

# **BMS Institute of Technology and Management**

(An Autonomous Institution, Affiliated to VTU, Belagavi)  
Approved by AICTE New Delhi, Accredited by NAAC with 'A' Grade  
Yelahanka, Bengaluru - 560064



## **Master of Computer Applications (MCA)** (Accredited by NBA, New Delhi)



### **CURRICULUM**

**Scheme of Teaching and Examination 2024 Scheme  
AY 2024-25**

**I & II Semesters**

# **BMS EDUCATIONAL TRUST, BENGALURU**



Dharmaprakasha Rajakarya Prasaktha  
**Late. Sri B. M. Sreenivasaiah**  
Founder, BMSCE



**Late Sri. B. S. Narayan**  
Founder, BMS Educational Trust  
Founder Donor Trustee

## **Vision of BMS Educational Trust**

“Promoting Prosperity of Mankind by Augmenting Human Resource Capital Through Quality Technical Education and Training”

## **Mission of BMS Educational Trust**

“Accomplish Excellence in the Field of Technical Education Through Education Research and Service Needs of Society”

## About BMS Educational Trust

The history of BMS educational institutions can be traced back to 1946, when a noted philanthropist Dharmaprakasha, Rajakarya Prasaktha late Sri. B.M. Sreenivasaiah established the first-ever private engineering college in the country named, BMS College of Engineering (BMSCE). He had a great vision of promoting the prosperity of mankind by augmenting human resource capital through quality education and training. After his sad demise, his illustrious son Late Sri B.S. Narayan strived hard to realize the vision set through the formation of BMS Educational Trust in 1953. He was instrumental in establishing several educational institutions under the Trust. After his passing away, his wife Dr. B.S. Ragini Narayan continued with unwavering devotion the tradition of contributing high-quality human resource to the society, the objective with which the Trust was established. She is now the Chairperson, Donor Trustee and Member Secretary of the Trust. The activities of BMS educational institutions are well guided by a Council of Trustees appointed by her. It has established a conducive academic environment in all its institutions to effectively realize the vision.

Presently, the Trust runs the following 10 high quality and reputed institutions.

1. BMS College of Engineering (BMSCE), Bengaluru
2. BMS College of Law (BMSCL), Bengaluru
3. BMS Pre-University College for Women (BMSPUCW), Bengaluru
4. BMS Degree college for Women (BMSCW), Bengaluru
5. BMS Evening College of Engineering (BMSECE), Bengaluru
6. BMS Institute of Technology and Management (BMSIT&M), Bengaluru
7. BMS School of Architecture (BMSSA), Bengaluru.
8. BMS Evening College of Arts and Commerce (BMSCE), Bengaluru
9. BMS College of Architecture (BMSCA), Bengaluru
10. BMS College of Commerce and Management (BMSCCM), Bengaluru

## About BMS Institute of Technology and Management

BMS Institute of Technology and Management was established in 2002 to cater to the need for high-quality technical education in India. The 22-acre lush green and serene campus of BMSIT&M is located in Northern Bengaluru closer to the Kempegowda International Airport (KIAL). Currently, there are 9 UG programs, 3 PG programs and 11 research centers under VTU catering to the educational needs of close to 4000 students and 143 research scholars. All the programs are being run as per the VTU guidelines for affiliated institutions. Now that BMSIT&M has been granted fresh autonomous status by the UGC and VTU from the academic year 2021-22, the curriculum design, delivery, assessment and evaluation with respect to the batch of students getting admitted w.e.f. 2021-22 will be the responsibility of the institution. The high-quality faculty and staff members, excellent academic and support infrastructure, quality learning aids, productive collaborations with industry, research institutes and government have together created a highly conducive ambience for students to realize their full potential. With continuous improvement in all dimensions, BMSIT&M has become one of the preferred destinations for engineering education for students across the country and neighboring countries as well.

## **About the Department of MCA**

The Department of Master of Computer Applications (MCA) was established during the academic year 2003-04, with an approved intake of 60, to develop quality IT professionals to meet the human resource demand. The department is accredited by NBA, New Delhi and obtained academic autonomy in the year 2021-22. The department is recognized as a Research Centre under Visvesvaraya Technological University from the academic year 2016-17 and currently having 16 research scholars registered for Ph.D. The Department has 12 qualified and dedicated teaching staff, 2 technical staff and 1 office staff who put in their best possible efforts to ensure that the students gain the knowledge along with other life-skills, which helps them to face the world confidently and with high self-esteem while making their journey with BMIT&M comfortable as well. Disciplined environment conducive to Teaching-Learning, along with rigorous academic mentoring, is maintained at the department.

### **VISION OF THE INSTITUTE**

To emerge as one of the finest technical institutions of higher learning to develop professionals who are technically competent, ethical and environment friendly for betterment of society.

### **MISSION OF THE INSTITUTE**

Accomplish stimulating learning environment through high quality academic instruction, innovation and industry-institute interface.

### **VISION OF THE DEPARTMENT**

To emerge as a leading department in computer applications, producing skilled professionals equipped to deliver sustainable solutions.

### **MISSION OF THE DEPARTMENT**

Facilitate effective learning environment through quality education, industry interaction with orientation towards research, critical thinking and entrepreneurial skills.

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

**PEO1:** Develop innovative IT applications to meet industrial and societal needs.

**PEO2:** Adapt themselves to evolving domain requirements.

**PEO3:** Exhibit leadership skills and progress in their chosen career path.

## **PROGRAM OUTCOMES (POs)**

**PO1:** Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.

**PO2:** Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.

**PO3:** Design, develop and investigate problems with an innovative approach for solutions incorporating ESG/SDG goals.

**PO4:** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

**PO5:** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups using methodologies such as agile.

**PO6:** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.

**PO7:** Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware.

**PO8:** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

## **Preamble:**

Technical education, today, is faced with extremely complex challenges due to the pressing need for comprehensive, inclusive, optimal and sustainable solutions to global and local problems. Hence, there is a need for engineering colleges to utilize the academic autonomy granted to them in full measure to assess the gaps in the present system, review and redesign the curriculum, its delivery and evaluation processes to effectively meet all such challenges. Such an exercise should be broad-based and take into consideration:

- The ever-increasing influence of science and technology on human society.
- The faster pace of new developments and the rapid obsolescence of prevailing practices.
- Penetration of Information and Communication Technology in all sectors of human activity and economic development.
- Service sector becoming a major avenue for the employment of technical professionals and economic gains.
- Increasing multicultural work environment and fading organizational boundaries
- Very volatile, uncertain, complex and ambiguous business environment.

A higher education institute with academic autonomy should see opportunities in these challenges. From that perspective, these institutions are responsible for producing graduates who, among others, will have:

- A strong foundation in the basics of science, technology, mathematics and engineering disciplines.
- The command over the chosen area of technical specialization.
- The capacity to apply the professional knowledge and skills acquired to solve complex engineering problems most optimally.
- Ability to self-learn and for life-long learning.
- The expertise in analysis, design, modelling and simulation of complex systems.
- The ability of rational, logical and critical thinking.
- The leadership qualities to inspire team members to achieve grand shared vision.

BMSIT&M intends to produce such graduates who strive to be complete engineers in all respects and to succeed in addressing the challenges posed by the modern world. BMSIT&M exercises the academic freedom given by the University -

- With a great sense of responsibility and accountability
- To enhance the visibility and credibility of the institute in the national and international Higher Education segment.
- To demonstrate its research prowess, creativity, innovativeness and entrepreneurial capabilities.
- To gain the confidence and respect of all its stakeholders, especially students, alumni, parents and the society at large.

## Program Information - MCA

|  |  |
|--|--|
| Name of the Programme  | <b>Master of Computer Applications - MCA</b> |
| Scheme   | Choice Based Credit System                   |
| Duration of the course   | 2 years (4 Semesters)                        |
| Duration of Semester   | 16 Weeks                                     |
| Total credits  | 80   |
| CIE : SEE  | 50:50  |
| Maximum duration of course completion                                | 4 years                                      |
| 10-12 hours of Teaching-Learning Process                             | 1 credit                                     |
| 2 hours Laboratory/Tutorial per week                                 |  |
| 25 hours of Teaching-Learning Process                                | 2 credits                                    |
| 40 hours of Teaching-Learning Process                                | 3 credits                                    |
| 50 hours of Teaching-Learning Process                                | 4 credits                                    |
| 40 hours of Teaching-Learning Process with 10-12 laboratory sessions | 4 credits (IPCC)                             |

### Semester-wise Credit Distribution

| Sem          | Core      | Elective  | Major Project | Internship | Mathematics | Humanities, Ethics & Management | Online Learning        | Total     |
|--------------|-----------|-----------|---------------|------------|-------------|---------------------------------|------------------------|-----------|
| I            | 16        | -         | -             | -          | 4           | Mandatory Course (NC)*          | -                      | 20        |
| II           | 18        | 3         | -             | -          | -           | -                               | Mandatory Course (NC)~ | 21        |
| III          | -         | 9         | 10            | -          | -           | -                               | -                      | 19        |
| IV           | -         | -         | 6             | 11         | -           | -                               | 3                      | 20        |
| <b>Total</b> | <b>34</b> | <b>12</b> | <b>16</b>     | <b>11</b>  | <b>4</b>    | <b>-</b>                        | <b>3</b>               | <b>80</b> |

~ Online Learning can be taken up and completed only on recognized and authorized platforms

\* Communication and Soft Skills course can be completed using Quiklrn platform

## Curriculum 2024-26 Scheme – MCA



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**Scheme of Teaching and Examination: Effective from AY 2024 – 25**  
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

| <b>PG PROGRAM: MASTER OF COMPUTER APPLICATIONS (MCA)</b> |                 |                 |   |                      |          |           |           | <b>Semester: I</b> |           |           |             |
|--|-----------------|-----------------|---|----------------------|----------|-----------|-----------|--------------------|-----------|-----------|-------------|
| Sl. No   | Course Category | Course Code     | Course Title                                      | Teaching Hours /Week |          |           | Credits   | Examination        |           |           |             |
|  |                 |                 |   | L                    | T        | P         |           | Duration           | CIE Marks | SEE Marks | Total Marks |
| 1  | BSC             | <b>24MCA101</b> | Mathematical Foundation for Computer Applications | 3                    | 2        | 0         | 4         | 3                  | 50        | 50        | 100         |
| 2  | IPCC            | <b>24MCA102</b> | Java Programming                                  | 3                    | 0        | 2         | 4         | 3                  | 50        | 50        | 100         |
| 3  | PCC             | <b>24MCA103</b> | Data Structures and Algorithms                    | 3                    | 0        | 0         | 3         | 3                  | 50        | 50        | 100         |
| 4  | PCC             | <b>24MCA104</b> | Database Management Systems                       | 3                    | 0        | 0         | 3         | 3                  | 50        | 50        | 100         |
| 5  | PCC             | <b>24MCA105</b> | Operating System with Unix                        | 3                    | 0        | 0         | 3         | 3                  | 50        | 50        | 100         |
| 6  | PCCL            | <b>24MCA106</b> | Data Structures and Algorithms Lab                | 0                    | 0        | 2         | 1         | 3                  | 50        | 50        | 100         |
| 7  | PCCL            | <b>24MCA107</b> | Database Management Systems Lab                   | 0                    | 0        | 2         | 1         | 3                  | 50        | 50        | 100         |
| 8  | PCCL            | <b>24MCA108</b> | Web Programming Lab                               | 0                    | 0        | 2         | 1         | 3                  | 50        | 50        | 100         |
| 9  | MC              | <b>24MCACS1</b> | Communication and Soft Skills                     | 0                    | 0        | 2         | 0         | -                  | -         | -         | PP          |
| <b>TOTAL</b>   |                 |                 |   | <b>15</b>            | <b>2</b> | <b>10</b> | <b>20</b> | -                  | -         | -         | <b>800</b>  |

\*Bridge Course for students with non-computer science background shall be conducted with 2 hours per week culminating with a structured assessment process.





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|--|-------------------|------------------|------------------------------------|----------------------|----------|----------|-----------|---------------------|-----------|-----------|-------------|
| Sl. No   | Course Category   | Course Code      | Course Title                       | Teaching Hours /Week |          |          | Credits   | Examination         |           |           |             |
|  |                   |                  |                                    | L                    | T        | P        |           | Duration            | CIE Marks | SEE Marks | Total Marks |
| 1  | IPCC              | <b>24MCA201</b>  | Full Stack Development             | 3                    | 0        | 2        | 4         | 3                   | 50        | 50        | 100         |
| 2  | PCC               | <b>24MCA202</b>  | Machine Learning                   | 3                    | 0        | 0        | 3         | 3                   | 50        | 50        | 100         |
| 3  | PCC               | <b>24MCA203</b>  | Mobile Application Development     | 3                    | 0        | 0        | 3         | 3                   | 50        | 50        | 100         |
| 4  | PCC               | <b>24MCA204</b>  | Cloud Computing                    | 3                    | 0        | 0        | 3         | 3                   | 50        | 50        | 100         |
| 5  | PCC               | <b>24MCA205</b>  | Computer Networks                  | 3                    | 0        | 0        | 3         | 3                   | 50        | 50        | 100         |
| 6  | PEC               | <b>24MCA206X</b> | Elective                           | 3                    | 0        | 0        | 3         | 3                   | 50        | 50        | 100         |
| 7  | PCCL              | <b>24MCA207</b>  | Machine Learning Lab               | 0                    | 0        | 2        | 1         | 3                   | 50        | 50        | 100         |
| 8  | PCCL              | <b>24MCA208</b>  | Mobile Application Development Lab | 0                    | 0        | 2        | 1         | 3                   | 50        | 50        | 100         |
| 9  | MC                | <b>24MCACS2</b>  | Communication and Soft Skills      | 0                    | 0        | 2        | 0         | -                   | -         | -         | PP          |
| 10   | MC<br>Online Mode | <b>24MCAOC</b>   | Research Methodology & IPR         | 0                    | 1        | 0        | 0         | -                   | -         | -         | PP          |
| <b>TOTAL</b>   |                   |                  |                                    | <b>18</b>            | <b>1</b> | <b>8</b> | <b>21</b> | -                   | -         | -         | <b>800</b>  |

| <b>Elective</b><br><b>24MCA206X</b> |                            |
|-------------------------------------|----------------------------|
| <b>Course Code</b>                  | <b>Course Title</b>        |
| <b>24MCA2061</b>                    | Cyber Security             |
| <b>24MCA2062</b>                    | Robotic Process Automation |
| <b>24MCA2063</b>                    | Big Data Analytics         |
| <b>24MCA2064</b>                    | Blockchain Technology      |
| <b>24MCA2065</b>                    | Software Quality Assurance |



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| <b>PG PROGRAM: MASTER OF COMPUTER APPLICATIONS (MCA)</b> |                 |                  |                      |                      |          |          |           | <b>Semester: III</b> |           |           |             |
|--|-----------------|------------------|----------------------|----------------------|----------|----------|-----------|----------------------|-----------|-----------|-------------|
| Sl. No   | Course Category | Course Code      | Course Title         | Teaching Hours /Week |          |          | Credits   | Examination          |           |           |             |
|  |                 |                  |                      | L                    | T        | P        |           | Duration             | CIE Marks | SEE Marks | Total Marks |
|  |                 |                  |                      |                      |          |          |           |                      |           |           |             |
| 1  | PEC             | <b>24MCA301X</b> | Specialization – I   | 3                    | 0        | 0        | 3         | 3                    | 50        | 50        | 100         |
| 2  | PEC             | <b>24MCA302X</b> | Specialization – II  | 3                    | 0        | 0        | 3         | 3                    | 50        | 50        | 100         |
| 3  | PEC             | <b>24MCA303X</b> | Specialization – III | 3                    | 0        | 0        | 3         | 3                    | 50        | 50        | 100         |
| 4  | PW              | <b>24MCA304</b>  | Project Phase - I    | 0                    | 0        | 8        | 10        | 3                    | 50        | 50        | 100         |
| <b>TOTAL</b>   |                 |                  |                      | <b>9</b>             | <b>0</b> | <b>8</b> | <b>19</b> | -                    | -         | -         | <b>400</b>  |

|   | <b>Artificial Intelligence &amp; Data Science (A)</b> | <b>Software Development and Operations (B)</b> | <b>Advanced Network Systems (C)</b>  | <b>System Security &amp; Applications (D)</b> |
|---|---|--|--------------------------------------|---|
| <b>Specialization I</b><br><b>24MCA301X</b>   | Business Analytics                                    | Agile Software Development                     | Augmented & Virtual Reality          | Web Security                                  |
| <b>Specialization II</b><br><b>24MCA302X</b>  | Natural Language Processing                           | Object Oriented Analysis and Design            | Industrial IoT                       | Ethical Hacking                               |
| <b>Specialization III</b><br><b>24MCA303X</b> | Data Engineering                                      | Enterprise Resource Planning                   | Wireless Networks & Mobile Computing | Cryptography and Network Security             |



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| <b>PG PROGRAM: MASTER OF COMPUTER APPLICATIONS (MCA)</b> |                        |                    |  |                             |          |           |                | <b>Semester: IV</b> |                  |                  |                    |
|--|------------------------|--------------------|--|-----------------------------|----------|-----------|----------------|---------------------|------------------|------------------|--------------------|
| <b>Sl. No</b>  | <b>Course Category</b> | <b>Course Code</b> | <b>Course Title</b>  | <b>Teaching Hours /Week</b> |          |           | <b>Credits</b> | <b>Examination</b>  |                  |                  |                    |
|  |                        |                    |  | <b>L</b>                    | <b>T</b> | <b>P</b>  |                | <b>Duration</b>     | <b>CIE Marks</b> | <b>SEE Marks</b> | <b>Total Marks</b> |
| 1  | PEC<br>Online Mode     | <b>24MCA401</b>    | Online Course on Emerging Technology (12 Weeks) / Professional Certification | 0                           | 2        | 0         | <b>3</b>       | -                   | 100              | -                | 100                |
| 2  | INT                    | <b>24MCA402</b>    | Internship   | 0                           | 0        | 0         | <b>11</b>      | 3                   | 50               | 50               | 100                |
| 3  | PW                     | <b>24MCA403</b>    | Project Phase - II   | 0                           | 0        | 10        | <b>6</b>       | 3                   | 50               | 50               | 100                |
| <b>TOTAL</b>   |                        |                    |  | <b>0</b>                    | <b>2</b> | <b>10</b> | <b>20</b>      | -                   | -                | -                | <b>300</b>         |



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## CONTINUOUS INTERNAL EVALUATION AND SEMESTER END EXAMINATION PATTERN ACADEMIC BATCH 2024-25 (MCA)

| CONTINUOUS INTERNAL EVALUATION (CIE): IPCC Course (3-0-2)  |   |                            |            |                        |                        | Max. Marks: 50                 |
|--|---|----------------------------|------------|------------------------|------------------------|--------------------------------|
|  |   | Internal Assessments (IAs) | Max. Marks | Average /Sum           | Marks after scale-down | Final Marks                    |
| Theory Component (60% of CIE)  | IA Tests  | IA-1 (1.5 Hr)              | 40         | 40                     | 20                     | 20+<br>10+<br>10+<br>10=<br>50 |
|  |   | IA-2 (1.5 Hr)              | 40         |                        |                        |                                |
|  | Assignment  | ASMT                       | 10         | 20                     | 10                     |                                |
|  | AAT   | AAT                        | 10         |                        |                        |                                |
| Practical Component (40% of CIE)   | Cumulative assessment of laboratory program execution | 10 Marks for each program  | 100        | -                      | 10                     |                                |
|  | IA Test   | IA (03 Hrs.)               | 50         | 100                    | 10                     |                                |
|  |   | Open Ended Programs        | 50         |                        |                        |                                |
| SEMESTER END EXAMINATION (SEE): IPCC Courses (3-0-2)   |   |                            |            |                        |                        | Max. Marks: 50                 |
| Examination Duration: 03 Hrs   |   |                            |            |                        |                        |                                |
|  |   |                            | Max. Marks | Marks after scale-down | Final Marks            |                                |
| Theory Component (100% of SEE)   | No. of Modules  | 05                         | 100        | 50                     | 50                     |                                |
|  | Questions/Module                                      | 02                         |            |                        |                        |                                |
|  | Marks/Question  | 20                         |            |                        |                        |                                |
|  | No. of Questions to be answered/module                | 01                         |            |                        |                        |                                |
|  | No. of Questions to be answered/course                | 05                         |            |                        |                        |                                |
| <b>The minimum marks to be secured in CIE to appear for SEE shall be 25. (50% of maximum marks (30M) under theory component i.e., 15M and 50% of maximum marks (20) under laboratory component i.e., 10)).</b> |   |                            |            |                        |                        |                                |
| <b>A minimum of 40% in SEE is required i.e., 20M.</b>  |   |                            |            |                        |                        |                                |
| <b>In addition to the minimum CIE and SEE requirements, an aggregate of 50% marks from CIE and SEE, put together, is required for passing the course i.e., 50M.</b>  |   |                            |            |                        |                        |                                |



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| <b>CONTINUOUS INTERNAL EVALUATION (CIE): PCCL or PEC Course (0:3:3) (0:1:3)</b>  |                                 |   |                         |                               |                               |                    |
|--|---------------------------------|---|-------------------------|-------------------------------|-------------------------------|--------------------|
|  |                                 |   |                         |                               |                               | Max. Marks: 50     |
|  |                                 | <b>Internal Assessments (IAs)</b>           | <b>Max. Marks</b>       | <b>Average/ Sum</b>           | <b>Marks after scale-down</b> | <b>Final Marks</b> |
| Practical Component  | Cumulative Marks of Programs    | 10 Marks for each program                   | 100                     | -                             | 30                            | 30+<br>20=<br>50   |
|  | IA Tests                        | IA (03 Hrs.)                                | 50                      | 150                           | 20                            |                    |
|  | Open Ended Programs             | Prg 1                                       | 50                      |                               |                               |                    |
|  |                                 | Prg 2                                       | 50                      |                               |                               |                    |
| <b>SEMESTER END EXAMINATION (SEE): PCCL or PEC Course (0:3:3) (0:1:3)</b>  |                                 |   |                         |                               |                               |                    |
| Examination Duration: 03 Hrs   |                                 |   |                         |                               |                               | Max. Marks: 50     |
|  |                                 |   | <b>Max. Marks - 100</b> | <b>Marks after scale-down</b> | <b>Final Marks</b>            |                    |
| Practical Component  | Write up                        | 20%   | 20                      | 50                            | 50                            |                    |
|  | Conduction procedure and result | 60%   | 60                      |                               |                               |                    |
|  | Viva-Voce                       | 20%   | 20                      |                               |                               |                    |
|  | Change of experiment            | -10% from marks allotted for procedure part | -6                      | -                             |                               |                    |
| <b><i>The minimum marks to be secured in CIE to appear for SEE shall be 25.</i></b>  |                                 |   |                         |                               |                               |                    |
| <b><i>A minimum of 40% in SEE is required i.e., 20M.</i></b>   |                                 |   |                         |                               |                               |                    |
| <b><i>In addition to the minimum CIE and SEE requirements, an aggregate of 50% marks from CIE and SEE, put together, is required for passing the course i.e., 50M.</i></b> |                                 |   |                         |                               |                               |                    |



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| <b>CONTINUOUS INTERNAL EVALUATION (CIE): PCC or PEC Course (3:2:0) (2:0:0) (3:0:0)</b>   |  |                                   |                   |                               |                               |                    |
|--|--|-----------------------------------|-------------------|-------------------------------|-------------------------------|--------------------|
| Max. Marks: 50   |  |                                   |                   |                               |                               |                    |
|  |  | <b>Internal Assessments (IAs)</b> | <b>Max. Marks</b> | <b>Average/Sum</b>            | <b>Marks after scale-down</b> | <b>Final Marks</b> |
| Theory Component   | IA Tests                                   | IA-1 (1.5 Hr)                     | 40                | 40                            | 30                            | 30+<br>20=<br>50   |
|  |  | IA-2 (1.5 Hr)                     | 40                |                               |                               |                    |
|  | AAT  | AAT-1                             | 10                | 20                            | 20                            |                    |
|  |  | AAT-2                             | 10                |                               |                               |                    |
| <b>SEMESTER END EXAMINATION (SEE): PCC or PEC Course (3:2:0) (2:0:0) (3:0:0)</b>   |  |                                   |                   |                               |                               |                    |
| Examination Duration: 03 Hrs   |  |                                   |                   |                               |                               |                    |
| Max. Marks: 50   |  |                                   |                   |                               |                               |                    |
|  |  |                                   | <b>Max. Marks</b> | <b>Marks after scale-down</b> | <b>Final Marks</b>            |                    |
| Theory Component   | No. of Modules                             | 05                                | 100               | 50                            | 50                            |                    |
|  | Questions/Module                           | 02                                |                   |                               |                               |                    |
|  | Marks/Question                             | 20                                |                   |                               |                               |                    |
|  | No. of Questions to be answered/<br>module | 01                                |                   |                               |                               |                    |
|  | No. of Questions to be answered/           | 05                                |                   |                               |                               |                    |
| <b><i>The minimum marks to be secured in CIE to appear for SEE shall be 25.</i></b>  |  |                                   |                   |                               |                               |                    |
| <b><i>A minimum of 40% in SEE is required i.e., 20M.</i></b>   |  |                                   |                   |                               |                               |                    |
| <b><i>In addition to the minimum CIE and SEE requirements, an aggregate of 50% marks from CIE and SEE, put together, is required for passing the course i.e., 50M.</i></b> |  |                                   |                   |                               |                               |                    |



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**SEMESTER - I**

**Mathematical Foundations for Computer Applications**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA101 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:2:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L14T   | Exam Hours | 3  |

**Credits: 04**

**Course objectives:**

This course will enable the students to

1. Understand the concepts of sets and number theory.
2. Perform various basic operations on propositional logic.
3. Solve problems using concepts of relations & probability distribution
4. Apply the abstract concepts of algebra & graph theory
5. Compute statistical measures for the given set of data.

**Preamble:** Mathematical foundation is essential in both theoretical and applied areas of computer science. It covers wide range of concepts such as set theory, probability, graph theory, matrices and vectors, and statistical methods which are applied in the domains of machine learning, artificial intelligence, and data science.

**Module - 1**

**Mathematical Logic, Set Theory, Functions and Relations**

Propositional logic, Propositional Equivalences, Sets, Set operations, Inclusion and Exclusion principle, Functions, Relation, Properties of relations, Equivalence relations, Partial Ordering, Applications of set theory and logic in computer science, Use cases of the concepts.

(08 Hours)

**Module - 2**

**Probability Distribution**

Concept of Random variable, Discrete Probability Distributions, Continuous Probability Distributions, Mean and Variance of random variables. Binomial and Poisson Distribution, Exponential and Normal Distribution with Mean and Variance.

(08 Hours)

**Module - 3**

**Matrices and Vector Algebra**

Matrices, Matrix operations, Related matrices, Eigen values, and Eigen vectors, Vectors, types of vectors, Operations of vector and applications, Use cases of the concepts.

(08 Hours)

**Module - 4**

**Graph Theory**

Graphs and graphs models and terminologies, Representation of graphs, Euler and Hamilton Graphs, Shortest-Path-Travelling salesman problem, Planar graph and graph coloring, Use cases of the concepts.

(08 Hours)

**Module - 5**

**Statistical Methods**

Collection of data, Graphical representation, Comparison of frequency distribution, Measures of tendency, Correlation, Coefficient of correlation, Lines of regression, Rank correlation, Curve Fitting-Graphical method, Principle of Least Square- to fit a straight line and Parabola, Fitting of other curves of the form  $y=ax^b$ ,  $y=ae^{bx}$ , Applications of linear regression and curve fitting.  
(08 Hours)

**Course outcomes:**

The students will be able to:

CO1: Solve the problems based on mathematical logic, set theory and relations.

CO2: Apply appropriate probability distribution for a given problem.

CO3: Apply matrices and vectors for a given use case.

CO4: Model the given problem using graph theory concepts.

CO5: Perform statistical evaluation for curve fitting.

**CIE:**

- 60% of CIE is based on Internal Assessment Tests
- 40% of CIE is based on Alternate Assessment Methods

**SEE:**

- SEE will be conducted for 100 marks.

**Text Books:**

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill publications, 7<sup>th</sup> edition.
2. Dr. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44<sup>th</sup> Edition.
3. Walpole Myers, "Probability and Statistics for Engineers and Scientists", Pearson Education, 8<sup>th</sup> Edition.

**References:**

1. Ralph P. Grimaldi and B V Ramana, "Discrete and combinatorial Mathematics", 5<sup>th</sup> Edition, Pearson, 2011.
2. J K Sharma, "Discrete Mathematics", MacMillan Publishers India Ltd, 3<sup>rd</sup> Edition, 2011.
3. J P Trembly and R Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill, 2017.

**Alternate Assessment Tools (AATs) suggested:**

1. Problem Solving

**Web links/e-resources:**

1. Probability distributions:  
<https://www.youtube.com/watch?v=CfZa1daLjwo&list=PLaFfQroTgZnzbK-Rie19FdV6diehETQy>.
2. Travelling salesman problem Graph Theory 13 Travelling salesman's problem & Chinese postman problem.
3. Eigen values and Eigen vectors Eigenvalues and Eigenvectors | Properties and Important Result | Matrices.
4. Curve fitting :  
[https://www.youtube.com/watch?v=PtRq60VZGlE&list=PLNKD1qB9pptvgPP\\_zrKXa64SPYtKQpy-C](https://www.youtube.com/watch?v=PtRq60VZGlE&list=PLNKD1qB9pptvgPP_zrKXa64SPYtKQpy-C).





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**SEMESTER - I**

**Java Programming**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA102 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:2    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L 28P  | Exam Hours | 3  |

**Credits: 04**

**Course objectives:**

This course will enable the students to

1. Understand the basic syntax, operators set, functions and OOP concepts in Java.
2. Develop problem-solving skills using java programming to tackle real world problems.
3. Master advanced Java programming concepts, including threads, exceptions and interfaces.
4. Apply OOP design principles to design and develop robust, scalable Java applications.
5. Develop GUI based applications using Java frameworks and libraries.

**Preamble:** The Java Programming course is a comprehensive program designed to equip students with the fundamental knowledge and skills required to develop robust, scalable, and efficient software applications using Java. Java is a widely used programming language in various industries, including web development, Android app development, Enterprise software development.

**Module - 1**

**Java Programming Fundamentals**

An overview of Java, Data Types and Operators, Program Control Statements, Introducing Classes, Objects and Methods. Methods, Classes, Constructors, Access control, Pass Objects to Methods, How Arguments are passed, Returning Objects, Method Overloading, Overloading Constructors.

(08 Hours)

**Module - 2**

**Inheritance, Interfaces and Packages**

Inheritance, using super to Call Superclass constructors, using super to Access Superclass Members, creating a Multilevel Hierarchy, Superclass References and Subclass Objects, Method Overriding, Using Abstract Classes. Interface Fundamentals, Creating an Interface, implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Constants in Interfaces, Interfaces can be extended, Nested Interfaces, Package Fundamentals, Packages and Member Access, Importing Packages.

(08 Hours)

**Module - 3**

**Exception Handling and Multi-Threading Programming**

The Exception Hierarchy, Exception Handling Fundamentals, the Consequences of an Uncaught Exception, using Multiple catch clauses, Catching subclass Exceptions, Throwing an Exception, Throwable, using finally, using throws; Multithreading: The Thread Class and Runnable Interface, Creating Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, Synchronization, using Synchronization Methods, The Synchronized

|   |  |
|---|--|
| Statement, Thread Communication using notify(), wait() and notify All(), Suspending, Resuming and stopping Threads.<br>(08 Hours)   |  |
| <b>Module - 4</b>   |  |
| <b>Servlet Programming</b><br>Servlet Structure, Packaging, Lifecycle, HTTP Request and response, Handling client request, Form data, HTTP status request headers, HTTP Status codes, HTTP response headers, Handling cookies, Session tracking.  |  |
| <b>JSP Programming</b><br>Need of JSP, Basic syntax, Scripting elements, Limiting Java code in JSP, JSP expression, JSP directives, JSP attributes.<br>(08 Hours)   |  |
| <b>Module - 5</b>   |  |
| <b>Spring Framework and Hibernate</b><br>Introducing the Spring Framework, Problems with the Traditional Approach to J2EE, Lightweight Frameworks, Spring's Values, Spring in Context, Inversion of Control and Dependency Injection, Architecting Applications with Spring; Introduction to Hibernate, Application of Hibernate.<br>(08 Hours) |  |
| <b>Practical components for IPCC</b>  |  |
| <b>Sl.No.</b>   | <b>Experiments</b>   |
| 1   | a. Class, object<br>b. Method Overloading & Constructor Overloading.     |
| 2   | Inheritance<br>a. Method Overriding<br>b. Abstract class                 |
| 3   | a. Interfaces<br>b. Packages   |
| 4   | a. Exception Handling<br>b. Creating own exception subclasses            |
| 5   | a. Multithreaded Programming<br>b. Thread Priorities and Synchronization |
| 6   | a. Java Servlets<br>b. Java Server Pages                                 |
| 7   | JDBC Connectivity  |
| 8   | A simple Spring application  |
| <b>Course outcomes:</b><br>The students will be able to:<br>CO1: Demonstrate object-oriented programming concepts.<br>CO2: Apply Java constructs to obtain solutions.<br>CO3: Develop reusable and efficient Java code.<br>CO4: Build a Java based client-server application.<br>CO5: Implement Java application using Spring framework.        |  |
| <b>CIE:</b><br><ul style="list-style-type: none"> <li>• CIE is based on Theory and Laboratory Components of the course.</li> <li>• Theory component is evaluated for 60% of CIE i.e., 30 Marks and Laboratory component is evaluated for 40% of CIE i.e., 20 Marks.</li> </ul>  |  |

**SEE:**

- SEE will be conducted for 100 marks.

**Text Books:**

1. "Java: The Complete Reference" by Herbert Schildt (Publisher: McGraw-Hill), 9th Edition, ISBN: 978-0-07-180856-9, 2014.
2. Professional Java™ Development with the Spring Framework by Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas Risberg, Colin Sampaleanu , Released July 2005, Publisher(s): Wrox ,ISBN: 9780764574832.
3. Java Servlet and JSP Programming" by Jason Brittain and Brian D. Eubanks (Publisher: O'Reilly Media).

**References:**

1. "Head First Design Patterns" by Kathy Sierra and Bert Bates (Publisher: O'Reilly Media).
2. "Beginning Hibernate 6 Java Persistence from Beginner to Pro" , by Joseph B. Ottinger Jeff Linwood Dave Minte Fifth Edition, Apress.

**Alternate Assessment Tools (AATs) suggested:**

1. Spring Framework
2. Project Development and Presentation

**Web links/e-resources:**

1. [www.java.com](http://www.java.com)
2. <https://www.programiz.com/java-programming>



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**SEMESTER - I**

**Data Structures and Algorithms**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA103 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L      | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Understand fundamentals of data structures and their applications essential for programming/problem solving.
2. Utilize an appropriate data structure like stack, queues, lists, trees and graphs to solve a given problem.
3. Develop non-linear data structures and their applications such as trees and graphs sorting, traversing and searching algorithms.
4. State algorithm's efficiencies using asymptotic notations.
5. Analyse the efficiency of various algorithms.

**Preamble:** Data Structures are a specialized means of organizing and storing data in computers in such a way that operations can be performed on the stored data more efficiently. Data structures have a wide and diverse scope of usage across the fields of Computer Science and many other fields of Engineering. Data Structures are the main part of many computer science algorithms as they enable the programmers to handle the data in an efficient way. It plays a vital role in enhancing the performance of a software.

**Module - 1**

**Data Structures**

Definition, Classification and Operations, Dynamic memory allocation, Dynamic Arrays, Self-referential structures.

**Stacks**

Definition, Stack operations, Array representation of stacks, Stacks using dynamic arrays.

**Stack applications**

Infix to postfix conversion, Evaluation of postfix expression.

**Recursion**

Factorial, GCD, Fibonacci sequence, Tower of Hanoi, Ackerman's function.

(08 Hours)

**Module - 2**

**Queues**

Definition, Array representation, Queue operations, Circular queues, Circular queues using dynamic arrays, De-queues, Priority queues.

**Linked Lists**

Definition, Representation of linked lists in memory, Memory allocation; Garbage collection.

(08 Hours)

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| <b>Module – 3</b>   |
| <p><b>Linked list operations</b><br/>Traversing, Searching, Insertion, and deletion. Doubly linked lists, Circular linked lists.</p> <p><b>Trees</b><br/>Terminology, Binary trees, Properties of binary trees, Array and linked representation of Tree, Binary tree traversals - Inorder, Preorder, Postorder.</p> <p><b>Binary Search Trees</b><br/>BST insert and delete operations, Application of binary search trees.</p> <p style="text-align: right;">(08 Hours)</p>  |
| <b>Module – 4</b>   |
| <p><b>Asymptotic Notations</b><br/>Big-Oh notation (O), Omega notation (<math>\Omega</math>), Theta notation(<math>\Theta</math>) with examples, Basic efficiency classes, Important problem types, Mathematical analysis of non-recursive and Recursive algorithms with examples problems.</p> <p><b>Brute force design technique</b><br/>Selection sort, Sequential search, String matching algorithm with complexity Analysis.</p> <p style="text-align: right;">(08 Hours)</p>  |
| <b>Module – 5</b>   |
| <p><b>Divide and Conquer</b><br/>Binary search, Merge sort, Quick sort with complexity analysis.</p> <p><b>Greedy Technique</b><br/>Prim’s Algorithm, Kruskal’s algorithm, Dijkstra’s algorithm with performance analysis, Decrease and conquer – DFS, BFS.</p> <p style="text-align: right;">(08 Hours)</p>  |
| <p><b>Course outcomes:</b><br/>The students will be able to:<br/>CO1: Illustrate linear and non-linear data structures.<br/>CO2: Apply suitable data structures for a given problem.<br/>CO3: Implement sorting and searching techniques.<br/>CO4: Analyse the algorithms using complexity metrics.</p>   |
| <p><b>CIE:</b></p> <ul style="list-style-type: none"> <li>• 60% of CIE is based on Internal Assessment Tests</li> <li>• 40% of CIE is based on Alternate Assessment Methods</li> </ul>  |
| <p><b>SEE:</b></p> <ul style="list-style-type: none"> <li>• SEE will be conducted for 100 marks.</li> </ul>   |
| <p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, Universities Press, 2nd edition, 2019</li> <li>2. Seymour Lipschutz, Data Structures, Schaum's Outline Series, 1st Edition, 2014.</li> </ol> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Gilberg &amp; Forouzan, Data Structures: A Pseudo-code approach with C, Cengage Learning, 2nd edition, 2014.</li> <li>2. Jean-Paul Tremblay &amp; Paul G. Sorenson, An Introduction to Data Structures with Applications, McGraw Hill, 2nd Edition, 2013.</li> <li>3. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.</li> <li>4. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.</li> </ol> |
| <b>Alternate Assessment Tools (AATs) suggested:</b>   |

1. Linked List Applications.
2. Time complexity.

**Web links/e-resources:**

1. Introduction to Data Structures: <http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html>
2. Sorting: <https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html>
3. Trees, BFS,DFS : <https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html>



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**SEMESTER - I**

**Database Management System**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA104 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L      | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Understand the fundamental concepts of Database Management Systems.
2. Compare between file systems and database systems.
3. Design ER diagrams, schema and relational tables.
4. Formulate SQL queries.
5. Develop real-time database applications.

**Preamble:** Database Management Systems (DBMS) is a software system that allows users to create, manage, and manipulate data in a database and are important because they help businesses store, manage, and access data efficiently. It is used in all applications.

**Module - 1**

**Overview**

Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, Data models, Schemas and instances, Three schema architecture and data independence.

**Entity-Relationship Model**

Conceptual database using high level conceptual data models for Database design, A sample database application, Entity types, Entity sets, Attributes and Keys relationship types, Relationship sets, Roles and structural constraints, Weak entity types.

(08 Hours)

**Module - 2**

**Relational Model**

Relational vs non-relational DBMS, Relational model concepts, Relational model constraints and Relational database schema update operations, Transactions and dealing with constraint violations, Unary relational operations, Relational algebra operations from set theory, Binary relational operations, JOIN and DIVISION, Additional relational operations, Examples of queries in relational algebra, Relational database design using ER-to-relational mapping.

(08 Hours)

**Module - 3**

**Introduction to SQL**

Overview of the SQL query language, SQL data definition, Basic structure of SQL queries, additional basic operations, Null values, Aggregate functions, Modification of the Database, Join Expressions, Views, Transactions, Integrity constraints, SQL data types and schemas, Authorization, Database programming issues and techniques, Embedded SQL.

(08 Hours)

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|---|
| <b>Module – 4</b>   |
| <p><b>Database Design</b><br/>         Informal design guidelines for relation schemas, Functional dependencies, Normal forms based on primary keys, General definitions of 2<sup>nd</sup> and 3<sup>rd</sup> Normal forms, Boyce Code Normal Forms, Stored procedures and functions, Triggers, Views.</p> <p style="text-align: right;">(08 Hours)</p>   |
| <b>Module – 5</b>   |
| <p><b>Transaction Management</b><br/>         Transaction concept, A simple transaction model, Desirable properties of transaction.</p> <p><b>Concurrency Control</b><br/>         Lock based protocols, Recovery concepts, Recovery in multi-database systems, Database backup and recovery from catastrophic failures.</p> <p style="text-align: right;">(08 Hours)</p>   |
| <p><b>Course outcomes:</b><br/>         The students will be able to:<br/>         CO1: Apply the basic concepts of database management.<br/>         CO2: Formulate SQL queries for a given problem scenario.<br/>         CO3: Improve the database design by normalization.<br/>         CO4: Create stored procedures/ functions for a given use case.<br/>         CO5: Implement transaction management concepts.</p>                             |
| <p><b>CIE:</b></p> <ul style="list-style-type: none"> <li>• 60% of CIE is based on Internal Assessment Tests.</li> <li>• 40% of CIE is based on Alternate Assessment Methods.</li> </ul>  |
| <p><b>SEE:</b></p> <ul style="list-style-type: none"> <li>• SEE will be conducted for 100 marks.</li> </ul>   |
| <p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Elmasri and Navathe, “Fundamentals of Database Systems”, 5th Edition, Addison - Wesley, 2011.</li> </ol>  |
| <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, 3<sup>rd</sup> Edition, McGraw-Hill, 2003.</li> <li>2. Silberschatz, Korth and Sudarshan, “Data base System Concepts”, 6<sup>th</sup> Edition, Tata McGraw Hill, 2011.</li> </ol>  |
| <p><b>Alternate Assessment Tools (AATs) suggested:</b></p> <ol style="list-style-type: none"> <li>1. Develop an application with proper interface and database.</li> </ol>  |
| <p><b>Web links/e-resources:</b></p> <ol style="list-style-type: none"> <li>1. Stored Procedure: <a href="https://www.youtube.com/watch?app=desktop&amp;v=Sggdhot-MoM">https://www.youtube.com/watch?app=desktop&amp;v=Sggdhot-MoM</a></li> <li>2. Research paper using DBMS <a href="https://www.ijrte.org/wp-content/uploads/papers/v7i6s5/F10370476S519.pdf">https://www.ijrte.org/wp-content/uploads/papers/v7i6s5/F10370476S519.pdf</a></li> </ol> |





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**SEMESTER – I**

**Operating System with Unix**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA105 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L      | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students

1. To understand the services of operating system.
2. To know about various types of operating systems.
3. To analyse and understand the need for processes, threads and their implementation models.
4. To learn CPU and Memory management technique.
5. To study the architecture of a Linux system.

**Preamble:** Operating system is an interface between the user and the computer. Operating system is critical to implement any software: system software or application software. It's application is there in almost all electronic gadgets/devices viz: Laptops, smart watches, mobiles, refrigerators etc.

**Module – 1**

**Operating System Basics**

Introduction to Operating System, OS types, Feature Migration, Computing Environments, System Components, Operating – System Services, System Calls, System Programs, System Structure, Virtual machines.

(08 Hours)

**Module – 2**

**Process Management**

Process Concept, Process control block, Scheduling Criteria, Scheduling Algorithms. Process Synchronization: The Critical Section Problem, Semaphores, Readers-Writers Problem, Dining Philosopher's Problem using Semaphores.

(08 Hours)

**Module – 3**

**Deadlocks**

System model, Deadlock Characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from deadlock.

(08 Hours)

**Module – 4**

**Memory Management**

Memory Management Strategies, Basic hardware, Swapping, Memory Allocation, Paging, Segmentation, Virtual Memory concept.

(08 Hours)

## Module – 5

### Unix

Unix architecture, Components of Unix, Unix file system, Environment variables, Unix files.

### Linux Case Study

Basic Linux commands to deal with files and directories, File permissions, Pipes and filters, Pattern matching, Find command, Administrative commands.

(08 Hours)

### Course outcomes:

The students will be able to:

CO1: Illustrate operating system concepts.

CO2: Apply the suitable OS algorithm for any given use case.

CO3: Analyse memory management techniques.

CO4: Build shell scripts using Linux commands and language constructs.

### CIE:

- 60% of CIE is based on Internal Assessment Tests.
- 40% of CIE is based on Alternate Assessment Methods.

### SEE:

- SEE will be conducted for 100 marks.

### Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating Systems Principles", 8th Edition, Wiley – India.
2. Unix Concepts and Applications- Sumitaba Das, 4<sup>th</sup> Edition, Mc Graw Hill Publications.

### References:

1. D M Dhamdhare, "Operating Systems – A Concept Based Approach", 2nd Edition, Tata McGraw – Hill, 2002.
2. Behrouz A Forouzan and Richard F Gilberg, "LINUX and Shell Programming", 1st Edition, Thomson Course Technology, 2005.

### Alternate Assessment Tools (AATs) suggested:

1. Unix commands.
2. Shell Script.

### Web links/e-resources:

1. Basic Unix Commands <https://www.unixtutorial.org/basic-unix-commands>.



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**SEMESTER - I**

**Data Structures and Algorithms Lab**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA106 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 0:0:2    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 28P      | Exam Hours | 3  |

**Credits: 01**

**Course objectives:**

This course will enable the students to

1. Develop linear data structures and their applications such as stacks, queues and lists.
2. Develop non-linear data structures and their applications
3. Implement sorting and searching algorithms based on their complexity metrics.

| Sl.No. | Experiments   |
|--------|---|
| 1      | <p>Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)</p> <ol style="list-style-type: none"><li>a. Push an Element on to Stack</li><li>b. Pop an Element from Stack</li><li>c. Demonstrate Overflow and Underflow situations on Stack</li><li>d. Display the status of Stack</li><li>e. Exit</li></ol> <p>Support the program with appropriate functions for each of the above operations</p>       |
| 2      | <p>Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %( Remainder), ^ (Power) and alphanumeric operands.</p>  |
| 3      | <p>Design, Develop and Implement a menu driven Program in C for the following operations on QUEUE of integers (Array Implementation of Queue with maximum size MAX)</p> <ol style="list-style-type: none"><li>a. Insert an Element on to QUEUE</li><li>b. Delete an Element from QUEUE</li><li>c. Demonstrate Overflow and Underflow situations on QUEUE</li><li>d. Display the status of QUEUE</li><li>e. Exit</li></ol> <p>Support the program with appropriate functions for each of the above operations.</p> |
| 4      | <p>Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of integers (Array Implementation of Queue with maximum size MAX)</p> <ol style="list-style-type: none"><li>a. Insert an Element on to Circular QUEUE</li><li>b. Delete an Element from Circular QUEUE</li><li>c. Demonstrate Overflow and Underflow situations on Circular QUEUE</li><li>d. Display the status of Circular QUEUE</li><li>e. Exit</li></ol>  |

|  |   |
|--|---|
| 5  | <p>Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, PhNo</p> <ol style="list-style-type: none"> <li>Create a SLL of N Students Data by using front insertion.</li> <li>Display the status of SLL and count the number of nodes in it</li> <li>Perform Insertion / Deletion at End of SLL</li> <li>Perform Insertion / Deletion at Front of SLL (Demonstration of stack)</li> <li>Exit</li> </ol>   |
| 6  | <p>Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept.</p> <ol style="list-style-type: none"> <li>Create a DLL of N Employees Data by using end insertion.</li> <li>Display the status of DLL and count the number of nodes in it</li> <li>Perform Insertion and Deletion at End of DLL</li> <li>Perform Insertion and Deletion at Front of DLL</li> <li>Demonstrate how this DLL can be used as Double Ended Queue</li> <li>Exit</li> </ol> |
| 7  | <p>Design, Develop and Implement a menu driven Program in C for the following operations on Circular Linked List (CLL) of Employee Data with the fields: SSN, Name, Dept.</p> <ol style="list-style-type: none"> <li>Create a CLL of N Employees Data by using end insertion.</li> <li>Display the status of CLL and count the number of nodes in it</li> <li>Perform Insertion and Deletion at End of CLL</li> <li>Perform Insertion and Deletion at Front of DLL</li> <li>Exit</li> </ol>   |
| 8  | <p>Implement a menu driven Program in C for the following operations on Binary Search Tree(BST) of Integers</p> <ol style="list-style-type: none"> <li>Create a BST of N Integers</li> <li>Traverse the BST in Inorder, Preorder and Post Order</li> <li>Search the BST for a given element and report the appropriate message</li> <li>Exit</li> </ol>   |
| 9  | <p>Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of <math>n &gt; 5000</math> and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/C++ how the divide and conquer method works along with its time complexity analysis</p>  |
| 10   | <p>Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> <li>Create a Graph of N cities using Adjacency Matrix.</li> <li>Print all the nodes reachable from a given starting node in a digraph using any traversal method (DFS/BFS).</li> </ol>  |
| <p><b>Course outcomes:</b><br/> The students will be able to:<br/> CO1: Illustrate linear and non-linear data structures.<br/> CO2: Apply suitable data structures for a given problem.<br/> CO3: Implement sorting and searching techniques.<br/> CO4: Analyse the algorithms using complexity metrics.</p> |   |

**CIE:**

- 60% of CIE is based on Cumulative assessment of laboratory program execution.
- 40% of CIE is based on IA Test and Alternate Assessment Method.

**SEE:**

- SEE will be conducted for 100 marks



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**SEMESTER - I**

**Database Management System LAB**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA107 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 0:0:2    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 28P      | Exam Hours | 3  |

**Credits: 01**

**Course objectives:**

This course will enable the students to

1. Design ER diagrams, schema and relational tables.
2. Formulate SQL queries.
3. Develop real-time database applications.

| <b>Sl.No.</b> | <b>Experiments</b>  |
|---------------|---|
| 1             | Implementation of<br>DDL Commands <ul style="list-style-type: none"><li>• CREATE</li><li>• DROP</li><li>• ALTER</li></ul> DML commands <ul style="list-style-type: none"><li>• INSERT</li><li>• UPDATE</li><li>• DELETE</li><li>• SELECT</li></ul> TCL Commands <ul style="list-style-type: none"><li>• Commit</li><li>• Rollback</li><li>• Savepoint</li></ul> Integrity Constraints <ul style="list-style-type: none"><li>• Domain Constraints</li><li>• Entity Integrity Constraints</li><li>• Referential Integrity Constraint</li><li>• Key Constraint</li></ul>                                 |
| 2             | STUDENT DATABASE<br>Consider the following schema:<br>STUDENT (USN, name, date_of_birth, branch, mark1, mark2, mark3, total, GPA)<br>Execute the following queries: <ol style="list-style-type: none"><li>1. Update the column total by adding the columns mark1, mark2, mark3.</li><li>2. Find the GPA score of all the students.</li><li>3. Find the students who were born on a particular year of birth from the date_of_birth column.</li><li>4. List the students who are studying in a particular branch of study.</li><li>5. Find the maximum GPA score of the student branch-wise.</li></ol> |

|   |  |
|---|--|
|   | <p>6. Find the students whose name starts with the alphabet "S".</p> <p>7. Find the students whose name ends with the alphabets "AR".</p> <p>Delete the student details whose USN is given as 1BY24MC005.</p>  |
| 3 | <p>COMPANY DATABASE</p> <p>Consider the schema for Company Database:</p> <p>EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN,DNo)</p> <p>DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)</p> <p>DLOCATION (DNo,DLoc)</p> <p>PROJECT (PNo, PName, PLocation, DNo)</p> <p>WORKS_ON (SSN, PNo, Hours)</p> <p>Execute the following queries:</p> <ol style="list-style-type: none"> <li>1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.</li> <li>2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.</li> <li>3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department.</li> <li>4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).</li> <li>5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.</li> </ol> |
| 4 | <p>MOVIE DATABASE</p> <p>Consider the schema for Movie Database:</p> <p>ACTOR (Act_id, Act_Name, Act_Gender)</p> <p>DIRECTOR (Dir_id, Dir_Name, Dir_Phone)</p> <p>MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)</p> <p>MOVIE_CAST (Act_id, Mov_id, Role)</p> <p>RATING (Mov_id, Rev_Stars)</p> <p>Execute the following queries:</p> <ol style="list-style-type: none"> <li>1. List the titles of all movies directed by 'Hitchcock'.</li> <li>2. Find the movie names where one or more actors acted in two or more movies.</li> <li>3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).</li> <li>4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.</li> <li>5. Update rating of all movies directed by 'Steven Spielberg' to 5.</li> </ol>   |
| 5 | <p>LIBRARY DATABASE</p> <p>Consider the following schema for a Library Database:</p> <p>BOOK (Book_id, Title, Publisher_Name, Pub_Year)</p> <p>BOOK_AUTHORS (Book_id, Author_Name)</p> <p>PUBLISHER (Name, Address, Phone)</p> <p>BOOK_COPIES (Book_id, Branch_id, No-of_Copies)</p> <p>BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date)</p> <p>LIBRARY_BRANCH (Branch_id, Branch_Name, Address)</p> <p>Execute the following queries:</p>   |

|   |  |
|---|--|
|   | <ol style="list-style-type: none"> <li>1. Retrieve details of all books in the library–id, title, name of publisher, authors, number of copies in each branch, etc.</li> <li>2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.</li> <li>3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.</li> <li>4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.</li> <li>5. Create a view of all books and its number of copies that are currently available in the Library.</li> </ol>   |
| 6   | <p>Election Database</p> <p>Design an ER-diagram for the following scenario. Convert the same into a relational model, normalize Relations into a suitable Normal form and then solve the following queries.</p> <p>A country wants to conduct an election for the parliament. A country having many constituencies. Each constituency is identified uniquely by Constituency_id, having the Name, belongs to a state, Number_of_voters. A constituency can have many voters. Each voter is uniquely identified by using Voter_id, having the Name, age, address (involves Houseno, city, state, pincode). Each voter belongs to only one constituency. There are many candidates contesting in the election. Each candidate is uniquely identified by using candidate_id, having Name, phone_no, age, state. A candidate belongs to only one party. There are many parties. Each party is uniquely identified by using Party_id, having Party_Name, Party_symbol. A candidate can contest from many constituencies under a same party. A party can have many candidates contesting from different constituencies. No constituency having the candidates from the same party. A constituency can have many contesting candidates belongs to different parties. Each voter votes only one candidate of his/her constituency.</p> <p>Execute the following queries:</p> <ol style="list-style-type: none"> <li>1. List the details of the candidates who are contesting from more than one constituencies which belongs to different states.</li> <li>2. Display the state name having maximum number of constituencies.</li> <li>3. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter" msg.</li> <li>4. Create a stored procedure to display the number of voters in the specified constituency, where the constituency name is passed as an argument to the stored procedure.</li> <li>5. Create a TRIGGER to UPDATE the count of "Number_of_voters" of the respective constituency in "CONSTITUENCY" table, AFTER inserting a tuple into the "VOTERS" table.</li> </ol> |
| <p><b>Course outcomes:</b></p> <p>The students will be able to:</p> <p>C01: Apply the basic concepts of database management.</p> <p>C02: Formulate SQL queries for a given problem scenario.</p> <p>C03: Improve the database design by normalization.</p> <p>C04: Create stored procedures/ functions for a given use case.</p> <p>C05: Implement transaction management concepts.</p> |  |



**CIE:**

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**SEMESTER - I**

**Web Programming Lab**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA108 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 0:0:2    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 28P      | Exam Hours | 3  |

**Credits: 01**

**Course objectives:**

This course will enable the students to

1. Explore the various web scripting technologies.
2. Use HTML/XHTML, CSS, and Bootstrap to Design and Decorate simple to complex web pages.
3. Validate the web page at client side, server side using either JavaScript.
4. Build a Web application for any use case.

**Preamble:** Web Technology is a basic web development programming language. We can develop both static and responsive webpages using this. Many real-time web applications are developed using this programming.

| <b>Sl.No.</b> | <b>Experiments</b>  |
|---------------|---|
| 1             | Create an XHTML page that provides information about your department. Your XHTML page must use the following tags:<br>a. Text Formatting tags<br>b. Horizontal rule<br>c. Meta element<br>d. Links<br>e. Images<br>f. Ordered list unordered list (use of additional tags encouraged)   |
| 2             | Write a HTML program for time-table using tables.   |
| 3             | Write a HTML program to divide the webpage using frames.  |
| 4             | Develop and demonstrate the usage of inline, external and internal style sheet using CSS. Use HTML page that contains at least three paragraphs of text, listed elements and a table with four rows and four columns.   |
| 5             | Develop and demonstrate a HTML file that includes JavaScript script for the following problems:<br>a) Input: A number n obtained using prompt Output: The first n Fibonacci numbers<br>b) Input: A number n obtained using prompt Output : A table of numbers from 1 to n and their squares using alert   |
| 6             | Develop and demonstrate, using JavaScript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. Modify the above document so that when a text is moved |

|   |  |
|---|--|
|   | from the top stacking position, it returns to its original position rather than to the bottom.   |
| 7   | Develop and demonstrate a HTML file which includes JavaScript that uses functions for the following problems:<br>a. Parameter: A string Output: The position in the string of the left-most vowel.<br>b. Parameter: A number Output: The number with its digits in the reverse order.                                      |
| 8   | Develop a simple calculator to perform arithmetic (addition, subtraction, multiplication and division) operations on given two numbers. Use an HTML tag that allows the user to input two numbers and to display the result of arithmetic operation. Write suitable HTML and JavaScript and CSS to your simple calculator. |
| 9   | Design a Login web page to accept the username and password as input and do the following:<br>Validate the password, it should consist of at least 8 characters in length, must consists 1 capital case, 1 small case, 1 special characters.   |
| 10  | Write a HTML program to develop a static Web Page for Book Catalog.  |
| <p><b>Course outcomes:</b><br/>The students will be able to:<br/>CO1: Apply basic concepts and tools of web technologies.<br/>CO2: Design web pages using suitable tools &amp; technologies.<br/>CO3: Build a web application with proper validation.</p> |  |
| <p><b>CIE:</b></p> <ul style="list-style-type: none"> <li>• 60% of CIE is based on Cumulative assessment of laboratory program execution.</li> <li>• 40% of CIE is based on IA Test and Alternate Assessment Method.</li> </ul>                           |  |
| <p><b>SEE:</b></p> <ul style="list-style-type: none"> <li>• SEE will be conducted for 100 marks.</li> </ul>   |  |
| <p><b>Alternate Assessment Tools (AATs) suggested:</b></p> <ul style="list-style-type: none"> <li>• Develop a website using appropriate tags.</li> </ul>  |  |



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**SEMESTER - I**

**Bridge Course**

|                               |       |            |   |
|-------------------------------|-------|------------|---|
| Course Code                   | BC    | CIE Marks  | - |
| Contact Hours (L:T:P)         | 0:2:0 | SEE Marks  | - |
| Total Number of Lecture Hours | 25T   | Exam Hours | - |

**Credits: 00**

**Course objectives:**

This course will enable the students to

1. Realize the functionality of logic gates.
2. Apply Boolean axioms to simplify Boolean expressions, combinational and sequential circuits.
3. Explain the basic principles and operations of different components of digital computer.
4. Apply C concepts to simple programs.
5. Obtain a thorough understanding of fundamentals.

**Preamble:** Bridge Course is designed to fill the gap and connect non-computer science background students so that they easily adapt to the curriculum of MCA.

**Module - 1**

**Introduction**

Digital logic gates, Number systems, Boolean Algebra, Simplification, Construction of logic circuits, Adders, Subtractors, 1's and 2's complement.

(05 Hours)

**Module - 2**

**Computer Basics**

Functional units of computers, Operational concepts, Byte addressability, Instruction types, Sequencing, Addressing modes.

(05 Hours)

**Module - 3**

**Memory**

Basic memory concepts, Memory types, Semi-Conductor RAM organization, Memory hierarchy, Cache memory, Virtual memory, Secondary storage devices.

(05 Hours)

**Module - 4**

**C Basics**

Data Types, Operators, Control structures, Arrays, Procedures and Functions, Parameter passing, Recursion.

(05 Hours)

**Module - 5**

**C Basics**

Structures and Unions, Pointers, Memory allocation functions, I/o formatting.

(05 Hours)

**Textbooks:**

1. M.Morris Mano, "Digital Logic and Computer Design", Pearson, 2012.
2. Carl Hamacher, Zvonko Vranesic Safwat Zaky, "Computer Organization", 5<sup>th</sup> edition, TataMcGraw-Hill, 2011
3. Balaguruswamy, "Basics of C Programming".

**Alternate Assessment Tools (AATs) suggested:**

1. Assignment on problem solving in digital electronics.
2. Writing C programs to solve simple problems.

**Web links/e-resources:**

1. <https://www.coursera.org/courses?query=computer%20architecture>
2. <https://www.edx.org/learn/computer-architecture>
3. <https://www.udemy.com/topic/computer-architecture/>
4. <https://www.linkedin.com/learning/>
5. <https://www.youtube.com/c/Freecodecamp>
6. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-823-computer-system-architecture-fall-2005/>
7. <https://www.cs.cmu.edu/~213/>
8. <https://cs50.harvard.edu/>
9. <https://cs50.harvard.edu/discuss/>
10. <https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/>
11. <https://www.youtube.com/user/Computerphile>
12. <https://www.youtube.com/c/GateSmashers>
13. <https://www.youtube.com/user/nesoacademy>



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**SEMESTER - II**

**Full Stack Development**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA201 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:2    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L 28P  | Exam Hours | 3  |

**Credits: 04**

**Course objectives:**

This course will enable the students to

1. Understanding the MERN stack and its role in full-stack development.
2. Learn to build dynamic React apps using components, state, events, and controlled forms with Bootstrap.
3. Build RESTful APIs with Express for efficient data handling, validation, and error management.
4. Understand MongoDB basics.
5. Learn project setup, automation, and code organization for improved productivity.

**Preamble:** The MERN stack equips students with essential skills for developing modern web applications using MongoDB, Express, React, and Node.js. This course enables the creation of dynamic user interfaces and robust back-end services, meeting the high demand for full-stack developers in today's job market and creates opportunities in web development and software engineering, particularly in e-commerce, social media, and real-time applications.

**Module - 1**

**Introduction**

What's MERN? MERN Components, Why MERN?, Server-less Hello World, JSX, Project setup, Express, Separate script files, JSX transform, Older browsers support, Automate.

(08 Hours)

**Module - 2**

**React Component**

Issue tracker, React classes, Composing components, Passing data using properties, Passing data using children, Dynamic composition.

**React State**

Initial state, Async state initialization, Updating state, Lifting state up, Event handling, Stateless components, Designing components.

(08 Hours)

**Module - 3**

**React Forms**

Controlled components in forms, More filters, Typed input, Edit form, Specialized input components, Number input, Date input, Text input, Update API, Updating an issue, Updating a field, Delete API, Deleting an issue.

**React Bootstrap**

Bootstrap Installation, Buttons, Navigation bar, Panels, Tables, Forms, The grid system, Inline forms, Horizontal forms, Validation alerts, Toasts, Modals.

(08 Hours)

| <b>Module - 4</b>   |  |
|---|--|
| <b>Express</b><br>Express, Rest API, The List API, List API integration, The create API, Create API integration, Query variables, Input validations, Displaying errors.<br><p style="text-align: right;">(08 Hours)</p>   |  |
| <b>Module - 5</b>   |  |
| <b>MongoDB</b><br>MongoDB basics, MongoDB CRUD operations, MongoDB node.js driver, Schema initialization, reading from MongoDB, Writing to MongoDB.<br><p style="text-align: right;">(08 Hours)</p>   |  |
| <b>Practical components for IPCC</b>  |  |
| Sl.No.  | Experiments  |
| 1   | Build a web application using the MERN stack that enables users to create, manage, and track tickets for various issues or tasks. <ul style="list-style-type: none"> <li>• Create models and routes for handling ticket data.</li> <li>• Create the Frontend React App and Installing Module.</li> <li>• Add CSS file to add styles to front end.</li> </ul> |
| 2   | Build the blogging platform using MERN stack that allows user to create, read, update and delete blog posts. <ul style="list-style-type: none"> <li>• Create the Backend Server.</li> <li>• Setup Frontend with React.</li> <li>• Add CSS file to add styles to front end.</li> </ul>  |
| 3   | Build Summarizer Website using MERN Stack. (API Integration) <ul style="list-style-type: none"> <li>• Generate OpenAI API Key.</li> <li>• Create React App.</li> <li>• Set up Express Server.</li> <li>• Create the 'server.js' file in the server directory.</li> <li>• Start the Development Servers.</li> </ul>   |
| <b>Course outcomes:</b><br>The students will be able to:<br>CO1: Demonstrate MERN stack and its components.<br>CO2: Design React applications using various components.<br>CO3: Build dynamic web applications.<br>CO4: Implement RESTful APIs.<br>CO5: Integrate MongoDB for data management.                                      |  |
| <b>CIE:</b> <ul style="list-style-type: none"> <li>• CIE is based on Theory and Laboratory Components of the course.</li> <li>• Theory component is evaluated for 60% of CIE i.e., 30 Marks and Laboratory component is evaluated for 40% of CIE i.e., 20 Marks.</li> </ul>   |  |
| <b>SEE:</b> <ul style="list-style-type: none"> <li>• SEE will be conducted for 100 marks.</li> </ul>  |  |
| <b>Text Books:</b><br>1. Vasan Subramanian, Pro MERN Stack Full Stack Web App development with Mongo, Express, React and Node, Second Edition, Apress, ISBN-13 (pbk): 978-1-4842-4390-9 ISBN-13 (electronic): 978-1-4842-4391-6 <a href="https://doi.org/10.1007/978-1-4842-4391-6">https://doi.org/10.1007/978-1-4842-4391-6</a> . |  |

**References:**

1. David Choi, Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL, Packt Publishing, 2020.
2. Frank Zammetti, Modern Full-Stack Development Using TypeScript, React, Node.js, Webpack, and Docker, Apress, 2020.

**Alternate Assessment Tools (AATs) suggested:**

1. Building an Application Development using MERN stack.
2. Case study on tools implemented to deploy Full Stack Application.

**Web links/e-resources:**

1. <https://youtu.be/98BzS5Oz5E4?si=MDuN9SaSFir-u-8M>.
2. <https://www.youtube.com/watch?v=O3BUHwfHf84>.





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**SEMESTER - II**

**Machine Learning**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA202 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L      | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Understand the basic theory underlying machine learning.
2. Formulate machine learning problems corresponding to different applications.
3. Explore a range of machine learning algorithms along with their pros and cons.
4. Apply machine learning algorithms to solve problems of moderate complexity.
5. Optimize the models learnt and report on the expected accuracy achieved.

**Preamble:** Machine learning (ML) is the science of getting computers to act in particular applications, without being explicitly programmed for every possible outcome. ML has paved the way to self-driving cars, on-device speech recognition, fast and efficient web search, improved understanding of the human genome, etc. This course will deal with the most common and effective ML algorithms, and ways to implement these algorithms from scratch. The theoretical foundations of frequently used ML algorithms and the practical know-how needed will be addressed. Several case studies and applications will be utilized to learn how to apply learning algorithms to new/unforeseen practical applications.

**Module - 1**

**Overview**

Data objects and Attribute types, Overview of Machine Learning Algorithms – Basics of Supervised and Unsupervised Algorithms.

**Machine Learning Basics**

Well posed learning problems, Perspectives and issues in Machine Learning, Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version Space, Candidate Elimination Algorithm.

(08 Hours)

**Module - 2**

**Decision Tree Learning**

Decision Tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, Problems based on ID3 algorithm, Issues in decision tree learning.

(08 Hours)

**Module - 3**

**Bayesian Learning**

Introduction, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, Naïve Bayes Classifier, Bayesian belief networks.

(08 Hours)

**Module - 4**

**Unsupervised Learning**

Association Analysis - basic concepts and methods, Frequent itemset Generation, Apriori algorithm, FP-Growth Algorithm, Categorization of Major Clustering Methods, Instance based learning: Introduction to K-NN.

(08 Hours)

### Module - 5

#### Evaluating Hypothesis

Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, Case study based on 1-tail and 2-tail tests, AB Testing.

(08 Hours)

#### Course outcomes:

The students will be able to:

CO1: Analyze the various learning models.

CO2: Apply machine learning algorithms for the given problems.

CO3: Build an appropriate learning model for a given data set.

CO4: Perform statistical and probabilistic analysis of machine learning techniques.

CO5: Evaluate machine learning algorithms on various data sets.

#### CIE:

- 60% of CIE is based on Internal Assessment Tests
- 40% of CIE is based on Alternate Assessment Methods

#### SEE:

- SEE will be conducted for 100 marks.

#### Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education Inc, 4<sup>th</sup> Edition.

#### References:

1. Ethem Alpaydin, Introduction to Machine learning, 2<sup>nd</sup> Edition, MIT Press.
2. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, Morgan Kaufman Publishing, 3<sup>rd</sup> Edition, 2012

#### Alternate Assessment Tools (AATs) suggested:

1. Case Study / Implementation of ML algorithms.
2. Evaluate ML algorithms on data sets.

#### Web links/e-resources:

1. Reinforcement Learning - IIT Madras, <https://tinyurl.com/3ptxbf43>
2. Statistics for Data Science – IIT Madras, <https://tinyurl.com/yc4uk5ya>



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**SEMESTER - II**

**Mobile Application Development**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA203 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L      | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Understand the preliminary requirements to build mobile applications.
2. Design the GUI based activity screens using one of the tools of mobile application.
3. Analyze the flows of activities of mobile applications.
4. Apply the technologies to create mobile adaptive web applications.
5. Implement and Test Builds using one of the marketing tools of mobile.

**Preamble:** Mobile application development refers to the process of creating software applications that run on mobile devices, such as smartphones and tablets. It involves a combination of design, programming, testing, and deployment to produce apps that provide users with specific functionalities and experiences. As mobile devices have become integral to daily life, mobile app development has grown significantly, influencing industries, services, and entertainment globally.

**Module - 1**

**Introduction**

Preliminary considerations, Cost of development, Importance of mobile Strategies in the business world and Effective use of screen real estate.

**Understanding Mobile Applications**

Understanding mobile applications users, Understanding mobile information design, Understanding mobile platforms, Using the tools of mobile interface design.

(08 Hours)

**Module - 2**

**Getting Started with Android Programming**

What is Android, Obtaining the required tools, Anatomy of an android application, Components of android applications, Activities, and Fragments, Utilizing the action bar.

(08 Hours)

**Module - 3**

**Android UI Design and Location Based Services**

Views and view groups, Basic views, Fragments, Displaying maps, Getting location data, Publishing for publishing, Deploying APK Files.

(08 Hours)

**Module - 4**

**Android Messaging and Networking**

SMS Messaging, Sending Email, Networking, Downloading binary data, Text files, Accessing web services, Performing asynchronous call, Creating your own services, Communicating between a service and an activity, Binding, Activities to services.

(08 Hours)

## Module – 5

### Flutter

Installation on windows, Architecture of flutter application, Introduction to DART programming, Widgets and layouts, State management, Writing android specific code.

(08 Hours)

### Course outcomes:

The students will be able to:

- CO1: Analyze the features of mobile devices.
- CO2: Design applications using Android components.
- CO3: Develop mobile based application using database.
- CO4: Design an application using image capturing and location details.
- CO5: Create a mobile application for any given use case.

### CIE:

- 60% of CIE is based on Internal Assessment Tests.
- 40% of CIE is based on Alternate Assessment Methods.

### SEE:

- SEE will be conducted for 100 marks.

### Text Books:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", 1st Edition, 2012, ISBN: 978-1-118-20390-3.
2. Wei-Meng Lee, "Beginning Android Application Development", Wiley 2011.
3. Flutter – Tutorials Point, Tutorials Point (I) Pvt. Ltd – 2019.

### References:

1. Reto Meier, "Professional Android 4 Application Development", WroxPublications 2012.

### Alternate Assessment Tools (AATs) suggested:

1. Mobile Application Development on Societal/Environmental issues using Android Studio.
2. Mobile Application Development on Management issues using Flutter framework.

### Web links/e-resources:

1. <https://flutter.dev/docs>
2. <https://developer.android.com/>
3. <https://reactnative.dev/docs/getting-started>
4. <https://www.udemy.com/>
5. <https://www.freecodecamp.org/>



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**SEMESTER - II**

**CLOUD COMPUTING**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA204 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L      | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Explore basics of Cloud.
2. Know the purpose of various cloud services and their limitations.
3. Understand various services provided by different cloud service providers.
4. Differentiate between various service models and deployment models.
5. Deploy applications using AWS.

**Preamble:** Cloud is further extension of Distributed computing. Cloud provides us so many services that can be accessed via web. It has become an indispensable part of our lives. From entertainment to programming to storage, cloud is very critical in today's world.

**Module - 1**

**Cloud Computing Basics**

Distributed System Models and Enabling Technologies - Scalable Computing Service over the Internet, System Models for Distributed and Cloud Computing, Performance, Security and Energy efficiency.

(08 Hours)

**Module - 2**

**Virtualization**

Implementation levels of Virtualization, Virtualization structure/tools and mechanisms: Hypervisor and Xen architecture, Binary translation with full virtualization, Para virtualization with compiler support, Live VM migration steps.

**Cloud computing architecture**

Cloud computing and Service models: IaaS, PaaS, SaaS.

(08 hours)

**Module - 3**

**Data Center design and inter-connection networks**

Warehouse-scale datacentre, Data centre inter-connection networks, Modular data centres

**Cloud security**

Cloud security defence strategies, Distributed intrusion/anomaly detection

(08 hours)

**Module - 4**

**Cloud Implementations**

Programming the GAE, Google file system(GFS), BigTable, Google's NoSQL system.

**AWS**

Creating an EC2 instance using AWS, Hosting a web application, S3 storage service, Lambda service, Auto scaling.

|   |
|---|
| <p><b>Azure Cloud</b><br/>Architecture, Storage, Infrastructure and Compute services.</p> <p style="text-align: right;">(08 hours)</p>  |
| <b>Module - 5</b>   |
| <p><b>Emerging Software Cloud Environments</b><br/>Open source Eucalyptus and Nimbus<br/><b>Applications of Cloud:</b> Healthcare, Business, Social media applications.<br/><b>Case study:</b> Salesforce Cloud</p> <p style="text-align: right;">(08 hours)</p>  |
| <p><b>Course outcomes:</b><br/>The students will be able to:<br/>CO1: Analyse the requirements for scalable services and computing environment.<br/>CO2: Classify various cloud service models and their providers.<br/>CO3: Compare various cloud deployment models.<br/>CO4: Deploy applications on real-time cloud platforms.</p>  |
| <p><b>CIE:</b></p> <ul style="list-style-type: none"> <li>• 60% of CIE is based on Internal Assessment Tests</li> <li>• 40% of CIE is based on Alternate Assessment Methods</li> </ul>  |
| <p><b>SEE:</b></p> <ul style="list-style-type: none"> <li>• SEE will be conducted for 100 marks.</li> </ul>   |
| <p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Kai Hwang, Geoffrey C. Fox. Jack J Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, MK Publishers, 2012.</li> </ol> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper , “Cloud Computing for Dummies” (Wiley India Edition).</li> <li>2. J.Vette, Toby J. Vette, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, (Tata McGraw Hill).</li> </ol> |
| <p><b>Alternate Assessment Tools (AATs) suggested:</b></p> <ol style="list-style-type: none"> <li>1. Deploy any project using EC2 and demonstrate its execution using AWS.</li> <li>2. Explain the role of Cloud in DevOps. Illustrate the use of commonly used cloud services with the help of an example.</li> </ol>  |
| <p><b>Web links/e-resources:</b></p> <ol style="list-style-type: none"> <li>1. Manage AWS Resources - AWS Management Console - AWS (Module 5)</li> </ol>  |



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**SEMESTER - II**

**Computer Networks**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA205 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L      | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Learn the Basic concepts of Computer Networking.
2. Understand the concepts of OSI and TCP/IP model.
3. Describe the functions of Physical and Data Link layers.
4. Describe the functions of Network and Transport layers.
5. Demonstrate the TCP/IP sockets in UNIX operating System.

**Preamble:** Computer networks are systems that connect multiple computing devices to share resources, data, and communication across physical or digital distances. They form the backbone of modern digital communication, enabling everything from personal emails to large-scale data transfers and cloud computing. Computer networks allow for resource sharing, internet access, collaborative working, and global connectivity, making them essential in both personal and organizational environments.

**Module - 1**

**Introduction**

Networks, protocols and standards, Layered tasks, The OSI model, Layers in the OSI model, TCP/IP protocol suite, Addressing.

(08 Hours)

**Module - 2**

**Physical Layer and Media**

Periodic analog signals, Digital signals, Transmission impairment, Data rate limits, performance, Transmission media.

**Data Link Layer**

Error detection and Correction, Data link control, Multiple access.

(08 Hours)

**Module - 3**

**Network Layer**

Logical addressing, Internet protocol, Address Mapping, Error reporting and Multicasting, Delivery forwarding and Routing.

(08 Hours)

**Module - 4**

**Transport Layer**

Process-to-Process Delivery, UDP, TCP and SCTP, Congestion control and Quality of service.

(08 Hours)

**Module - 5**

**Application Layer**

Domain name system, Distribution of name space, DNS in the Internet, Resolution, DNS messages.

### **Linux Networking**

Elementary TCP sockets, TCP client/server example.

(08 Hours)

#### **Course outcomes:**

The students will be able to:

- CO1: Apply the basic concepts of computer networking.
- CO2: Demonstrate OSI reference model and TCP/IP model.
- CO3: Analyze the working of network protocols.
- CO4: Implement networking concepts using appropriate tools.

#### **CIE:**

- 60% of CIE is based on Internal Assessment Tests
- 40% of CIE is based on Alternate Assessment Methods

#### **SEE:**

- SEE will be conducted for 100 marks.

#### **Text Books:**

1. Forouzan, "Data Communications and Networking 5E", McGraw Hill Education.
2. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, "UNIX Network Programming", Volume 1, 3<sup>rd</sup> Edition, PHI Learning Publication, 2010.

#### **References:**

1. Andrew S. Tanenbaum, "Computer Networks", 5<sup>th</sup> Edition, Pearson Publication, 2011
2. Larry Peterson and Bruce Davie, "Computer Networks: A Systems Approach", Version 6.2, MK Publication.

#### **Alternate Assessment Tools (AATs) suggested:**

1. Implementation of Computer Network concepts using Java/Python

#### **Web links/e-resources:**

1. <https://www.geeksforgeeks.org/network-configuration-trouble-shooting-commands-linux/>
2. <https://www.javatpoint.com/java-networking>
3. <https://www.coursera.org/courses?query=computer%20networks>
4. <https://www.edx.org/learn/computer-networking>
5. <https://www.udemy.com/topic/computer-networking/>
6. <https://www.youtube.com/c/Freecodecamp>





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**SEMESTER - II**

**Cyber Security**

|                               |                  |            |    |
|-------------------------------|------------------|------------|----|
| Course Code                   | <b>24MCA2061</b> | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0            | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L              | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Understand the fundamental concepts of cyber security and its importance.
2. Identify and analyse potential security threats and vulnerabilities.
3. Implement security measures to protect computer systems.
4. Develop skills to detect and respond to cyber-attacks.
5. Apply cryptography techniques to ensure data security.

**Preamble:** The Cyber Security course covers fundamental concepts, techniques, and best practices to protect computer systems, networks, and data. It has various real-time applications including secure online transactions and data protection. Career paths include Cyber security specialist, information security analyst and Chief Information Security Officer (CISO). The field has high demand and growth prospects, roughly 32% annual growth rate. Average salaries range from 10K dollars to 20K dollars per year.

**Module - 1**

**Introduction**

Introduction to Cyber Security - - Defining cyber security, History of cyber security, Types of cyber-attacks, Security threats and vulnerabilities.

(08 Hours)

**Module - 2**

**Security Frameworks and Foundations**

National Institute of Standards and Technology (NIST) Framework, MITRE ATT&CK Framework, OWASP Foundation, OSINT framework.

(08 Hours)

**Module - 3**

**Cryptography**

Introduction to cryptography, - Types of cryptography (symmetric, asymmetric), Hash functions and digital signatures, Public key infrastructure (PKI).

(08 Hours)

**Module - 4**

**Operating System Security**

Operating system security fundamental, Access control and authentication, File system security, Secure boot and firmware protection.

(08 Hours)

**Module - 5**

**Incident Response and Forensic Analysis**

Incident response planning, Forensic analysis tools and techniques, Network traffic analysis, Malware analysis and reverse engineering.

(08 Hours)

**Course outcomes:**

The students will be able to:

CO1: Analyse cyber security threats and vulnerabilities.

CO2: Apply cryptographic techniques to secure the data.

CO3: Demonstrate system resilience to cyber-attacks.

CO4: Develop incident response plans with forensic analyses.

**CIE:**

- 60% of CIE is based on Internal Assessment Tests
- 40% of CIE is based on Alternate Assessment Methods

**SEE:**

- SEE will be conducted for 100 marks.

**Text Books:**

1. "Cyber Security" by Nina Godbole Sunit Belapure, 2012, Wiley India.
2. "Cyber Security: A Comprehensive Introduction" by Dr. Mark Ciampa (Publisher: Cengage Learning)

**References:**

1. "Hacking: The Art of Exploitation" by Jon Erickson (Publisher: No Starch Press)
2. "Security in Computing" by Charles P. Pfleeger (Publisher: Prentice Hall)

**Alternate Assessment Tools (AATs) suggested:**

**Assessment 1: Group Project (20%)**

1. Develop a comprehensive security plan for a hypothetical organization.
2. Include risk assessment, vulnerability analysis, and incident response plan.

**Assessment 2: Written Examination (80%)**

1. Multiple-choice questions (40%)
2. Short-answer questions (30%)
3. Essay questions (30%)

**Web links/e-resources:**

1. Cyber Attacks and Defense Tactics, Techniques and Procedures: <https://attack.mitre.org/>
2. Cyber Security Certifications, Trainings and Resources: <https://www.sans.org/apac/>
3. Penetration Test Tools collection: <https://www.kali.org/>



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**SEMESTER - II**

**Robotic Process Automation(RPA)**

|                               |           |            |    |
|-------------------------------|-----------|------------|----|
| Course Code                   | 24MCA2062 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0     | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L       | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Gain a clear understanding of RPA and benefits, understanding the limits and constraints of automation.
2. Understand the basic Automation components, features and technology.
3. Acquire the knowledge on purpose and use of the control centre.
4. Understand the various use cases and write bots.

**Preamble:** Robotic process automation (RPA) is a form of business process automation technology based on metaphorical software robots or on artificial intelligence /digital workers. It is sometimes referred to as software robotics. RPA involves the use of software that mimics human actions while interacting with applications in a computer and accomplishing rule-based tasks. This often requires reading from and typing or clicking on existing applications that are used to perform the given tasks.

**Module - 1**

**RPA Foundations**

What is RPA? Flavors of RPA, The Benefits of RPA- The downsides of RPA, RPA Compared to BPO, BPM and BPA, Consumer Willingness for Automation, The Workforce of the Future.

**RPA Skills**

On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR, Databases, APIs, AI, Cognitive Automation, Agile, Scrum, Kanban and Waterfall, DevOps, Flowcharts.

(08 Hours)

**Module - 2**

**Components of RPA**

RPA Platforms, About UiPath, The future of automation.

**Record and Play**

UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder, Step-by-step examples using the recorder.

(8 Hours)

**Module - 3**

**Sequence, Flowchart, and Control Flow**

Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow.

|   |
|---|
| <p><b>Data Manipulation</b><br/> Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example).</p> <p style="text-align: right;">(8 Hours)</p>   |
| <b>Module – 4</b>   |
| <p><b>Taking Control of the Controls</b><br/> Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR? Types of OCR available, How to use OCR?, Avoiding typical failure points.</p> <p style="text-align: right;">(8 Hours)</p>  |
| <b>Module – 5</b>   |
| <p><b>Exception Handling, Debugging, and Logging</b><br/> Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting.</p> <p style="text-align: right;">(8 Hours)</p>   |
| <p><b>Course outcomes:</b><br/> The students will be able to:<br/> CO1: Analyse the problem to understand the scope and extent of process automation.<br/> CO2: Apply the robotic process automation knowledge to automate operations.<br/> CO3: Implement exception handling and automation strategies in real time applications.<br/> CO4: Interpret various aspects of debugging in RPA applications.<br/> CO5: Develop basic robots using UiPath Community Edition.</p> |
| <p><b>CIE</b></p> <ul style="list-style-type: none"> <li>• 60% of CIE is based on Internal Assessment Tests.</li> <li>• 40% of CIE is based on Alternative Assessment Methods.</li> </ul>   |
| <p><b>SEE:</b></p> <ul style="list-style-type: none"> <li>• SEE will be conducted for 100 marks.</li> </ul>   |
| <p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, 2020, ISBN-13 (electronic):978-7-4842-5729-6, Publisher: A press.</li> <li>2. Alok Mani Tripathi, Learning Robotic Process Automation, Packt, 1st Edition, 2018.</li> </ol>   |
| <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and Their Benefits, CreateSpace Independent Publishing Platform, 2018.</li> </ol>   |
| <p><b>Alternate Assessment Tools (AATs) suggested:</b></p> <ol style="list-style-type: none"> <li>1. Develop a bot that can fetch details about IBM Laptop prices from Flipkart website.</li> <li>2. Bring out the pros and cons of any two RPA tools and their applications.</li> </ol>  |
| <p><b>Web links/e-resources:</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://www.uipath.com/">https://www.uipath.com/</a></li> </ol>   |



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**SEMESTER - II**

**Big Data Analytics**

|                               |           |            |    |
|-------------------------------|-----------|------------|----|
| Course Code                   | 24MCA2063 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0     | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L       | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Understand the basics of analytics process model and its requirements.
2. Solve any given analytics problem by applying various algorithms for handling large volumes of data.
3. Understand the HDFS architecture and Map-Reduce techniques for solving the big data problems.
4. Explore Spark architecture and its APIs.
5. Explore advanced big data analytics concepts.

**Preamble:** The Big Data Analytics course teaches students key skills for analysing large datasets and understanding the entire data analytics process. With real-time applications in sectors like IT, healthcare, and marketing, the course emphasizes the growing demand for professionals who can derive actionable insights from big data. Graduates will be well-prepared for dynamic career opportunities, ready to tackle real-world challenges in data analytics.

**Module - 1**

**Big Data and Analytics**

Example applications, Basic nomenclature, Analysis Process Model, Analytical model requirements, Types of data sources, Sampling, Types of data elements, Data exploration, Exploratory statistical analysis, Missing values, Outlier detection and Treatment, Standardizing data labels, Categorization.

(08 Hours)

**Module - 2**

**Descriptive Analytics and Data Processing**

Overview of predictive and descriptive analytics, Basic descriptive analytics concepts, Association rules and Sequence rules, Segmentation techniques, Handling large-scale data.

(08 Hours)

**Module - 3**

**The Hadoop Distributed File System (HDFS)**

The Design of HDFS, HDFS architecture, HDFS concepts, Blocks, Namenodes and Datanodes, HDFS federation, HDFS high-availability.

**File Operations**

Anatomy of a file read, Anatomy of a file write.

**MapReduce Framework**

|  |
|--|
| Using a sample dataset (Weather Data), Map and reduce functions, Data flow, Scaling out, Java MapReduce, Combiner functions, Input splits, Configuration files and Running distributed jobs on a cluster.<br><p style="text-align: right;">(08 Hours)</p>  |
| <b>Module - 4</b>  |
| <b>Introduction to Apache Spark</b><br>Spark's Architecture, Language APIs, Data frames, Partitions, Lazy evaluation, Spark's toolset, Structured API execution, Key transformations and actions.<br><p style="text-align: right;">(08 Hours)</p>  |
| <b>Module - 5</b>  |
| <b>Programming Hive</b><br>Hive in the Hadoop Ecosystem, Data Types and File Formats, HiveQL: Data Definition, Databases in Hive, Alter Database, Creating Tables, External Tables, Partitioned Tables, External Partitioned Tables, Dropping Tables, Alter Tables, HiveQL: Data Manipulation, Queries (till GROUP BY Clauses).<br><p style="text-align: right;">(08 Hours)</p>  |
| <b>Course outcomes:</b><br>The students will be able to:<br>CO1: Apply big data analytics concepts to real-world challenges.<br>CO2: Analyse large datasets using descriptive/predictive techniques.<br>CO3: Illustrate distributed data processing using Hadoop components.<br>CO4: Write Hive queries against large datasets on clusters.  |
| <b>CIE:</b> <ul style="list-style-type: none"> <li>• 60% of CIE is based on Internal Assessment Tests</li> <li>• 40% of CIE is based on Alternate Assessment Methods</li> </ul>  |
| <b>SEE:</b> <ul style="list-style-type: none"> <li>• SEE will be conducted for 100 marks.</li> </ul>   |
| <b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications" Wiley.</li> <li>2. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.</li> <li>3. Bill Chambers, Matei Zaharia, "Spark: The Definitive Guide", O'reilly, 2018.</li> <li>4. Jason R, Dean W, Edward C, "Programming Hive", O'reilly, 2012.</li> </ol> |
| <b>References:</b> <ol style="list-style-type: none"> <li>1. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley.</li> <li>2. Chris Eaton, Dirk Deroos et al., "Understanding Big data", McGraw Hill, 2012.</li> </ol>  |
| <b>Alternate Assessment Tools (AATs) suggested:</b> <ol style="list-style-type: none"> <li>1. Case study on analyzing a dataset using exploratory data analysis techniques.</li> <li>2. Hands-on assignments where students apply segmentation techniques on dataset provided.</li> </ol>  |
| <b>Web links/e-resources:</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.youtube.com/live/XueP_cx_rqg?si=PLRXLywCTRtr24mk">https://www.youtube.com/live/XueP_cx_rqg?si=PLRXLywCTRtr24mk</a></li> <li>2. <a href="https://youtu.be/zez2Tv-bcXY?si=Qg96qLtwR07QQ9Wb">https://youtu.be/zez2Tv-bcXY?si=Qg96qLtwR07QQ9Wb</a></li> </ol>   |



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**SEMESTER - II**

**Blockchain Technology**

|                               |           |            |    |
|-------------------------------|-----------|------------|----|
| Course Code                   | 22MCA2064 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0     | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L       | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable students to

1. Understand the fundamentals of Blockchain and Bitcoin
2. Differentiate variants of Blockchain and Cryptocurrencies
3. Apply complex methods in Blockchain for privacy and conflict resolution
4. Implement the key concepts of Bitcoin
5. Design smart contracts in real-time applications

**Preamble:** Securing the transactions and eliminating the third party involvement in financial transactions is gaining importance and Blockchain technology will provide lots of use cases in multiple domains like banking, healthcare etc. Blockchain expertise will provide good career growth as businesses turn to implementation of Blockchain technology for secure transactions.

**Module - 1**

**Introduction**

Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, Public and private key basics, Pros and cons of Blockchain, Myths about Bitcoin.  
(08 Hours)

**Module - 2**

**Architecture**

Blockchain: Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.  
(08 Hours)

**Module - 3**

**Hashing in Blockchain**

Concept of Double Spending, Hashing, Mining, Proof of work.  
Introduction to Merkel tree, Privacy, payment verification, Resolving Conflicts, Creation of Blocks.  
(08 Hours)

**Module - 4**

**Bitcoin concepts**

Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, Choosing bitcoin wallet, Converting Bitcoins to Fiat Currency.  
(08 Hours)

**Module - 5**

**Smart Contract**

Introduction to Smart contracts, usage, Application, working principle, Laws and Regulations, Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Case Studies  
(08 Hours)

**Course outcomes:**

The students will be able to:

CO1: Explain the significance of Blockchain for security and transparency.

CO2: Illustrate the Blockchain Architecture.

CO3: Outline the concepts of Cryptocurrency networks.

CO4: Analyse the applications of smart contracts in various domains.

CO5: Identify various use cases of Blockchain technology.

**CIE:**

- 60% of CIE is based on Internal Assessment Tests
- 40% of CIE is based on Alternate Assessment Methods

**SEE:**

- SEE will be conducted for 100 marks.

**Textbooks:**

1. Bikramaditya Singhal , Gautam Dhameja, "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions", APress
2. Arshdeep Bahga, Vijay Madiseti, "Blockchain Applications: A Hands-On Approach", APress

**References:**

1. Melanie Swan, "Blockchain", Oreilly
2. Arthu.T, "Bitcoin and Blockchain Basics: A non-technical introduction for beginners"
3. Aravind Narayan. Joseph Bonneau, "Bitcoin and Cryptocurrency Technologies", Princeton

**Alternate Assessment Tools (AATs) suggested:**

1. Case studies on public, private and hybrid blockchain
2. Creation of Cryptocurrency wallet

**Web links/e-resources:**

1. <https://builtin.com/blockchain/blockchain-applications>
2. Smart Contracts - [https://www.youtube.com/watch?v=wT6Qa\\_kxM6Y](https://www.youtube.com/watch?v=wT6Qa_kxM6Y)





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**SEMESTER - II**

**Software Quality Assurance**

|                               |           |            |    |
|-------------------------------|-----------|------------|----|
| Course Code                   | 24MCA2065 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 3:0:0     | SEE Marks  | 50 |
| Total Number of Lecture Hours | 40L       | Exam Hours | 3  |

**Credits: 03**

**Course objectives:**

This course will enable the students to

1. Differentiate the various testing techniques.
2. Analyse the problem and derive suitable test cases.
3. Apply suitable technique for designing of flow graph.
4. Explain the need for planning and monitoring a process

**Preamble:** Software Testing is one of the critical aspect of software development life cycle. It deals with verification and validation of a software. Any software before its release, has to undergo rigorous testing process. Testing individual components and testing an entire system is equally important to ensure the correctness. A combination of techniques is used to test a software system. Specialized testing teams will carry-out the testing process.

**Module - 1**

**Basics of Software Testing**

Humans, Errors and Testing, Software Quality; Requirements, Behavior and Correctness, Correctness Vs Reliability; Testing and Debugging; Test Metrics; Software and Hardware Testing; Testing and Verification.

**Basic Principles, Test case selection**

Defect Management; Execution History; Test Generation Strategies; Static Testing; Test Generation from Predicates. Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback, Test Specification and cases, Adequacy Criteria.

(08 Hours)

**Module - 2**

**A perspective on Testing**

Basic definitions, Test cases, Insights from a Venn diagram, identifying test cases, Error and fault taxonomies, Level of testing, Examples: Generalized pseudo code, The triangle problem, the Next Date function, The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter.

(08 Hours)

**Module - 3**

**Boundary value testing, Equivalence class testing, Decision table based testing**

Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for triangle problem, Next Date function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem.

(08 Hours)

**Module - 4**

**Path Testing, Data flow testing, Levels of Testing, Integration Testing**

DD Paths, Test coverage metrics Basis path testing, Guidelines and observations, Definition Use testing, Traditional view of testing levels, Alternative life cycle models, Separating integration and system testing.

(08 Hours)

**Module - 5****Fault Based Testing, Planning and Monitoring the Process, Documenting Analysis and Test**

Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis; From Test case specification to Test Cases, Scaffolding, Generic vs. specific Scaffolding, Test Oracles, Self-checks as oracles, Capture and Replay. Quality and Process, Test and Analysis strategies and plans, Test strategy document, Analysis and test plan, Test and analysis reports.

(08 Hours)

**Course outcomes:**

The students will be able to:

CO1: Demonstrate the phases of Software testing life cycle.

CO2: Differentiate between various Testing types.

CO3: Design test cases for any given use case.

CO4: Evaluate the software application using suitable testing tools.

**CIE:**

- 60% of CIE is based on Internal Assessment Tests
- 40% of CIE is based on Alternate Assessment Methods

**SEE:**

- SEE will be conducted for 100 marks.

**Text Books:**

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.

**References:**

1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2<sup>nd</sup> Edition, Pearson, 2007.
2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.
3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995.
4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015.
5. Naresh Chauhan, Software Testing, Oxford University press.

**Alternate Assessment Tools (AATs) suggested:**

1. Take a mini project and write a test cases.
2. Take BMSIT Department of MCA page find error, faculty in it.

**Web links/e-resources:**

1. <https://www.cypress.io/>
2. <https://www.selenium.dev/>
3. <https://www.istqb.org/>
4. <https://www.ministryoftesting.com/>



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**SEMESTER - II**

**Machine Learning Lab**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA207 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 0:0:2    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 28P      | Exam Hours | 3  |

**Credits: 01**

**Course objectives:**

This course will enable the students to

1. Understand the basic theory underlying machine learning.
2. Formulate machine learning problems corresponding to different applications.
3. Explore a range of machine learning algorithms along with their pros and cons.
4. Apply machine learning algorithms to solve problems of moderate complexity.
5. Optimize the models learnt and report on the expected accuracy achieved.

| Sl.No. | Experiments  |
|--------|--|
| 1.     | <b>Web Scraping</b> – A method to obtain large amounts of data from websites. Most of this data is unstructured data in an HTML format which is then converted into structured data in a spreadsheet or a database so that it can be used in various applications. Beautiful Soup is a Python web scraping library that allows us to parse and scrape HTML and XML pages and prepare the dataset in the .csv format. |
| 2.     | <b>Data Pre-processing</b> - Process of cleaning, organizing, and transforming raw data before it is used for analysis or modeling. Pre-processing tasks to be included are removing incorrect or irrelevant data, handling missing values, smoothing noisy data, data transformation and data reduction.  |
| 3.     | <b>Linear Regression</b> - A type of supervised machine learning algorithm that computes the linear relationship between the dependent variable and one or more independent features by fitting a linear equation to observed data. Simple Linear Regression and Multiple Linear Regression will be covered.   |
| 4.     | K-NN Algorithm   |
| 5.     | SVM Algorithm  |
| 6.     | Naïve-Bayes Classifier   |
| 7.     | Bagging Methods  |
| 8.     | Boosting Methods   |

**Course outcomes:**

The students will be able to:

CO1: Analyze the various learning models.

CO2: Apply machine learning algorithms for the given problems.

CO3: Build an appropriate learning model for a given data set.

CO4: Perform statistical and probabilistic analysis of machine learning techniques.

CO5: Evaluate machine learning algorithms on various data sets.

**CIE:**

- 60% of CIE is based on Cumulative assessment of laboratory program execution.

- 40% of CIE is based on IA Test and Alternate Assessment Method.

**SEE:**

- SEE will be conducted for 100 marks.

**Alternate Assessment Tools (AATs) suggested:**

- Application of ML algorithms on any data set



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**SEMESTER - II**

**Mobile Application Development Lab**

|                               |          |            |    |
|-------------------------------|----------|------------|----|
| Course Code                   | 24MCA208 | CIE Marks  | 50 |
| Contact Hours (L:T:P)         | 0:0:2    | SEE Marks  | 50 |
| Total Number of Lecture Hours | 28P      | Exam Hours | 3  |

**Credits: 01**

**Course objectives:**

This course will enable the students to

1. Understand the preliminary requirements to build mobile applications.
2. Design the GUI based activity screens using one of the tools of mobile application.
3. Analyse the flows of activities of mobile applications.
4. Apply the technologies to create mobile adaptive web applications.
5. Implement Test Builds using one of the marketing tools of mobile.

| Sl.No. | Experiments                                     |
|--------|---|
| 1      | Views   |
| 2      | Activities                                      |
| 3      | Fragments                                       |
| 4      | Intents   |
| 5      | Graphics & Media                                |
| 6      | Internal & External Database                    |
| 7      | SMS Messaging                                   |
| 8      | Image capturing and Location based applications |

**Course outcomes:**

The students will be able to:

- CO1: Analyze the features of mobile devices.
- CO2: Design applications using Android components.
- CO3: Develop mobile based application using database.
- CO4: Design an application using image capturing and location details.
- CO5: Create a mobile application for any given use case.

**CIE:**

- 60% of CIE is based on Cumulative assessment of laboratory program execution.
- 40% of CIE is based on IA Test and Alternate Assessment Method.

**SEE:**

- SEE will be conducted for 100 marks.

**Alternate Assessment Tools (AATs) suggested:**

- Design a Mobile application to track location on google maps.
- Design a Mobile application to capture image and store in mobile memory.