinkel, Gene Spafford, and Alan Schwartz, Practical UNIX and Internet Security, 3rd edition

**E Books / MOOCs/ NPTEL**

1. <https://www.oreilly.com/library/view/learning-the-unix/1565923901/>

**DATA STRUCTURES WITH ALGORITHMS LAB**

<b>Course Code</b>	<b>25MCA107</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>0:0:4:0</b>	<b>Credits</b>	<b>02</b>
<b>Total Teaching Hours</b>	<b>26</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>

**Teaching Department: Master of Computer Applications**

**Course Objectives:**

1.	Implement the primitive data structures such as arrays and structures.
2.	Implement Stack, Queue data structures statically using arrays and dynamically using linked lists.
3.	Implement recursive and non recursive programs.
4.	Implement the non linear data structures such as Linked list, Binary Trees, Graphs.
5.	Implement different sorting methods and searching methods

**List of Experiments**

1.	C programs using pointers.
2.	C programs using Arrays and Structures.
3.	C programs to demonstrate the operations of stack. (using arrays and structures).
4.	C programs to convert the valid infix arithmetic expression to postfix and prefix form.
5.	Evaluate postfix expression.
6.	Recursive C programs to <ul style="list-style-type: none"> <li>i) Find the Factorial of a number.</li> <li>ii) Find Fibonacci of a number.</li> <li>iii) Solve Towers of Hanoi Problem.</li> <li>iv) Find the GCD of two numbers.</li> <li>v) Find the multiplication of two numbers.</li> </ul>
7.	C programs to simulate the working of simple queue, circular queue and priority queue using arrays and structures.
8.	C programs to demonstrate the operations of singly & doubly linked list. (operations like insert a node at the front, at the back, at the specified position; delete a node from the front end, from the back end, from the specified position; search a node, if the info field is specified; display all the nodes in the list).
9.	Implement stack and queues dynamically using Linked lists.
10.	C programs on binary trees. (Construct a binary search tree and Traverse the tree using all the methods i.e., inorder, preorder, postorder).
11.	C programs to demonstrate the different searching techniques over a list of integers. (Linear search, Binary search).
12.	C programs to sort a list of elements using different sorting techniques. (Bubble sort selection sort, quick sort, simple insertion sort, shell sort, merge sort, Heap sort, Binary tree sort).

**Course Outcomes:** At the end of the course student will be able to

1.	Implement static and dynamic Stack and Queue data structures. Demonstrate the concept of Recursive programs and the implementation details of linked lists.
2.	Explain the implementation details of Binary tree and Graph data structures. Implement and Illustrate various Sorting and Searching Techniques

<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>										
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	<b>PSO</b>	<b>PSO</b>
<b>↓Course Outcomes</b>									<b>1</b>	<b>2</b>
<b>25MCA107.1</b>	3	3	3	3	3	-	-	-	3	2
<b>25MCA107.2</b>	3	3	3	3	3	-	-	-	3	2
<b>1: Low 2: Medium 3: High</b>										
<b>REFERENCE BOOKS:</b>										
1.	Yedidyah Langsam and Moshe J Augenstein and Aaron M Tenenbaum: Data Structures using C and C++, 2 <sup>nd</sup> Edition, Pearson Education Asia, 2002.									
2.	Reema Thareja – "Data Structures Using C", 2 <sup>nd</sup> Edition, Oxford University press									
3.	Jean-Paul Tremblay: An Introduction to Data Structures with Applications, Tata McGraw Hill									
4.	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2 <sup>nd</sup> Edition, Universities Press.									
5.	Introduction to the Design and Analysis of Algorithms. Anany Levitin, Pearson Education, 2 <sup>nd</sup> Edition.									
6.	Horowitz E., Sahani S., Rajashekharan S: Computer Algorithm, Galgotia Publications.									

ADVANCED DATABASE SYSTEMS LAB													
Course Code				25MCA108			Course Type			PCC			
Teaching Hours/Week (L: T: P:S)				0:0:4:0			Credits			02			
Total Teaching Hours				26			CIE + SEE Marks			50+50			
Teaching Department: Master of Computer Applications													
Course Objectives:													
1.	Create and query the databases using SQL DML, DDL and DQL commands.												
2.	Use the features of MySQL to write procedural programs including stored procedures, cursors, and triggers.												
3.	Create and query NoSQL database using Mongoddb.												
Course Outcomes: At the end of the course students will be able to													
1.	Apply SQL and procedural programming concepts in SQL and MySQL to query, update, and manage relational databases effectively.												
2.	Develop CRUD operations in a NoSQL database like MongoDB to manage unstructured and semi-structured data.												
List of Experiments													
1.	Exercise on creating tables.												
2.	Exercise on altering tables, dropping tables.												
3.	Exercise on giving table level constraints, field level constraints.												
4.	Exercise on insertion, retrieval, deletion and modification of data values.												
5.	Exercise on ORDER BY, GROUP BY, HAVING clauses.												
6.	Exercise on Aggregate functions in SQL.												
7.	Exercise on Joins, Unions, Sub queries, Nested Sub queries, Co-related sub-queries.												
8.	Exercise on creating views, dropping views.												
9.	Exercise on MySQL : control structures, connecting tables.												
10.	Exercise on MySQL : Procedures, Cursors, Triggers												
11.	Exercise on MongoDB.												
Course Outcomes: At the end of the course students will be able to													
1.	Use database language statements to query, update, and manage a database using SQL and PL/SQL.												
2.	Apply the concepts used in performing CRUD operations using NoSQL database like MongoDB.												
Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes													
Program Outcomes→				1	2	3	4	5	6	7	8	PSO	PSO
↓ Course Outcomes												1	2
25MCA108.1				3	-	3	2	3	2	-	3	3	-
25MCA108.2				3	-	3	3	2	3	-	3	3	-
1: Low 2: Medium 3: High													
TEXTBOOKS:													
1.	Elmasri and Navathe: Fundamentals of Database Systems, 7 <sup>th</sup> Edition 2016												
2.	Ivan Bayross : Commercial Application Development using Oracle Developer 2000												

3.	Seema Acharya, Subhashini Chellappan, “Big Data Analytics”, 1 <sup>st</sup> Edition, Wiley, 2015
4.	Raghu Ramakrishnan and Johannes Gehrke : Database Management Systems, 6 <sup>th</sup> Edition, McGraw-Hill
<b>REFERENCE BOOKS</b>	
1.	Silberschatz, Korth and Sudarshan: Database Systems Concepts, 6 <sup>th</sup> Edition, McGraw-Hill
2.	Alexis Leon, Mathews Leon: Database Management Systems, Vikas Publishing House
3.	Connolly: Database Systems: A Practical Approach To Design Implementation And Management, 3 <sup>rd</sup> Edition, Person Education
<b>E Books / MOOCs/ NPTEL</b>	
1.	NOC : Fundamentals of Database Systems(Course sponsored by Aricent), IIT Kanpur, Dr. Arnab Bhattacharya <a href="https://nptel.ac.in/courses/106104135">https://nptel.ac.in/courses/106104135</a>
2.	Oracle PL/SQL Language Pocket Reference, 5th Edition: A Guide to Oracle's PL/SQL Language Fundamentals. <a href="https://www.pdfdrive.com/oracle-plsql-language-pocket-reference-5th-edition-a-guide-to-oracles-plsql-language-fundamentals-d167357800.html">https://www.pdfdrive.com/oracle-plsql-language-pocket-reference-5th-edition-a-guide-to-oracles-plsql-language-fundamentals-d167357800.html</a>
3.	MySQL® Notes for Professionals book: <a href="https://www.goalkicker.com/MySQLBook/">https://www.goalkicker.com/MySQLBook/</a>
4.	Learning MongoDB: <a href="https://www.dbooks.org/learning-mongodb-5605980453/#google_vignette">https://www.dbooks.org/learning-mongodb-5605980453/#google_vignette</a>

## DATA COMMUNICATION AND NETWORKS LAB

<b>Course Code</b>	<b>25MCA109</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>0:0:4:0</b>	<b>Credits</b>	<b>02</b>
<b>Total Teaching Hours</b>	<b>26</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>

**Teaching Department: Master of Computer Applications**

### Course Objectives:

1.	To get practical knowledge of working principles of various communication protocols
2.	To analyze the various routing algorithms and To know the concept of data/packet transfer between nodes.
3.	Analyse structure and formats of TCP/IP layer protocols using network tools like network simulators.
4.	Implementing various network algorithms such as error control, error detection, routing and security related algorithms.

### List of Experiments

1.	Implementation of error detection mechanisms
2.	Implementation of the congestion control algorithms.
3.	Implementation of routing algorithms.
4.	Implementation of client / server programs using TCP and UDP.
5.	Implementation of RSA algorithm for encryption/Decryption of message between client & server.
6.	Implementation of frame sorting logic, to order frames received from multiple senders.
7.	Implementation of TELNET.
8.	Simulation of Networking components using any Network Simulation software
9.	Implementation of wireless technology
10.	Use of Open NMS and TCL tool.

**Course Outcomes:** At the end of the course student will be able to

1.	Interpret the practical approach to network communication protocols.
2.	Classify the applications of various Routing Protocols/Algorithms.

### Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	PSO	PSO
↓Course Outcomes									1	2
<b>25MCA109.1</b>	3	3	3	3	2	-	3	3	3	1
<b>25MCA109.2</b>	3	3	2	2	3	-	3	3	3	1

**1: Low 2: Medium 3: High**

### REFERENCE BOOKS:

1.	Cisco CCNA Study Guide v2.71, Aaron Balchunas
2.	CCNA, Study Guide, 6 <sup>th</sup> Edition, TodLammle

### E Resources

1.	<a href="https://www.isi.edu/nsnam/ns/">https://www.isi.edu/nsnam/ns/</a>
2.	<a href="https://www.geeksforgeeks.org/network-simulator-3/">https://www.geeksforgeeks.org/network-simulator-3/</a>

FUNDAMENTALS OF PROGRAMMING – BRIDGE COURSE														
Course Code				25MCA110				Course Type		MNC				
Teaching Hours/Week (L: T: P: S)				0:0:4:0				Credits		00				
Total Teaching Hours				26				CIE		50				
Teaching Department: Master of Computer Applications														
Course Objectives:														
1.	Learn the basics of programming structure and module.													
2.	Study the concept of decision-making statements, loop controlling structures.													
3.	Learn and execute programs on arrays and structures.													
4.	Gain knowledge about pointers and execute the programs using pointers.													
List of Experiments														
	Simple C programs with input – output statements.													
	C programs with decision making statements.													
	C programs using loop control structures.													
	C programs using arrays.													
	C programs using structures.													
	C programs using pointers.													
Course Outcomes: At the end of the course student will be able to														
1.	Explain the basics of programming structure and module. Demonstrate the concept of decision-making statements, loop controlling structures. Execute simple programs, programs using arrays and structures.													
2.	Interpret the concepts of functions and subroutine, execute the programs. Summarize the pointer concepts and execute the programs using pointers.													
Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes														
	Program Outcomes→			1	2	3	4	5	6	7	8	PSO	PSO	
	↓ Course Outcomes											1	2	
	25MCA110.1			3	3	3	3	2	-	3	3	3	2	
	25MCA110.2			3	3	2	2	3	-	2	3	3	2	
1: Low 2: Medium 3: High														



