# **KONGU ENGINEERING COLLEGE**

(Autonomous Institution Affiliated to Anna University, Chennai)

## PERUNDURAI ERODE – 638 060

## TAMILNADU INDIA



REGULATIONS, CURRICULUM & SYLLABI - 2020 (CHOICE BASED CREDIT SYSTEM) (For the students admitted during 2020 - 2021 and onwards)

## MASTER OF COMPUTER APPLICATIONS DEGREE IN COMPUTER APPLICATIONS

**DEPARTMENT OF COMPUTER APPLICATIONS** 



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#### KONGU ENGINEERING COLLEGE PERUNDURAI ERODE – 638 060 (Autonomous)

#### **INSTITUTE VISION**

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

#### **INSTITUTE MISSION**

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

#### **QUALITY POLICY**

We are committed to

- Provide value based quality education for the development of students as competent and responsible citizens.
- Contribute to the nation and beyond through research and development
- Continuously improve our services

### DEPARTMENT OF COMPUTER APPLICATIONS

#### VISION

To be a center of excellence for development and dissemination of knowledge in computer applications for the nation and beyond

#### MISSION

Department of Computer Applications is committed to:

- MS1: Engrave the students into competent and creative technocrats and give them a competitive advantage in the ever-changing and challenging global work environment.
- MS2: Import value-based education and integrate research results and innovations into other scientific disciplines
- MS3: Educate students to be successful, ethical and effective problem-solvers and life-long learners who will contribute to the well-being of our nation
- MS4: Prosper in academic activities by continual improvement in teaching methods, laboratory facilities and research activities.
- MS5: Develop consultancy for various industries

#### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Post Graduate of Computer Applications programme will:

- PEO1: apply computing and mathematical knowledge to identify, formulate, design, implement and develop software solutions for problems across a broad range of application domains
- PEO2: communicate effectively as an individual and also as a leader in diverse groups and in multidisciplinary setting
- PEO3: develop the professional ethics in work and realize the role of self in the development of society with a strive for independent and life-long learning in the broadest context ever-flourishing technological changes

| <b>MS\PEO</b> | PEO1 | PEO2 | PEO3 |
|---------------|------|------|------|
| MS1           | 3    | 3    | 3    |
| MS2           | 2    | 2    | 2    |
| MS3           | 3    | 3    | 3    |
| MS4           | 1    | 3    | 3    |
| MS5           | 3    | 2    | 3    |

#### MAPPING OF MISSION STATEMENTS (MS) WITH PEOS

1 -Slight, 2 -Moderate, 3 -Substantial

#### PROGRAM OUTCOMES (POs)

Post Graduates of Computer Applications will:

- **PO1** Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
- **PO2 Problem Analysis:** Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
- **PO3 Design/Development of Solutions:** Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- **PO4** Conduct Investigations of Complex Computing Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- **PO5** Modern Tool usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations
- **PO6** Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large
- **PO7** Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices
- **PO8 Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices
- **PO9** Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
- **PO10** Communication Efficacy: Communicate effectively with the computing community, and with society at large, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
- **PO11 Project Management and Finance:** Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and

leader in a team, to manage projects and in multidisciplinary environments.

**PO12** Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional

#### PROGRAM SPECIFIC OUTCOMES (PSOs)

Post Graduates of Computer Applications will:

- **PSO1** Understand, analyze and develop computer applications in the areas related to Cloud Computing, web design, big data analytics, mobile communication, Internet of Things, data mining and networking.
- **PSO2** Apply standard Software Engineering practices and strategies in software project development using open-source programming environment to deliver a quality product.

| <b>PEO\PO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| PEO1          | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 2   |     | 2    | 2    | 3    | 3    | 2    |
| PEO2          | 2   | 2   | 2   | 2   | 2   | 3   | 3   | 3   | 3   | 2    | 2    | 2    | 3    | 2    |
| PEO3          | 2   | 2   |     |     |     | 2   | 2   | 3   |     | 2    |      | 3    | 2    | 2    |
|               |     |     |     |     |     |     |     |     |     |      |      |      |      |      |

**MAPPING OF PEOs WITH POs AND PSOs** 

1 – Slight, 2 – Moderate, 3 – Substantial

#### KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

#### (An Autonomous Institution Affiliated to Anna University)

#### **REGULATIONS 2020**

#### CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

#### MASTER OF COMPUTER APPLICATIONS (MCA) DEGREE PROGRAMME

These regulations are applicable to all candidates admitted into MCA Degree programme from the academic year 2020 – 2021 onwards.

#### 1. DEFINITIONS AND NOMENCLATURE

In these Regulations, unless otherwise specified:

- i. "University" means ANNA UNIVERSITY, Chennai.
- ii. "College" means KONGU ENGINEERING COLLEGE.
- iii. "Programme" means Master of Computer Applications (MCA) Degree programme
- iv. "Course" means a Theory / Theory cum Practical / Practical course that is normally studied in a semester Data structures, Computer Networks etc.
- v. "Credit" means a numerical value allocated to each course to describe the candidate's workload required per week.
- vi. "Grade" means the letter grade assigned to each course based on the marks range specified.
- vii. "Grade point" means a numerical value (0 to 10) allocated based on the grade assigned to each course.
- viii. "Principal" means Chairman, Academic Council of the College.
- ix. "Controller of Examinations" means authorized person who is responsible for all examination related activities of the College.
- x. "Head of the Department" means Head of the Department concerned of the College.

#### 2. PROGRAMME

The MCA programme approved by Anna University, Chennai and All India Council for Technical Education, New Delhi is offered by the College.

### 3. ADMISSION REQUIREMENTS

Candidates seeking admission to the MCA Degree Programme shall be required to have passed an appropriate qualifying Degree Examination of Anna University or any examination of any other University or authority accepted by the Anna University, Chennai as equivalent thereto, subject to amendments as may be made by the Anna University, Chennai from time to time. The candidates shall also be required to satisfy all other conditions of admission prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

#### 4. STRUCTURE OF PROGRAMME

#### 4.1 Categorisation of Courses

The MCA programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training/industrial training, project work, internship, etc. that have been approved by the Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

- i. Foundation Courses (FC)
- ii. Professional Core (PC) Courses
- iii. Professional Elective (PE) Courses
- iv. Employability Enhancement Courses (EC) like Mini Project, Project work, Professional Skills/Industrial Training and Internship in Industry or elsewhere
- v. Mandatory Courses (MC) like Induction Training Program and Universal Human Values.

#### 4.2 Credit Assignment

#### 4.2.1. Credit Assignment

Each course is assigned certain number of credits as follows:

| Contact period per week          | Credits |
|----------------------------------|---------|
| 1 Lecture / Tutorial Period      | 1       |
| 2 Practical Periods              | 1       |
| 2 Project Work Periods           | 1       |
| 40 Training / Internship Periods | 1       |

The minimum number of credits to complete the MCA programme is 85.

### 4.3 Employability Enhancement Courses

A candidate shall be offered with the employability enhancement courses like mini project, project work, professional skills training/ industrial training and internship during the programme to gain/exhibit the knowledge/skills.

#### 4.3.1 Professional Skills Training/Industrial Training

A candidate may be offered with appropriate training courses imparting programming skills, communication skills, problem solving skills, aptitude skills etc. It is offered in second semester including vacation periods and it can carry two credits.

(or)

A candidate may be allowed to go for training at research organizations or industries for a required number of hours in second semester including first semester vacation period. Such candidate can earn two credits for this industrial training course in place of Professional Skills Training course in second semester.

#### 4.3.2 Mini Project

A candidate shall earn two credits by successfully completing the project by using his/her innovations in second semester during his/her programme.

### 4.3.3 Internships

The curriculum enables a candidate to go for full time internship during entire final semester and can earn credits through it for his/her academics vide clause 7.6 and clause 7.10.

A candidate is permitted to go for full time internship during final semester in place of Project work. Such candidate shall earn the minimum number of credits required to complete final semester other than project/internship through either approved Value Added Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively. The number of credits for the internship same as that of Project Work in the final semester.

Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.

#### 4.4 Value Added Courses / Online Courses / Self Study Courses

The candidates may optionally undergo Value Added Courses / Online Courses / Self Study Courses as elective courses.

- **4.4.1 Value Added Courses:** Value Added courses each with One / Two credits shall be offered by the college with the prior approval from the Board of Studies. A candidate can earn a maximum of three credits through value added courses during the entire duration of the programme.
- **4.4.2 Online Courses** Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by the Board of Studies.
- **4.4.3** Self Study Courses: The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty. Self study course is limited to one per semester.

- **4.4.4** The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance (up to third semester).
- **4.4.5** A candidate can earn a maximum of 15 credits through all value added courses, online courses and self study courses.

#### 4.5 Flexibility to Add or Drop Courses

- **4.5.1** A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.
- **4.5.2** From the second to third semesters the candidates have the option of registering for additional elective/Honors courses or dropping of already registered additional elective/Honors courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates. Total number of credits of such courses during the entire programme of study cannot exceed six.
- **4.6** Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.
- **4.7** The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.
- **4.8** The medium of instruction, examinations and project report shall be English.

#### 5. DURATION OF THE PROGRAMME

- **5.1** A candidate is normally expected to complete the MCA Degree programme in 4 consecutive semesters (2 Years), but in any case not more than 8 semesters (4 Years).
- **5.2** Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.
- **5.3** The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

#### 6. COURSE REGISTRATION FOR THE EXAMINATION

💈 Kongu Engineering College, Perundurai, Erode – 638060, India

- **6.1** Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.
- **6.2** The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8), earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.
- **6.3** If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.

#### 7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

7.1 The MCA programme consist of Theory Courses, Theory cum Practical courses, Practical courses, Mini Project, Project Work, Industrial / Professional Training, and Internship. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:

| Sl. No. | Category of Course   | Continuous<br>Assessment Marks   | End Semester<br>Examination<br>Marks                      |  |  |
|---------|--|--|---|--|--|
| 1.      | Theory / Practical   | 50   | 50  |  |  |
| 2.      | Theory cum Practical   | The distribution of decided based on the assigned to theor components. | f marks shall be<br>e credit weightage<br>y and practical |  |  |
| 3.      | Professional Skills Training / Industrial<br>Training / Internships / Mandatory Course | 100  |   |  |  |
| 4.      | Mini Project / Project Work  | 50   | 50  |  |  |
| 5.      | Value Added Course   | The distribution of  |   |  |  |
| б.      | All other Courses  | the credit<br>weightage assigned                                       |   |  |  |

**7.2** Examiners for setting end semester examination question papers for theory courses, theory cum practical courses and practical courses and evaluating end semester examination answer scripts, project works, and mini project shall be appointed by the Controller of Examinations after obtaining approval from the Principal.

#### 7.3 Theory Courses

For all theory courses out of 100 marks, the continuous assessment shall be 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.

| Sl.<br>No. | Туре   | Max.<br>Marks | Remarks  |
|------------|--|---------------|--|
|            | Test – I   | 30            |  |
| 1.         | Test – II  | 30            | Average of best two  |
|            | Test - III   | 30            |  |
| 2.         | Tutorial   | 15            | Should be of Open<br>Book/Objective Type.<br>Average of best 4 (or<br>more, depending on the<br>nature of the course, as<br>may be approved by<br>Principal) |
| 3.         | Assignment / Paper Presentation<br>in Conference / Seminar /<br>Comprehension / Activity based<br>learning / Class notes | 05            | To be assessed by the<br>Course Teacher based<br>on any one type.  |
|            | Total  | 50            | Rounded off to the one decimal place   |

**7.3.1** The assessment pattern for awarding continuous assessment marks shall be as follows:

However, the assessment pattern for awarding the continuous assessment marks may be changed based on the nature of the course and is to be approved by the Principal.

- **7.3.2** A reassessment test or tutorial covering the respective test or tutorial portions may be conducted for those candidates who were absent with valid reasons (Sports or any other reason approved by the Principal).
- **7.3.3** The end semester examination for theory courses shall be for duration of three hours.

#### 7.4 Theory cum Practical Courses

For courses involving theory and practical components, the evaluation pattern as per the



clause 7.1 shall be followed. Depending on the nature of the course, the end semester examination shall be conducted for theory and the practical components. The apportionment of continuous assessment and end semester examination marks shall be decided based on the credit weightage assigned to theory and practical components approved by Principal.

#### 7.5 Practical Courses

For all practical courses out of 100 marks, the continuous assessment shall be for 50 marks and the end semester examination shall be for 50 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidate's records shall be maintained.

**7.5.1** The assessment pattern for awarding continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course, and shall be based on rubrics for each experiment.

#### 7.6 **Project Work**

- **7.6.1** Project work shall be carried out individually. Candidates can opt for full time internship (vide clause 7.10) in lieu of project work. The project work is mandatory for all the candidates.
- **7.6.2** The Head of the Department shall constitute review committee for project work. There shall be three assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.
- **7.6.3** The continuous assessment and end semester examination marks for Project Work and the Viva-Voce Examination shall be distributed as indicated below.

| Continuous Assessment<br>(Max. 50 Marks) |       |   |                 |   |       | End Se<br>(1                               | emester Ex<br>Max. 50 M | kaminatio<br>larks)       | 'n    |
|--|-------|---|-----------------|---|-------|--|-------------------------|---------------------------|-------|
| Review I<br>(Max10 Marks)                |       | Review<br>(Max 20 N                         | ' II<br>/Iarks) | Review III<br>(Max. 20 Marks)               |       | Report<br>Evaluation<br>(Max. 20<br>Marks) | V<br>(Ma                | 'iva - Voce<br>1x. 30 Mar | ks)   |
| Rv.<br>Com                               | Guide | Review<br>Committee<br>(excluding<br>guide) | Guide           | Review<br>Committee<br>(excluding<br>guide) | Guide | Ext. Exr.                                  | Guide                   | Exr.1                     | Exr.2 |
| 5  | 5     | 10  | 10              | 10  | 10    | 20   | 10                      | 10                        | 10    |

- **7.6.4** The Project Report prepared according to approved guidelines and duly signed by the Guide and Project Co-ordinator shall be submitted to Head of the Department. The candidate(s) must submit the project report within the specified date as per the academic schedule of the semester. If the project report is not submitted within the specified date then the candidate is deemed to have failed in the Project Work and redo it in the subsequent semester.
- **7.6.5** If a candidate fails to secure 50% of the continuous assessment marks in the project work, he / she shall not be permitted to submit the report for that particular semester and shall have to redo it in the subsequent semester and satisfy attendance requirements.
- **7.6.6** Every candidate shall, based on his/her project work, publish a paper in a reputed journal or reputed conference in which full papers are published after

usual review. A copy of the full paper accepted and proof for that shall be produced at the time of evaluation.

- **7.6.7** The project work shall be evaluated based on the project report submitted by the candidate in the respective semester and viva-voce examination by a committee consisting of two examiners and guide of the project work.
- **7.6.8** If a candidate fails to secure 50 % of the end semester examination marks in the project work, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted as per clause 7.6.7.
- **7.6.9** A copy of the approved project report after the successful completion of viva-voce examination shall be kept in the department library.

#### 7.7 Mini Project

The evaluation method shall be same as that of the Project Work as per clause 7.6 excluding clause 7.6.6.

#### 7.8 Industrial Training

After completion of Industrial training the candidate shall submit a brief report on the training undergone and a certificate obtained from the organization concerned. The evaluation will be made based on this report and a Viva-Voce Examination. A copy of the certificate (issued by the Organization) submitted by the candidate shall be attached to the mark list and sent to Controller of Examinations by the Head of the Department.

| Continuous Assessment<br>(Max. 100 Marks) |                                |                     |  |  |  |  |  |  |
|---|--------------------------------|---------------------|--|--|--|--|--|--|
| Report<br>Evaluation<br>(Max. 40 Marks)   | Viva - Voce<br>(Max. 60 Marks) |                     |  |  |  |  |  |  |
| Review<br>Committee                       | Guide                          | Review<br>Committee |  |  |  |  |  |  |
| 40  | 20                             | 40                  |  |  |  |  |  |  |

#### 7.9 Professional Skills Training

The Professional Skills Training shall be conducted for minimum 80 hours in  $1^{st}$  semester vacation and during  $2^{nd}$  semester. The evaluation procedure shall be approved by the board of the offering department and Principal. The failure candidates shall register and can appear for the supplementary examination which will be conducted within 10 days after the commencement of the results declaration. This will not be considered as an attempt for the purpose of classification.

#### 7.10 Internships

Each candidate shall submit a brief report about the internship undergone and a certificate issued from the organization concerned at the time of Viva-voce examination to the review committee. The evaluation method shall be same as that of the Project Work as per clause 7.6 excluding 7.6.6.

#### 7.11 Value Added Course

Two assessments shall be conducted during the value added course duration by the offering department concerned.

#### 7.12 Online Course

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

#### 7.13 Self Study Course

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.

#### 7.14 Audit Course

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of Registration itself. Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SF (Satisfactory). Performance grade will not be shown for the audit course.

Since an audit course has no grade points assigned, it will not be counted for the purpose of GPA and CGPA calculations.

#### 7.15 Universal Human Values

The course imparting the human values shall be taught for all candidates. This course shall carry a maximum of 100 marks and shall be evaluated through continuous assessment tests only. The candidate(s) can earn 2 credits by successfully completing this course. Assessment method and evaluation pattern same as that of Training courses vide clause 7.1. Two continuous assessment tests will be conducted and the average marks will be taken for the calculation of grades.

### 8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

**8.1** A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.

- **8.1.1** Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (after rounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.
- **8.1.2** A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.
- **8.1.3** In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.
- **8.1.4** A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.
- 8.1.5 Candidate's progress is satisfactory.
- **8.1.6** Candidate's conduct is satisfactory and he/she was not involved in any indisciplined activities in the current semester.
- **8.2.** The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.
- **8.3** The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester when it is offered next.

#### 9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION

- **9.1** A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the higher semester.
- **9.2** When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.

**9.3** A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.

#### 10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS

- **10.1** A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.
- **10.2** The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.
- **10.3** The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.
- **10.4** If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.
- **10.5** The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

#### 11. PROVISION FOR BREAK OF STUDY

- **11.1** A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination. A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.
- **11.2** The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.

- **11.3** The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- **11.4** The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.
- **11.5** If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.
- **11.6** If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

### **12. PASSING REQUIREMENTS**

- **12.1** A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of 50 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.
- **12.2** A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.
- **12.3** For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements, but the grade awarded shall be only the lowest passing grade irrespective of the marks secured.

#### **13. REVALUATION OF ANSWER SCRIPTS**

A candidate shall apply for a photocopy of his / her semester examination answer script within a reasonable time from the declaration of results, on payment of a prescribed fee by submitting the proper application to the Controller of Examinations. The answer script shall be pursued and justified jointly by a faculty member who has handled the course and the course coordinator and recommended for revaluation. Based on the recommendation, the candidate can register for revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for revaluation and the results will be intimated to the candidate

concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

## 14. SUPPLEMENTARY EXAMINATION

If a candidate fails to clear all courses in the final semester after the announcement of final end semester examination results, he/she shall be allowed to take up supplementary examinations to be conducted within a reasonable time for the courses of final semester alone, so that he/she gets a chance to complete the programme.

## **15. AWARD OF LETTER GRADES**

| Range of % of Total Marks          | Letter Grade    | Grade Point |
|------------------------------------|-----------------|-------------|
| 91 to 100                          | O (Outstanding) | 10          |
| 81 to 90                           | A+ (Excellent)  | 9           |
| 71 to 80                           | A (Very Good)   | 8           |
| 61 to 70                           | B+ (Good)       | 7           |
| 50 to 60                           | B (Average)     | 6           |
| Less than 50                       | RA (Reappear)   | 0           |
| Satisfactory                       | SF              | 0           |
| Withdrawal                         | W               | -           |
| Absent                             | AB              | -           |
| Shortage of Attendance in a course | SA              | -           |

The Grade Point Average (GPA) is calculated using the formula:

$$GPA = \frac{\sum [(course credits) \times (grade points)] \text{ for all courses in the specific semester}}{\sum (course credits) \text{ for all courses in the specific semester}}$$

The Cumulative Grade Point Average (CGPA) is calculated from first semester (third semester for lateral entry candidates) to final semester using the formula

CGPA= 
$$\frac{\sum [(\text{course credits}) \times (\text{grade points})] \text{ for all courses in all the semesters so far}}{\sum (\text{course credits}) \text{ for all courses in all the semesters so far}}$$

The GPA and CGPA are computed only for the candidates with a pass in all the courses.

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester and at the end of successive semesters respectively.

A grade sheet for each semester shall be issued containing Grade obtained in each course, GPA and CGPA.

A duplicate copy, if required can be obtained on payment of a prescribed fee and satisfying other



procedure requirements.

Withholding of Grades: The grades of a candidate may be withheld if he/she has not cleared his/her dues or if there is a disciplinary case pending against him/her or for any other reason.

#### 16. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the MCA Degree provided the candidate has

- i. Successfully completed all the courses under the different categories, as specified in the regulations.
- ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).
- iii. Successfully passed any additional courses prescribed by the Board of Studies whenever readmitted under regulations other than R-2020 (vide clause 11.3)
- iv. No disciplinary action pending against him / her.

#### 17. CLASSIFICATION OF THE DEGREE AWARDED

#### **17.1** First Class with Distinction:

- **17.1.1** A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:
  - Should have passed the examination in all the courses of all the four semesters in the **First Appearance** within four consecutive semesters excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
  - Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
  - Should have secured a CGPA of not less than 8.50

(OR)

- **17.1.2** A candidate who joins from other institutions on transfer or a candidate who gets readmitted and has to move from one regulations to another regulations and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:
  - Should have passed the examination in all the courses of all the four semesters in the **First Appearance** within four consecutive semesters excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
  - Submission of equivalent course list approved by the Board of studies.
  - Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
  - Should have secured a CGPA of not less than 9.00

#### 17.2 First Class:

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses of all four semesters within six consecutive semesters excluding authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 7.00

#### 17.3 Second Class:

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

**17.4** A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

#### 18. MALPRACTICES IN TESTS AND EXAMINATIONS

If a candidate indulges in malpractice in any of the tests or end semester examinations, he/she shall be liable for punitive action as per the examination rules prescribed by the college from time to time.

#### **19. AMENDMENTS**

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the Kongu Engineering College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its MCA programme.

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| CURRICULUM BREAKDOWN STRUCTURE  |                |      |       |       |                         |  |  |  |  |  |  |
|---------------------------------|----------------|------|-------|-------|-------------------------|--|--|--|--|--|--|
| Summary of Credit Distribution  |                |      |       |       |                         |  |  |  |  |  |  |
| Category                        |                | Seme | ester |       | Total number of credits | Curriculum<br>Content (% of<br>total number of |  |  |  |  |  |
|                                 | I              | Π    |       | IV    |                         | credits of the<br>program)                     |  |  |  |  |  |
| FC                              | FC 04 04       |      |       |       | <mark>7.06</mark>       |  |  |  |  |  |  |
| PC                              | PC 19 21 09 49 |      |       | 57.64 |                         |  |  |  |  |  |  |
| PE                              | PE 04 09 03 16 |      | 18.82 |       |                         |  |  |  |  |  |  |
| EC                              |                |      | 02    | 12    | 14                      | 16.47  |  |  |  |  |  |
| МС                              | 02             |      |       |       | 02                      |  |  |  |  |  |  |
| Semester wise Total             | 25             | 25   | 20    | 15    | 85                      | 99.99  |  |  |  |  |  |
| Catagory                        |                |      |       |       |                         | Abbrovistion                                   |  |  |  |  |  |
| Category                        |                |      |       |       |                         | Abbreviation                                   |  |  |  |  |  |
| Lecture hours per week          |                |      |       |       |                         | L  |  |  |  |  |  |
| Tutorial hours per week         | т              |      |       |       |                         |  |  |  |  |  |  |
| Practical, Project work, Intern | k P            |      |       |       |                         |  |  |  |  |  |  |
| Credits                         | С              |      |       |       |                         |  |  |  |  |  |  |

|                                   | CATEGORISATION OF COURSES |  |   |   |    |   |   |  |  |  |  |  |  |
|-----------------------------------|---------------------------|--|---|---|----|---|---|--|--|--|--|--|--|
| FOUNDATION COURSES (FC)           |                           |  |   |   |    |   |   |  |  |  |  |  |  |
| S. No. Course Course Name L T P C |                           |  |   |   |    |   |   |  |  |  |  |  |  |
| 1.                                | 20MCT11                   | Mathematical Foundation of Computer Applications | 3 | 1 | 0  | 4 | I |  |  |  |  |  |  |
|                                   | ·                         |  |   |   | 04 |   |   |  |  |  |  |  |  |
|                                   |                           | MANDATORY COURSES (MC)                           |   |   |    |   | • |  |  |  |  |  |  |
| 1.                                | 20GET12                   | Universal Human Values                           | 2 | 0 | 0  | 2 | Ι |  |  |  |  |  |  |
|                                   |                           |  |   |   | 02 |   |   |  |  |  |  |  |  |

|           | PROFESSIONAL CORE (PC) |                                |   |   |   |   |     |                   |  |  |  |  |  |
|-----------|------------------------|--------------------------------|---|---|---|---|-----|-------------------|--|--|--|--|--|
| S.<br>No. | Course<br>Code         | Course Name                    | L | т | Ρ | С | Sem | Domain/<br>Stream |  |  |  |  |  |
| 1.        | 20MCT12                | Programming in C               | 3 | 0 | 0 | 3 | I   | SD                |  |  |  |  |  |
| 2.        | 20MCT13                | Data Structures and Algorithms | 3 | 0 | 0 | 3 | Ι   | SD                |  |  |  |  |  |

## Kongu Engineering College, Perundurai, Erode – 638060, India

| <b>F</b>  |   |  |   |  |   |   |               |   |
|---|---|--|---|--|---|---|---------------|---|
| 3.  | 20MCT14   | Database Technologies  | 3   | 0  | 0   | 3   | Ι             | SD  |
| 4.  | 20MCT15   | Software Engineering Methodologies   | 3   | 1  | 0   | 4   | I             | SD  |
| 5.  | 20MCL11   | Programming in C Laboratory  | 0   | 0  | 4   | 2   | Ι             | SD  |
| 6.  | 20MCL12   | Data Structures and Algorithms Laboratory  | 0   | 0  | 4   | 2   | Ι             | SD  |
| 7.  | 20MCL13   | Database Technologies Laboratory   | 0   | 0  | 4   | 2   | I             | SD  |
| 8.  | 20MCT21   | Object Oriented Programming  | 3   | 0  | 0   | 3   | П             | SD  |
| 9.  | 20MCT22   | Python Programming   | 3   | 0  | 0   | 3   | Ш             | SD  |
| 10.   | 20MCT23   | Machine Learning   | 3   | 0  | 0   | 3   | П             | DS  |
| 11.   | 20MCT24   | Operating Systems  | 3   | 1  | 0   | 4   | П             | SD  |
| 12.   | 20MCL21   | Object Oriented Programming Laboratory   | 0   | 0  | 4   | 2   | П             | SD  |
| 13.   | 20MCL22   | Python Programming Laboratory  | 0   | 0  | 4   | 2   | П             | SD  |
| 14.   | 20MCL23   | Machine Learning Laboratory  | 0   | 0  | 4   | 2   | П             | DS  |
| 15.   | 20GEL21   | Professional Skills Training   | 0   | 0  | 4   | 2   |               | SD  |
| 16.   | 20MCT31   | Data Communication Networks  | 3   | 1  | 0   | 4   |               | NS  |
| 17.   | 20MCT32   | Cloud Computing Technologies   | 3   | 0  | 0   | 3   |               | WT  |
| 18.   | 20MCL31   | Cloud Computing Technologies Laboratory  | 0   | 0  | 4   | 2   | III           | WТ  |
|   |   | Total Cradita to be sorread  |   |  |   |   |               |   |
|   |   | Total Credits to be earned   |   |  |   | 49  |               |   |
|   |   | PROFESSIONAL ELECTIVE (PE)   |   |  |   | 49  |               |   |
| S.<br>No.   | Course<br>Code  | PROFESSIONAL ELECTIVE (PE)<br>Course Name  | L   | т  | Р   | 49<br>C   | Sem           | Domain/<br>Stream   |
| S.<br>No.   | Course<br>Code  | PROFESSIONAL ELECTIVE (PE)<br>Course Name<br>Professional Elective I   | L   | т  | Р   | 49<br>C   | Sem           | Domain/<br>Stream   |
| <b>S.</b><br>No.  | Course<br>Code<br>20MCE01   | PROFESSIONAL ELECTIVE (PE) Course Name Professional Elective I Artificial Intelligence and Applications  | L<br>3  | <b>T</b>   | <b>P</b>  | <b>49</b><br><b>C</b><br>4  | Sem           | Domain/<br>Stream<br>DS   |
| <b>S.</b><br>No.  | Course<br>Code<br>20MCE01<br>20MCE02  | PROFESSIONAL ELECTIVE (PE) Course Name Professional Elective I Artificial Intelligence and Applications Advanced Design and Analysis of Algorithms   | L<br>3<br>3   | <b>T</b><br>1<br>1                                       | <b>P</b> 0 0  | <b>49 C</b> 4 4 4   | Sem<br>  <br> | Domain/<br>Stream<br>DS<br>SD   |
| <b>S.</b><br><b>No.</b><br>1.<br>2.<br>3.   | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03   | PROFESSIONAL ELECTIVE (PE) Course Name Professional Elective I Artificial Intelligence and Applications Advanced Design and Analysis of Algorithms Web Technologies  | L<br>3<br>3<br>3  | <b>T</b><br>1<br>1<br>1                                  | <b>P</b> 0 0 0 0  | <b>49 C</b> 4 4 4 4   | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT                                       |
| S.<br>No.<br>1.<br>2.<br>3.<br>4.   | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03<br>20MCE04  | PROFESSIONAL ELECTIVE (PE) Course Name Professional Elective I Artificial Intelligence and Applications Advanced Design and Analysis of Algorithms Web Technologies Research Methodologies   | L<br>3<br>3<br>3<br>3   | <b>T</b> 1 1 1 1 1 1                                     | P<br>0<br>0<br>0<br>0   | <b>49 C</b> 4 4 4 4 4   | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT<br>GEN                                |
| S.<br>No.<br>1.<br>2.<br>3.<br>4.<br>5.   | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03<br>20MCE04<br>20MCE05   | PROFESSIONAL ELECTIVE (PE) Course Name Professional Elective I Artificial Intelligence and Applications Advanced Design and Analysis of Algorithms Web Technologies Research Methodologies Statistical Data Analytics  | L<br>3<br>3<br>3<br>3<br>3<br>3                               | <b>T</b> 1 1 1 1 1 1 1 1                                 | P<br>0<br>0<br>0<br>0<br>0                                    | 49<br>C<br>4<br>4<br>4<br>4<br>4<br>4                               | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT<br>GEN<br>DS                          |
| S.<br>No.<br>1.<br>2.<br>3.<br>4.<br>5.   | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03<br>20MCE04<br>20MCE05   | PROFESSIONAL ELECTIVE (PE) Course Name Professional Elective I Artificial Intelligence and Applications Advanced Design and Analysis of Algorithms Web Technologies Research Methodologies Statistical Data Analytics Professional Elective II   | L<br>3<br>3<br>3<br>3<br>3                                    | <b>T</b> 1 1 1 1 1 1 1                                   | <b>P</b> 0 0 0 0 0 0 0  | <b>49 C</b> 4 4 4 4 4 4   | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT<br>GEN<br>DS                          |
| S.<br>No.<br>1.<br>2.<br>3.<br>4.<br>5.<br>6.   | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03<br>20MCE04<br>20MCE05   | PROFESSIONAL ELECTIVE (PE) Course Name Professional Elective I Artificial Intelligence and Applications Advanced Design and Analysis of Algorithms Web Technologies Research Methodologies Statistical Data Analytics Professional Elective II Natural Language Processing   | L<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3                     | T<br>1<br>1<br>1<br>1<br>1<br>1<br>0                     | P<br>0<br>0<br>0<br>0<br>0<br>0                               | 49<br>C<br>4<br>4<br>4<br>4<br>4<br>3                               | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT<br>GEN<br>DS<br>SD                    |
| S.<br>No.<br>1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.   | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03<br>20MCE04<br>20MCE05<br>20MCE06<br>20MCE07                       | PROFESSIONAL ELECTIVE (PE)         PROFESSIONAL ELECTIVE (PE)         Course Name         Professional Elective I         Artificial Intelligence and Applications         Advanced Design and Analysis of Algorithms         Web Technologies         Research Methodologies         Statistical Data Analytics         Professional Elective II         Natural Language Processing         Internet of Things                               | L<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3                | T<br>1<br>1<br>1<br>1<br>1<br>1<br>0<br>0                | P<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0                     | 49<br>C<br>4<br>4<br>4<br>4<br>4<br>3<br>3<br>3                     | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT<br>GEN<br>DS<br>SD<br>GEN             |
| S. No.<br>1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8.  | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03<br>20MCE04<br>20MCE05<br>20MCE06<br>20MCE07<br>20MCE08            | PROFESSIONAL ELECTIVE (PE)         PROFESSIONAL ELECTIVE (PE)         Course Name         Professional Elective I         Artificial Intelligence and Applications         Advanced Design and Analysis of Algorithms         Web Technologies         Research Methodologies         Statistical Data Analytics         Professional Elective II         Natural Language Processing         Internet of Things         Linux Administration  | L<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3      | T<br>1<br>1<br>1<br>1<br>1<br>1<br>0<br>0<br>0<br>0      | P<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0           | 49<br>C<br>4<br>4<br>4<br>4<br>4<br>4<br>3<br>3<br>3<br>3<br>3      | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT<br>GEN<br>DS<br>SD<br>GEN<br>NS       |
| S.           No.           1.           2.           3.           4.           5.           6.           7.           8.           9. | Course<br>Code<br>20MCE01<br>20MCE02<br>20MCE03<br>20MCE04<br>20MCE05<br>20MCE06<br>20MCE07<br>20MCE08<br>20MCE08 | PROFESSIONAL ELECTIVE (PE)         Course Name         Professional Elective I         Artificial Intelligence and Applications         Advanced Design and Analysis of Algorithms         Web Technologies         Research Methodologies         Statistical Data Analytics         Professional Elective II         Natural Language Processing         Internet of Things         Linux Administration         Software Project Management | L<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3 | T<br>1<br>1<br>1<br>1<br>1<br>1<br>0<br>0<br>0<br>0<br>0 | P<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | 49<br>C<br>4<br>4<br>4<br>4<br>4<br>4<br>3<br>3<br>3<br>3<br>3<br>3 | Sem           | Domain/<br>Stream<br>DS<br>SD<br>WT<br>GEN<br>DS<br>SD<br>GEN<br>NS<br>SD |

|           |                | F                                      |       |     |    |    |     |                   |
|-----------|----------------|--|-------|-----|----|----|-----|-------------------|
|           |                | Professional Elective III              |       |     |    |    |     |                   |
| 11.       | 20MCE11        | Mobile Application Development         | 3     | 0   | 0  | 3  |     | SD                |
| 12.       | 20MCE12        | Cryptography and Network Security      | 3     | 0   | 0  | 3  |     | NS                |
| 13.       | 20MCE13        | C# and ASP.NET                         | 3     | 0   | 0  | 3  |     | WT                |
| 14.       | 20MCE14        | Software Testing and Quality Assurance | 3     | 0   | 0  | 3  |     | SD                |
| 15.       | 20MCE15        | Digital Image Processing               | 3     | 0   | 0  | 3  |     | SD                |
|           |                | Professional Elective IV               |       |     |    |    |     |                   |
| 16.       | 20MCE16        | Bioinformatics                         | 3     | 0   | 0  | 3  |     | SD                |
| 17.       | 20MCE17        | Business Intelligence                  | 3     | 0   | 0  | 3  |     | DS                |
| 18.       | 20MCE18        | Big Data Analytics                     | 3     | 0   | 0  | 3  |     | DS                |
| 19.       | 20MCE19        | Accounting and Financial Management    | 3     | 0   | 0  | 3  |     | GEN               |
| 20.       | 20MCE20        | Network Management System              | 3     | 0   | 0  | 3  |     | NS                |
|           |                | Professional Elective V                |       |     |    |    |     |                   |
| 21.       | 20MCE21        | Deep Learning                          | 3     | 0   | 0  | 3  | IV  | DS                |
| 22.       | 20MCE22        | Blockchain Technology                  | 3     | 0   | 0  | 3  | IV  | NS                |
| 23.       | 20MCE23        | Distributed Database Systems           | 3     | 0   | 0  | 3  | IV  | NS                |
| 24.       | 20MCE24        | Decision Support Systems               | 3     | 0   | 0  | 3  | IV  | DS                |
| 25.       | 20MCE25        | Social Network Analysis                | 3     | 0   | 0  | 3  | IV  | DS                |
|           |                | Total Credits to be earned             |       |     |    | 16 |     |                   |
|           |                | EMPLOYABILITY ENHANCEMENT COURS        | SES ( | EC) |    |    |     |                   |
| S.<br>No. | Course<br>Code | Course Name                            | L     | т   | Р  | С  | Sem | Domain/<br>Stream |
| 26.       | 20MCP31        | Mini Project                           | 0     | 0   | 4  | 2  | III | -                 |
| 27.       | 20MCP41        | Project Work                           | 0     | 0   | 24 | 12 | IV  | -                 |
|           |                | Total Credits to be earned             |       |     |    | 14 |     |                   |

\*Domain/Stream Abbreviations: SD – Software Development, NS - Network and Security, DS – Data Science, WT- Web Technologies, GEN - General

## KEC R2020: SCHEDULING OF COURSES – M.C.A. (MASTER OF COMPUTER APPLICATIONS) Total Credits : 85

| Sem | Course 1  | Course 2   | Course 3  | Course 4   | Course 5   | Course 6  | Course 7  | Course 8  | Course 9   | Credits |
|-----|---|--|---|--|--|---|---|---|--|---------|
| I   | 20MCT11<br>Mathematical<br>Foundation of<br>Computer<br>Applications<br>(3-1-0-4) | 20MCT12<br>Programming<br>in C<br>(3-0-0-3)                | 20MCT13<br>Data<br>Structures<br>and<br>Algorithms<br>(3-0-0-3) | 20MCT14<br>Database<br>Technologies<br>(3-0-0-3) | 20MCT15<br>Software<br>Engineering<br>Methodologie<br>S<br>(3-1-0-4) | 20GET12<br>Universal<br>Human<br>Values<br>(2-0-0-2)                    | 20MCL11<br>Programming<br>in C<br>Laboratory<br>(0-0-4-2)   | 20MCL12<br>Data<br>Structures<br>and<br>Algorithms<br>Laboratory<br>(0-0-4-2) | 20MCL13<br>Database<br>Technologies<br>Laboratory<br>(0-0-4-2) | 25      |
| II  | 20MCT21<br>Object<br>Oriented<br>Programming<br>(3-0-0-3)                         | 20MCT22<br>Python<br>Programming<br>(3-0-0-3)              | 20MCT23<br>Machine<br>Learning<br>(3-0-0-3)                     | 20MCT24<br>Operating<br>Systems<br>(3-1-0-4)     | Professional<br>Elective I<br>(3-1-0-4)                              | 20MCL21<br>Object<br>Oriented<br>Programming<br>Laboratory<br>(0-0-4-2) | 20MCL22<br>Python<br>Programming<br>Laboratory<br>(0-0-4-2) | 20MCL23<br>Machine<br>Learning<br>Laboratory<br>(0-0-4-2)                     | 20GEL21<br>Professional<br>Skills Training<br>(0-0-4-2)        | 25      |
| 111 | 20MCT31<br>Data<br>Communicatio<br>n Networks<br>(3-1-0-4)                        | 20MCT32<br>Cloud<br>Computing<br>Technologies<br>(3-0-0-3) | Professional<br>Elective II<br>(3-0-0-3)                        | Professional<br>Elective III<br>(3-0-0-3)        | Professional<br>Elective IV<br>(3-0-0-3)                             | 20MCL31<br>Cloud<br>Computing<br>Laboratory<br>(0-0-4-2)                | 20MCP31<br>Mini Project<br>(0-0-4-2)                        |   |  | 20      |
| IV  | Professional<br>Elective V<br>(3-0-0-3)   | 20MCP41<br>Project Work<br>(0-0-24-12)                     |   |  |  |   |   |   |  | 15      |

| Sem. | Course<br>Code | Course Title  | PO1 | PO2          | PO3          | PO4          | PO5          | PO6 | PO7          | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|----------------|---|-----|--------------|--------------|--------------|--------------|-----|--------------|-----|-----|------|------|------|------|------|
| 1    | 20MCT11        | Mathematical Foundation of Computer<br>Applications | ~   | ~            | ✓            | ~            | ~            |     |              |     |     |      |      |      |      |      |
| 1    | 20MCT12        | Programming in C                                    | ✓   | $\checkmark$ | $\checkmark$ | ✓            | ✓            |     |              |     |     |      |      |      |      |      |
| 1    | 20MCT13        | Data Structures and Algorithms                      | ~   | ✓            | ✓            | ~            |              |     |              |     |     |      |      |      |      |      |
| 1    | 20MCT14        | Database Technologies                               | ✓   | ✓            | ✓            | ~            | ✓            |     |              |     |     |      |      |      | ✓    | ✓    |
| 1    | 20MCT15        | Software Engineering Methodologies                  | ~   | ✓            | ✓            |              |              |     |              |     |     |      |      |      |      |      |
| 1    | 20GET12        | Universal Human Values                              |     |              |              |              |              | ~   |              | ✓   |     |      |      |      |      |      |
| 1    | 20MCL11        | Programming in C Laboratory                         | ✓   | ✓            | ✓            | ~            | ✓            |     |              |     |     |      |      |      |      |      |
| 1    | 20MCL12        | Data Structures and Algorithms Laboratory           | ✓   | ✓            |              |              |              |     |              |     |     |      |      |      |      |      |
| 1    | 20MCL13        | Database Technologies Laboratory                    | ✓   | ✓            | ✓            | ✓            | ✓            |     |              |     |     |      |      |      | ✓    | ✓    |
| 2    | 20MCT21        | Object Oriented Programming                         | ✓   | ✓            | ✓            | ✓            | ✓            |     |              |     |     |      |      |      |      |      |
| 2    | 20MCT22        | Python Programming                                  | ✓   | ✓            | ✓            | ✓            | ✓            |     |              |     |     |      |      |      | ✓    | ✓    |
| 2    | 20MCT23        | Machine Learning                                    | ✓   | ✓            | ✓            | ✓            |              |     |              |     |     |      |      |      |      |      |
| 2    | 20MCT24        | Operating Systems                                   | ✓   | ✓            | ✓            | ~            |              |     |              |     |     |      |      |      | ✓    | ✓    |
| 2    | 20MCL21        | Object Oriented Programming Laboratory              | ✓   | ~            | ✓            | ~            | ~            |     |              |     |     |      |      |      |      |      |
| 2    | 20MCL22        | Python Programming Laboratory                       | ~   | ✓            | ✓            | ~            |              |     |              |     |     |      |      |      | ✓    | ✓    |
| 2    | 20MCL23        | Machine Learning Laboratory                         | ~   | ✓            | ✓            | ~            | ✓            |     |              |     |     |      |      |      | ✓    | ✓    |
| 2    | 20GEL21        | Professional Skills Training                        | ✓   | ✓            |              |              |              | ~   | ✓            |     | ~   | ~    | ✓    | ~    |      |      |
| 3    | 20MCT31        | Data Communication Networks                         | ~   | ✓            | ✓            | ~            |              |     |              |     |     |      |      |      | ✓    | ✓    |
| 3    | 20MCT32        | Cloud Computing Technologies                        | ✓   | ✓            | ✓            | ✓            |              |     |              |     |     |      |      |      | ✓    | ✓    |
| 3    | 20MCL31        | Cloud Computing Technologies Laboratory             | ✓   | ✓            | ✓            | ✓            | ✓            | ✓   |              |     |     |      |      |      | ✓    | ✓    |
| 3    | 20MCP31        | Mini Project  | ✓   | ✓            | ✓            | ✓            | ✓            | ✓   | ✓            | ✓   | ✓   | ✓    | ✓    | ✓    | ✓    | ✓    |
| 4    | 20MCP41        | Project Work  | ✓   | ✓            | ✓            | ✓            | ✓            | ✓   | ✓            | ✓   | ✓   | ✓    | ✓    | ✓    | ✓    | ✓    |
|      | Pro            | ofessional Elective Courses                         |     | •            | -            | •            | -            | •   | •            | •   | •   |      |      | •    | •    |      |
| 2    | 20MCE01        | Artificial Intelligence and Applications            | ✓   | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |     | $\checkmark$ |     |     |      |      |      | ✓    | ✓    |

#### MAPPING OF COURSES WITH PROGRAM OUTCOMES

M.C.A – Master of Computer Applications, Regulation, Curriculum and Syllabus – R2020

|      |         | ring College Derundurgi Frede 62000 lad         | ia  | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | I    | I    |      |              |      |
|------|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|--------------|------|
| Sem. | Code    | Course Title                                    | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1         | PSO2 |
| 2    | 20MCE02 | Advanced Design and Analysis of<br>Algorithms   | ~   | ~   | ~   | ~   | ~   |     |     |     |     |      |      |      |              |      |
| 2    | 20MCE03 | Web Technologies                                | ✓   | ✓   | ✓   | ✓   |     |     |     |     |     |      |      |      |              |      |
| 2    | 20MCE04 | Research Methodologies                          | ✓   | ✓   | ✓   | ✓   |     |     |     |     |     |      |      |      | $\checkmark$ | ~    |
| 2    | 20MCE05 | Statistical Data Analytics                      | ✓   | ✓   | ~   | ~   | ✓   |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE06 | Natural Language Processing                     | ~   | ✓   | ✓   | ✓   |     |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE07 | Internet of Things                              | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      | $\checkmark$ | ~    |
| 3    | 20MCE08 | Linux Administration                            | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE09 | Software Project Management                     | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE10 | Data Visualization Techniques                   | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      | ✓            | ✓    |
| 3    | 20MCE11 | Mobile Application Development                  | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      | ✓            | ✓    |
| 3    | 20MCE12 | Cryptography and Network Security               | ✓   | ✓   | ✓   | ✓   |     |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE13 | C# and ASP.NET                                  | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE14 | Software Testing and Quality Assurance          | ✓   | ✓   | ✓   | ✓   |     |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE15 | Digital Image Processing                        | ✓   | ✓   | ✓   |     |     |     |     |     |     |      |      |      |              |      |
| 3    | 20MCE16 | Bioinformatics                                  | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      | ✓            | ✓    |
| 3    | 20MCE17 | Business Intelligence                           | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | ✓            |      |
| 3    | 20MCE18 | Big Data Analytics                              | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      | ✓            |      |
| 3    | 20MCE19 | Accounting and Financial Management             | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      | ✓    | ✓    |              |      |
| 3    | 20MCE20 | Network Management System                       | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      | ✓            | ✓    |
| 4    | 20MCE21 | Deep Learning                                   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   | ✓   |     |      |      |      | ✓            | ✓    |
| 4    | 20MCE22 | Blockchain Technology                           | ✓   | ✓   | ✓   | ✓   |     |     |     |     |     |      |      |      |              |      |
| 4    | 20MCE23 | Distributed Database Systems                    | ✓   | ✓   | ✓   |     |     |     |     |     |     |      |      |      | ✓            | ✓    |
| 4    | 20MCE24 | Decision Support Systems                        | ✓   | ✓   | ✓   |     |     | ✓   | ✓   |     |     |      |      | ✓    | ✓            | ✓    |
| 4    | 20MCE25 | Social Network Analysis                         | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |      |      |      |              |      |
| 4    | 20GET13 | Innovation, Business and Venture<br>Development | ~   | ~   | ~   | ~   | ~   | ~   | ~   | ~   | ~   | ~    | ~    | ✓    | ✓            | ✓    |

| SEMESTER ·     | -1  |    |              |   |        |     |      |              |      |
|----------------|---|----|--------------|---|--------|-----|------|--------------|------|
| Course         | Course Title  | Но | Hours / Week |   | Credit | Мах | imum | Cate<br>gory |      |
| Code           |   | L  | Т            | Р |        | CA  | ESE  | Total        | gory |
| Theory/Theo    | ry with Practical                                   |    |              |   |        |     |      |              |      |
| 20MCT11        | Mathematical Foundation of Computer<br>Applications | 3  | 1            | 0 | 4      | 50  | 50   | 100          | FC   |
| 20MCT12        | Programming in C                                    | 3  | 0            | 0 | 3      | 50  | 50   | 100          | PC   |
| 20MCT13        | Data Structures and Algorithms                      | 3  | 0            | 0 | 3      | 50  | 50   | 100          | PC   |
| 20MCT14        | Database Technologies                               | 3  | 0            | 0 | 3      | 50  | 50   | 100          | PC   |
| 20MCT15        | Software Engineering Methodologies                  | 3  | 1            | 0 | 4      | 50  | 50   | 100          | PC   |
| 20GET12        | Universal Human Values                              | 2  | 0            | 0 | 2      | 100 | 0    | 100          | MC   |
| Practical / Er | nployability Enhancement                            |    |              |   |        |     |      |              |      |
| 20MCL11        | Programming in C Laboratory                         | 0  | 0            | 4 | 2      | 50  | 50   | 100          | PC   |
| 20MCL12        | Data Structures and Algorithms Laboratory           | 0  | 0            | 4 | 2      | 50  | 50   | 100          | PC   |
| 20MCL13        | Database Technologies Laboratory                    | 0  | 0            | 4 | 2      | 50  | 50   | 100          | PC   |
|                | Total Credits to be earned                          |    |              |   | 25     |     |      |              |      |

#### M.C.A. MASTER OF COMPUTER APPLICATIONS CURRICULUM – R2020

| SEMESTER      | - 11                                   |    |       |      |        |     |      |              |      |
|---------------|--|----|-------|------|--------|-----|------|--------------|------|
| Course        | Course Title                           | Но | urs/V | Veek | Credit | Max | imum | Cate<br>gory |      |
| Code          |  | L  | Т     | Р    |        | СА  | ESE  | Total        | gory |
| Theory/Theo   | ory with Practical                     |    |       |      |        |     |      |              |      |
| 20MCT21       | Object Oriented Programming            | 3  | 0     | 0    | 3      | 50  | 50   | 100          | PC   |
| 20MCT22       | Python Programming                     | 3  | 0     | 0    | 3      | 50  | 50   | 100          | PC   |
| 20MCT23       | Machine Learning                       | 3  | 0     | 0    | 3      | 50  | 50   | 100          | PC   |
| 20MCT24       | Operating Systems                      | 3  | 1     | 0    | 4      | 50  | 50   | 100          | PC   |
|               | Professional Elective I                | 3  | 1     | 0    | 4      | 50  | 50   | 100          | PE   |
| Practical / E | mployability Enhancement               |    |       |      |        |     |      |              |      |
| 20MCL21       | Object Oriented Programming Laboratory | 0  | 0     | 4    | 2      | 50  | 50   | 100          | PC   |
| 20MCL22       | Python Programming Laboratory          | 0  | 0     | 4    | 2      | 50  | 50   | 100          | PC   |
| 20MCL23       | Machine Learning Laboratory            | 0  | 0     | 4    | 2      | 50  | 50   | 100          | PC   |
| 20GEL21       | Professional Skills Training           | 0  | 0     | 4    | 2      | 100 | 0    | 100          | PC   |
|               | Total Credits to be earned             | •  | •     | •    | 25     |     | •    |              |      |

| SEMESTER                     | - 111                                   |     |         |      |        |     |      |       |      |
|------------------------------|---|-----|---------|------|--------|-----|------|-------|------|
| Course                       | Course Title                            | Ηοι | urs / V | Veek | Credit | Мах | imum | Cate  |      |
| Code                         |   |     |         |      |        | CA  | ESE  | Total | gory |
| Theory/Theory with Practical |   |     |         |      |        |     |      |       |      |
| 20MCT31                      | Data Communication Networks             | 3   | 1       | 0    | 4      | 50  | 50   | 100   | PC   |
| 20MCT32                      | Cloud Computing Technologies            | 3   | 0       | 0    | 3      | 50  | 50   | 100   | PC   |
|                              | Professional Elective II                | 3   | 0       | 0    | 3      | 50  | 50   | 100   | PE   |
|                              | Professional Elective III               | 3   | 0       | 0    | 3      | 50  | 50   | 100   | PE   |
|                              | Professional Elective IV                | 3   | 0       | 0    | 3      | 50  | 50   | 100   | PE   |
| Practical / E                | mployability Enhancement                |     |         |      |        |     |      |       |      |
| 20MCL31                      | Cloud Computing Technologies Laboratory | 0   | 0       | 4    | 2      | 50  | 50   | 100   | PC   |
| 20MCP31                      | Mini Project                            | 0   | 0       | 4    | 2      | 50  | 50   | 100   | EC   |
|                              | Total Credits to be earned              |     |         |      | 20     |     |      |       |      |

## M.C.A. MASTER OF COMPUTER APPLICATIONS CURRICULUM – R2020

| SEMESTER      | – IV                       |                     |   |     |      |      |     |       |      |
|---------------|----------------------------|---------------------|---|-----|------|------|-----|-------|------|
| Course        | Course Title               | Hours / Week Credit |   | Мах | imum | Cate |     |       |      |
| Code          |                            | L                   | Т | Р   |      | CA   | ESE | Total | gory |
| Theory/The    | ory with Practical         |                     |   |     |      |      |     |       |      |
|               | Professional Elective V    | 3                   | 0 | 0   | 3    | 50   | 50  | 100   | PE   |
| Practical / E | mployability Enhancement   |                     |   |     |      |      |     |       |      |
| 20MCP41       | Project Work               | 0                   | 0 | 24  | 12   | 50   | 50  | 100   | EC   |
|               | Total Credits to be earned |                     |   |     | 15   |      |     |       |      |

**Total Credits: 85** 



|         | LIST OF PROFESSIONAL ELECTIVE COURSES      | 5   |       |     |        |          |
|---------|--|-----|-------|-----|--------|----------|
| Course  | Course Title                               | Ηοι | urs/W | eek | Credit | Category |
| Code    |  | L   | Т     | Ρ   | orealt | Galogory |
|         | SEMESTER II                                |     |       |     |        |          |
|         | Professional Elective – I                  |     | 1     | 1   |        |          |
| 20MCE01 | Artificial Intelligence and Applications   | 3   | 1     | 0   | 4      | PE       |
| 20MCE02 | Advanced Design and Analysis of Algorithms | 3   | 1     | 0   | 4      | PE       |
| 20MCE03 | Web Technologies                           | 3   | 1     | 0   | 4      | PE       |
| 20MCE04 | Research Methodologies                     | 3   | 1     | 0   | 4      | PE       |
| 20MCE05 | Statistical Data Analytics                 | 3   | 1     | 0   | 4      | PE       |
|         | SEMESTER III                               |     |       |     |        |          |
|         | Professional Elective – II                 |     |       |     |        |          |
| 20MCE06 | Natural Language Processing                | 3   | 0     | 0   | 3      | PE       |
| 20MCE07 | Internet of Things                         | 3   | 0     | 0   | 3      | PE       |
| 20MCE08 | Linux Administration                       | 3   | 0     | 0   | 3      | PE       |
| 20MCE09 | Software Project Management                | 3   | 0     | 0   | 3      | PE       |
| 20MCE10 | Data Visualization Techniques              | 3   | 0     | 0   | 3      | PE       |
|         | Professional Elective – III                |     |       |     | •      |          |
| 20MCE11 | Mobile Application Development             | 3   | 0     | 0   | 3      | PE       |
| 20MCE12 | Cryptography and Network Security          | 3   | 0     | 0   | 3      | PE       |
| 20MCE13 | C# and ASP.NET                             | 3   | 0     | 0   | 3      | PE       |
| 20MCE14 | Software Testing and Quality Assurance     | 3   | 0     | 0   | 3      | PE       |
| 20MCE15 | Digital Image Processing                   | 3   | 0     | 0   | 3      | PE       |
|         | Professional Elective – IV                 |     | •     | •   |        |          |
| 20MCE16 | Bioinformatics                             | 3   | 0     | 0   | 3      | PE       |
| 20MCE17 | Business Intelligence                      | 3   | 0     | 0   | 3      | PE       |
| 20MCE18 | Big Data Analytics                         | 3   | 0     | 0   | 3      | PE       |
| 20MCE19 | Accounting and Financial Management        | 3   | 0     | 0   | 3      | PE       |
| 20MCE20 | Network Management System                  | 3   | 0     | 0   | 3      | PE       |
|         | SEMESTER IV                                |     |       |     | 1      |          |
|         | Professional Elective – V                  |     |       |     |        |          |
| 20MCE21 | Deep Learning                              | 3   | 0     | 0   | 3      | PE       |
| 20MCE22 | Blockchain Technology                      | 3   | 0     | 0   | 3      | PE       |
| 20MCE23 | Distributed Database Systems               | 3   | 0     | 0   | 3      | PE       |
| 20MCE24 | Decision Support Systems                   | 3   | 0     | 0   | 3      | PE       |
| 20MCE25 | Social Network Analysis                    | 3   | 0     | 0   | 3      | PE       |



#### M.C.A. MASTER OF COMPUTER APPLICATIONS CURRICULUM - R2020

| SEMESTER – I   |   |                |                |                |                 |                  |                 |                  |                 |
|----------------|---|----------------|----------------|----------------|-----------------|------------------|-----------------|------------------|-----------------|
| Course         | Course Title  | Hours / Week   |                | Credit         | Max             | imum             | Cate            |                  |                 |
|                |   | L              | T              | P              |                 | CA               | ESE             | Total            | gory            |
| Theory/Theo    | ry with Practical                                   |                |                |                |                 |                  |                 |                  |                 |
| 20MCT11        | Mathematical Foundation of Computer<br>Applications | <mark>3</mark> | 1              | 0              | <mark>4</mark>  | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | FC              |
| 20MCT12        | Programming in C                                    | <mark>3</mark> | <mark>0</mark> | <mark>0</mark> | <mark>3</mark>  | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | <mark>PC</mark> |
| 20MCT13        | Data Structures and Algorithms                      | <mark>3</mark> | <mark>0</mark> | <mark>0</mark> | <mark>3</mark>  | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | <mark>PC</mark> |
| 20MCT14        | Database Technologies                               | <mark>3</mark> | <mark>0</mark> | <mark>0</mark> | <mark>3</mark>  | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | <mark>PC</mark> |
| 20MCT15        | Software Engineering Methodologies                  | <mark>3</mark> | 1              | <mark>0</mark> | <mark>4</mark>  | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | PC              |
| 20GET12        | Universal Human Values                              | <mark>2</mark> | <mark>0</mark> | <mark>0</mark> | 2               | <mark>100</mark> | <mark>0</mark>  | <mark>100</mark> | MC              |
| Practical / Er | nployability Enhancement                            |                |                |                |                 |                  |                 |                  |                 |
| 20MCL11        | Programming in C Laboratory                         | <mark>0</mark> | <mark>0</mark> | <mark>4</mark> | 2               | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | <mark>PC</mark> |
| 20MCL12        | Data Structures and Algorithms Laboratory           | <mark>0</mark> | 0              | <mark>4</mark> | 2               | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | PC              |
| 20MCL13        | Database Technologies Laboratory                    | <mark>0</mark> | 0              | <mark>4</mark> | 2               | <mark>50</mark>  | <mark>50</mark> | <mark>100</mark> | PC              |
|                | Total Credits to be earned                          |                |                |                | <mark>25</mark> |                  |                 |                  |                 |

#### 20MCT11 - MATHEMATICAL FOUNDATION OF COMPUTER APPLICATIONS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | FC       | 3 | 1 | 0 | 4      |

| Preamble                      | To demonstrate the basic knowledge of Mathematics used to solve computational problems   |                 |
|-------------------------------|--|-----------------|
| Unit - I                      | Propositional Logic:   | <del>)</del> +3 |
| Propositional<br>Forms – Proc | Logic - Propositional Equivalents – Predicates and Quantifiers – Rules of Inference – Introduction to Proofs – Nor of Methods and Strategy.  | mal             |
| Unit - II                     | Sets, Relations and Functions:   | <del>)</del> +3 |
| Sets - Set O<br>Relations - C | perations - Laws of Set Theory - Principle of Inclusion and Exclusion. Relations: Properties of Relations - Represent<br>losure of Relations. Functions: Injective – Surjective - Bijective Functions - Inverse Functions. | ting            |
| Unit - III                    | Algorithms, Integers and Matrices:   | <del>)</del> +3 |
| Algorithms –<br>Integers and  | Growth of Functions – Complexity of Algorithms – The Integers and Division – Primes and Greatest Common Divisor<br>Algorithms - Matrices.  | 's –            |
| Unit - IV                     | Modeling Computation:  | <del>9</del> +3 |
| Languages a<br>Turing Machi   | nd Grammars - Finite - State Machines with Output - Finite - State Machine with No Input – Language Recognitio<br>ne.  | n –             |
| Unit - V                      | Graphs and Trees:  | <del>9</del> +3 |
| Graphs and<br>Paths. Trees    | Graph Models - Terminology – Special Types of Graphs – Representing Graphs – Connectivity – Euler and Hamil<br>Tree Traversal – Spanning Tree - Minimum Spanning Tree.   | lton            |

#### Lecture:45, Tutorial:15, Total: 60

#### **REFERENCES:**

- 1. Kenneth H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7th Edition, McGraw-Hill Education, India, 2018. (Indian Adaption by Kamala Krithivasan).
- 2. Bernard Kolman, Robert Busby & Sharon C. Ross, "Discrete Mathematical Structures", 6th Edition, Pearson Education, India, 2017.
- 3. Tamilarasi A., Natarajan A.M., "Discrete Mathematics and its Applications", 3rd Edition, Khanna Publishers, India, 2013.

#### COURSE OUTCOMES:

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                   | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | apply logical operations and predicate calculus to solve problems                      | Applying (K3)                |
| CO2           | explain the concept of sets, relation and functions for designing and solving problems | Understanding (K2)           |
| CO3           | analyze the running time and space complexity of algorithms.                           | Analyzing (K4)               |
| CO4           | design finite state machines with output and FSA without output                        | Applying (K3)                |
| CO5           | examine real world problems using graphs and trees                                     | Analyzing (K4)               |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO2             | 2   | 1   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 3   | 2   | 2   | 1   |     |     |     |     |      |      |      |      |      |
| CO4             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO5             | 3   | 3   | 2   | 2   | 1   |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | - Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |
| CAT1                        | 20                          | 40                      | 40                 |                     |                      |                    | 100        |  |  |  |  |
| CAT2                        | 10                          | 30                      | 30                 | 30                  |                      |                    | 100        |  |  |  |  |
| CAT3                        | 10                          | 25                      | 35                 | 30                  |                      |                    | 100        |  |  |  |  |
| ESE                         | 12                          | 28                      | 30                 | 30                  |                      |                    | 100        |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

#### 20MCT12 - PROGRAMMING IN C

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | PC       | 3 | 0 | 0 | 3      |

| Preamble  | To understand and solve logics in C and easily switch over to any other Language in future by learning the Basic Programming.  |  |  |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|--|--|--|
| Unit - I  | Basics of C Programming: 9   |  |  |  |  |  |  |  |  |  |
| Introduction t<br>Classes, Cor  | ntroduction to Programming Paradigms - Overview of C - Expressions: Data Types, Identifiers, Variables, Scopes, Qualifiers, Storage Classes, Constants, Operators, Expressions - Statements: Selection, Iteration, Jump - Expressions and Block.   |  |  |  |  |  |  |  |  |  |
| Unit - II   | Arrays and Pointers: 9   |  |  |  |  |  |  |  |  |  |
| Arrays: One Dimensional Array - Two Dimensional Arrays - Strings and Array of Strings - Pointers: Pointer Operators, Pointer<br>Arithmetic, Arrays of Pointers, Multiple Indirection, Initializing Pointer, Pointers to Function. |  |  |  |  |  |  |  |  |  |  |
| Unit - III  | Functions and Dynamic Memory Allocation: 9   |  |  |  |  |  |  |  |  |  |
| Function Ger<br>Function - R<br>Representation  | eral Format - Function Arguments: Pass by Value, Pass by Reference, Calling Functions with Arrays - Arguments to Main<br>eturn Statement - Recursion - Variable Length Parameter List - Built-in Functions: String and Math Functions - String<br>on using Pointers - Dynamic Memory Allocation. |  |  |  |  |  |  |  |  |  |
| Unit - IV   | User Defined Types: 9  |  |  |  |  |  |  |  |  |  |
| Structures - I<br>in Structures   | Structures - Nested Structures - Array of Structures - Passing Structures to Functions - Structure Pointers - Arrays and Structures with<br>n Structures - Self Referential Structures - Union - Bit Field - Enumeration - Typedef.  |  |  |  |  |  |  |  |  |  |
| Unit - V  | Console I/O, File Processing and Preprocessor: 9   |  |  |  |  |  |  |  |  |  |
| Concolo I/O:  | Pooding and Writing Characters and Strings Earmatted Cancelo I/O printf() scapf() File I/O: Streams and Files File   |  |  |  |  |  |  |  |  |  |

Console I/O: Reading and Writing Characters and Strings - Formatted Console I/O - printf() - scanf() - File I/O: Streams and Files - File System Basics of Sequential Access, Random Access - Preprocessors and Comments.

#### **REFERENCES:**

#### Total: 45

1. Herbert Schildt, "C: The Complete Reference", 4th Edition, McGraw Hill, 2017.

2. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016.

3. Kernighan B.W. and Ritchie D.M., "The C Programming Language", 2nd Edition, Pearson Education, 2008.

| СО | URS | E | OU | тс | 0 | ME | S: |  |
|----|-----|---|----|----|---|----|----|--|
|    |     |   |    |    |   |    |    |  |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to  | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | develop simple logics in C using basic constructs.  | Applying (K3)                |
| CO2           | apply arrays and pointers to write effective programs.  | Applying (K3)                |
| CO3           | build codes using functions and dynamic memory allocation.  | Applying (K3)                |
| CO4           | design and implement simple applications using user defined types.  | Applying (K3)                |
| CO5           | construct programs to store and retrieve data using files and understand the need of preprocessor directives. | Applying (K3)                |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO2             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO4             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO5             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | - Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |
| CAT1                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |
| CAT2                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |
| CAT3                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |
| ESE                         | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

#### 20MCT13 - DATA STRUCTURES AND ALGORITHMS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | PC       | 3 | 0 | 0 | 3      |

| Preamble                                     | This course is to provide a basic knowledge of Data Structures along with algorithms implementation  |                   |  |  |  |  |  |  |  |
|--|--|-------------------|--|--|--|--|--|--|--|
| Unit - I                                     | Stack, Queue and Lists:  | 9                 |  |  |  |  |  |  |  |
| Stack ADT: E<br>Expressions<br>Lists – Doubl | Basics and Types of Data Structures - Stack Model – Implementation – Applications of Stack: Balancing Symbols – I<br>– Infix to Postfix Conversion – Queue ADT: Queue Model – Implementation – Applications of Queues – List ADT: I<br>y Linked Lists – Circularly Linked Lists – Applications: Polynomial Manipulation. | Postfix<br>Linked |  |  |  |  |  |  |  |
| Unit - II                                    | Trees:   | 9                 |  |  |  |  |  |  |  |
| Preliminaries<br>Searching - I               | - Binary Trees - Representation - Expression Trees – Binary Tree Traversals - Binary Search Tree: Constructionsertion - Deletion - AVL Trees: Rotation – Insertion – Deletion – B-Trees - Red-Black Trees.   | tion –            |  |  |  |  |  |  |  |
| Unit - III                                   | Hashing:   | 9                 |  |  |  |  |  |  |  |
| Introduction<br>Hashing - Re                 | to Hashing - Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing - I<br>hashing – Extendible Hashing – Searching Techniques: Linear Search – Binary Search.   | Double            |  |  |  |  |  |  |  |
| Unit - IV                                    | Sorting:   | 9                 |  |  |  |  |  |  |  |
| Introduction -<br>Sorting: Multi             | - Insertion Sort – Heap Sort – Merge Sort – Quick Sort – Selection Sort – Bucket Sort – Bubble Sort – Shell Sort - E<br>way Merge – Polyphase Merge.   | xternal           |  |  |  |  |  |  |  |
| Unit - V                                     | Graph Algorithms:  | 9                 |  |  |  |  |  |  |  |

#### Unit - V Graph Algorithms:

Definitions – Representation of Graphs – Breadth First Search – Depth First Search – Minimum Cost Spanning Trees: Prim's Algorithm - Kruskal's Algorithm - Application - Shortest Path Algorithms: Dijkstra's Algorithm - All-Pairs Shortest Path Algorithm

#### **REFERENCES:**

| 1. | Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, India, 2016.                                    |
|----|--|
| 2. | Jean Paul Tremblay and Paul G. Sorensen, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, New Delhi, 2017. |
| 3. | Ellis Horowitz, Sahni S. and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, Silicon Press, India, 2008.              |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                      | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | implement a program using stack, queue, linked list data structures.                      | Applying (K3)                |
| CO2           | construct and perform basic operations on a various kinds of tree data structure.         | Applying (K3)                |
| CO3           | apply Hashing Techniques to generate hash address and to resolve the collision on it.     | Applying (K3)                |
| CO4           | make use of various sorting techniques to sort the given elements.                        | Applying (K3)                |
| CO5           | apply the Graph Data Structure and to find shortest path among the several possibilities. | Applying (K3)                |

Total: 45

| Mapping of COs with POs and PSOs                                |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs   | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1   | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO2   | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO3   | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO4   | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO5   | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |
| CAT1                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |
| CAT2                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |
| CAT3                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |
| ESE                         | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)
#### 20MCT14 - DATABASE TECHNOLOGIES

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | PC       | 3 | 0 | 0 | 3      |

| Preamble  | To understand the designing, modeling, manipulating, storing and retrieving of information  |  |  |  |  |  |  |
|---|---|--|--|--|--|--|--|
| Unit - I  | Data Models and Relational Model:   9   |  |  |  |  |  |  |
| Introduction<br>Databases -<br>and Admini<br>Relational C | <ul> <li>Database System Applications – Purpose of Database Systems – View of Data – Database Languages – Relational</li> <li>Database Design – Data Storage and Querying – Transaction Management – Database Architecture – Database Users</li> <li>strators – Relational Model – Structure of Relational Databases – Database Schema – Keys – Schema Diagrams –</li> <li>Query Languages – Relational Operations - Relational Algebra.</li> </ul> |  |  |  |  |  |  |
| Unit - II   | SQL and Database Design: 9  |  |  |  |  |  |  |
| Overview –<br>Database –<br>Design and                    | SQL Data Definition – Basic Structure – Operations – Aggregate Functions – Nested Sub Queries – Modification of the Intermediate SQL: Joins – Views - Integrity Constraints – SQL Data Types and Schemas – Authorization – Database E-R Model: E-R Model - Constraints – ER Diagrams – Reduction to Relational Schema – ER design Issues.   |  |  |  |  |  |  |

#### Unit - III Normalization Concepts:

Relational Database Design: Features of Good Relational Designs - Atomic Domains and First Normal Form - Functional Dependency Theory – Decomposition using Functional Dependencies: 2NF, 3NF, BCNF – Decomposition using Multivalued Dependencies - 4NF, 5NF.

#### Unit - IV Indexing, Query Processing and Transaction Management:

Indexing – Types of Indices - Query Processing: Overview – Measures of Query Cost - Query Optimization: Overview – Transformation of Relational Expressions – Choice of Evaluation Plan – Transactions: Concepts – Properties – Atomicity and Durability – Isolation - Serializability – Lock-Based Protocols.

#### Unit - V MongoDB:

Getting and Starting MongoDB - Introduction to the MongoDB Shell - Data Types - Using the MongoDB Shell – Creating, Updating, Deleting Documents - Querying – Introduction to the Aggregation Framework.

#### **REFERENCES:**

1.

Abraham Silberschatz, Henry F. Korth and Sudharshan S., "Database System Concepts", 7<sup>th</sup> Edition, Tata McGraw Hill, New York, 2019. (Unit I, II, IV).

- 2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7<sup>th</sup> Edition, Pearson, 2016. (Unit III).
- 3. Kristina Chodorow, "MongoDB: The Definitive Guide", 3<sup>rd</sup> Edition, O'Reilly Media Inc., 2019. (Unit V).

## COURSE OUTCOMES:

| On co | mpletion of the course, the students will be able to                   | (Highest Level)    |
|-------|--|--------------------|
| CO1   | explain the structure and model of the relational database system      | Understanding (K2) |
| CO2   | design multiple tables, and using group functions, sub queries         | Applying (K3)      |
| CO3   | survey different normalization methods in the design of relational     | Analyzing (K4)     |
| CO4   | database organize the order of storing data and transaction processing | Applying (K3)      |
| CO5   | implement the concepts of MongoDB                                      | Analyzing (K4)     |

9

9

9

Total: 45

**BT** Mannod

|                 |   |          |   |   | Маррі | ing of C | Os with | POs ar | nd PSO: | S |  |   |   |
|-----------------|---|----------|---|---|-------|----------|---------|--------|---------|---|--|---|---|
| COs/POs         | /POs         PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01         PS02 |          |   |   |       |          |         |        |         |   |  |   |   |
| CO1             | 2   | 1        |   |   | 1     |          |         |        |         |   |  | 1 | 1 |
| CO2             | 3   | 2        | 1   | 1 |       |          |         |        |         |   |  | 2 | 1 |
| CO3             | 2   |          | 2   | 2 | 1     |          |         |        |         |   |  | 3 | 1 |
| CO4             |   | 3        | 2   | 2 |       |          |         |        |         |   |  | 2 | 1 |
| CO5             | 2   |          | 2   | 2 | 1     |          |         |        |         |   |  | 3 | 1 |
| 1 – Slight, 2 – | Moderat   | e, 3 – S | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |   |       |          |         |        |         |   |  |   |   |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |
| CAT1                        | 25                          | 50                      | 25                 |                     |                      |                    | 100        |  |  |
| CAT2                        | 15                          | 30                      | 40                 | 15                  |                      |                    | 100        |  |  |
| CAT3                        | 15                          | 15                      | 50                 | 20                  |                      |                    | 100        |  |  |
| ESE                         | 20                          | 25                      | 30                 | 25                  |                      |                    | 100        |  |  |

### 20MCT15 - SOFTWARE ENGINEERING METHODOLOGIES

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | PC       | 3 | 1 | 0 | 4      |

| Preamble | To Provide an outline structure for developing software by learning various SDLC of object oriented solutions for real world problems. It is to learn and master the various concepts and methods of software development through object oriented analysis, design, testing, implementation and maintenance of the system and also assure quality of the software with its metrics. |
|----------|---|
|          |   |

#### Unit - I Software Development Life Cycle:

Introduction – Object Orientation - Object Oriented Methodologies – Terminologies - Software Development Life Cycle – Conventional Software Life Cycle Models – Build and Fix Model – Waterfall Model – Prototyping Model – Iterative Enhancement Model – Spiral Model – Extreme Programming - Object Oriented Software Life Cycle Models – Selection of Software Development Life Cycle Models.

#### Unit - II Object Oriented Requirements Elicitation and Analysis:

Software Requirement - Requirements Elicitation Techniques – Initial Requirements Document – Use Case Approach – Characteristics of a Good Requirement – SRS Document – Requirements Change Management – Object Oriented Analysis : Identification of Classes and Relationships, Identifying State and Behavior – Case Study LMS.

#### Unit - III Object Oriented Software Design:

Object Oriented Design – Interaction Diagrams – Sequence Diagram – Collaboration Diagrams – Refinement of Use Case Description – Refinement of Classes and Relationships – Construction of Detailed Class Diagram – Development of Detailed Design & Creation of Software Design Document – activity diagrams-State chart diagrams.

#### Unit - IV Software Quality and Metrics:

Need of Object Oriented Software Estimation – Lorenz and Kidd Estimation – Use Case Points Method – Class Point Method – Object Oriented Function Point – Risk Management – Software Quality Models – Analyzing the Metric Data – Metrics for Measuring Size and Structure – Measuring Software Quality - Object Oriented Metrics.

#### Unit - V Object Oriented Testing and Maintenance:

Software testing: Software Verification Techniques – Object Oriented Checklist- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Levels of Testing – Static and Dynamic Testing Tools - Software Maintenance – Categories – Challenges of Software Maintenance – Maintenance of Object Oriented Software – Regression Testing.

### Lecture:45, Tutorial:15, Total:60

#### **REFERENCES:**

- Yogesh Singh, RuchikaMalhotra, "Object Oriented Software Engineering", PHI Learning Private Limited, 2012.
   Ivar Jacobson. Magnus Christerson, PatrikJonsson, Gunnar Overgaard, "Object Oriented Software Engineering, A Use Case Driven Approach", Pearson Education, Seventh Impression, 2009.
- 3. Rajib Mall, "Fundamentals of Software Engineering", 5<sup>th</sup> Edition, Prentice Hall India, Delhi, 2018.

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                   | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | able to identify the appropriate process model to develop the object oriented software | Remembering (K1)             |
| CO2           | gain knowledge about requirement elicitation and analyzing techniques                  | Understanding (K2)           |
| CO3           | able to choose and design suitable UML diagrams  | Applying (K3)                |
| CO4           | able to estimate the object oriented application by applying metric data.              | Analyzing (K4)               |
| CO5           | able to apply correct testing methods and maintain software systems                    | Evaluating (K5)              |

9+3

9+3

9+3

9+3

9+3

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3                                | 2        | 2        |           |         |         |     |     |     |      |      |      |      |      |
| CO2             | 2                                | 1        | 2        |           |         |         |     |     |     |      |      |      |      |      |
| CO3             | 3                                | 1        | 2        |           |         |         |     |     |     |      |      |      |      |      |
| CO4             | 3                                | 2        | 2        |           |         |         |     |     |     |      |      |      |      |      |
| CO5             | 1                                | 1        | 2        |           |         |         |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | my  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |
| CAT1                        | 20                          | 20                      | 40                 | 10                  | <mark>5</mark>       | <mark>5</mark>     | 100        |  |
| CAT2                        | 15                          | 20                      | 45                 | 10                  | <mark>5</mark>       | <mark>5</mark>     | 100        |  |
| CAT3                        | 20                          | 20                      | 40                 | 10                  | <mark>5</mark>       | <mark>5</mark>     | 100        |  |
| ESE                         | 20                          | 30                      | <mark>35</mark>    | <mark>5</mark>      | <mark>5</mark>       | <mark>5</mark>     | 100        |  |

#### 20GET12 - UNIVERSAL HUMAN VALUES

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | MC       | 2 | 0 | 0 | 2      |

| Preamble | To make the student to know what they 'really want to be' in their life and profession, understand the meaning of            |
|----------|--|
|          | happiness and prosperity for a human being. Also to facilitate the students to understanding of harmony at all the levels of |
|          | human living, and live accordingly.  |

#### Unit - I Introduction:

Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.

#### Unit - II Harmony in the Self and Body:

Human Begin and Body – Understanding Myself as Co–existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I) – Understanding Myself – Harmony with Body.

#### Unit - III Harmony in the Family and Society:

Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.

#### Unit - IV Harmony in Nature and Existence:

Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co–existence of units of Space – Limited and unlimited – Active and No–activity – Existence is Co–existence.

## Unit - V Implications of the above Holistic Understanding of Harmony on Professional Ethics:

Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.

#### Total: 30

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#### **REFERENCES:**

| 1. | Gaur R.R., Sangal R., Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", 1 <sup>st</sup> Edition, Excell Books (P) Ltd, New Delhi, 2016. |
|----|--|
| 2. | Ivan Illich, "Energy & Equity", The Trinity Press, USA, 1974.  |
| 3  | Schumacher F. F. "Small is Beautiful: A study of economics as if people mattered" Britain 1973   |

#### COURSE OUTCOMES: BT Mapped On completion of the course, the students will be able to (Highest Level) understand the significance of value inputs in a classroom, distinguish between values and skills, Understanding (K2) CO1 understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society. CO2 distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-Understanding (K2) existence of Self and Body. CO3 understand the value of harmonious relationship based on trust, respect and other naturally acceptable Understanding (K2) feelings in human-human relationships and explore their role in ensuring a harmonious society. CO4 understand the harmony in nature and existence, and work out their mutually fulfilling participation in Understanding (K2) the nature. CO5 distinguish between ethical and unethical practices, and start working out the strategy to actualize a Understanding (K2) harmonious environment wherever they work.

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             |   |     |     |     |     | 1   |     | 3   |     |      |      |      |      |      |
| CO2             |   |     |     |     |     |     |     | 2   |     |      |      |      |      |      |
| CO3             |   |     |     |     |     | 1   |     | 3   |     |      |      |      |      |      |
| CO4             |   |     |     |     |     |     |     | 2   |     |      |      |      |      |      |
| CO5             |   |     |     |     |     |     |     | 3   |     |      |      |      |      |      |
| 1 – Slight, 2 – | - Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |
| CAT1                        | 25                          | 75                      | -                  | -                   | -                    | -                  | 100        |  |  |  |  |  |
| CAT2                        | 25                          | 75                      | -                  | -                   | -                    | -                  | 100        |  |  |  |  |  |
| CAT3                        | NA                          | -                       | -                  | -                   | -                    | -                  | -          |  |  |  |  |  |
| ESE                         | NA                          | -                       | -                  | -                   | -                    | -                  | -          |  |  |  |  |  |

\* ±3% may be varied (CAT 1,2 – 50 marks)

## 20MCL11 - PROGRAMMING IN C LABORATORY

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | PC       | 0 | 0 | 4 | 2      |

#### List of Exercises / Experiments :

| 1.  | Write C Programs using different Data Types, Operators and Expressions.  |
|-----|--|
| 2.  | Develop C Programs by applying various Control Statements.               |
| 3.  | Implement Simple Logics in C using Arrays.                               |
| 4.  | Develop Programs to Implement Pointers in C.                             |
| 5.  | Implement Simple Logics in C using Functions and Command Line Arguments. |
| 6.  | Apply Pass by Value and Pass by Reference for simple logics in C.        |
| 7.  | Perform Dynamic Memory Management in C.                                  |
| 8.  | Develop Applications using Structure and Union in C.                     |
| 9.  | Design and Implement File Processing in C.                               |
| 10. | Implement Preprocessing in C.  |

Total: 60

#### **REFERENCES/MANUAL/SOFTWARE:**

| 1. | Operating System : Windows/Linux      |
|----|---------------------------------------|
| 2. | Software: Turbo/Borland/GCC compilers |
| 3. | Laboratory Manual                     |

## COURSE OUTCOMES:

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to |   |               |  |  |  |
|---|---|---------------|--|--|--|
| CO1   | develop simple programs in C using basic Constructs, Control Statements, Arrays and Pointers. | Applying (K3) |  |  |  |
| CO2   | implement Pointers, Dynamic Memory Allocation and User-Defined Types in C Programs.           | Applying (K3) |  |  |  |
| CO3   | build programs using Files and Preprocessor Directives.                                       | Applying (K3) |  |  |  |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO2             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

## 20MCL12 - DATA STRUCTURES AND ALGORITHMS LABORATORY

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Programming in C                | 1    | PC       | 0 | 0 | 4 | 2      |

#### List of Exercises / Experiments :

| 1.  | Develop a program to perform various stack operations using an array.      |
|-----|--|
| 2.  | Implement a Program using Queue Data Structures.                           |
| 3.  | Perform Polynomial Manipulation using Linked List.                         |
| 4.  | Construct a binary search Tree for a given number of elements.             |
| 5.  | Write a program to perform Linear Search.                                  |
| 6.  | Apply recursive binary search technique to search the element in the list. |
| 7.  | Develop a program for sorting using divide and Conquer Techniques.         |
| 8.  | Arrange the given number of elements using selection sort method.          |
| 9.  | Write a program to perform linear search.                                  |
| 10. | Write a program to perform Graph Traversals.                               |

#### **REFERENCES/MANUAL/SOFTWARE:**

| 1. | V.V. Muniswamy. "C and Data Structures: with Lab Manual". International Publishing house, 2 <sup>nd</sup> Edition, 2010 |
|----|---|
| 2. | https://www.wctmgurgaon.com/wctm/dsa%20lab-it-labmanual.pdf   |
| 3. | Laboratory Manual   |

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| COUR<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to        |                                     |  |  |  |  |
|---------------|--|-------------------------------------|--|--|--|--|
| CO1           | implement a program using Linear and Non Linear Data Structures.                     | Applying (K3),<br>Manipulation (S2) |  |  |  |  |
| CO2           | apply different kinds of searching Techniques to search an element on a given input. | Applying (K3),<br>Manipulation (S2) |  |  |  |  |
| CO3           | make use of various sorting techniques to sort the number of elements.               | Applying (K3),<br>Manipulation (S2) |  |  |  |  |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO2             | 3   | 2   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 2   |     |     |     |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

## 20MCL13 - DATABASE TECHNOLOGIES LABORATORY

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 1    | PC       | 0 | 0 | 4 | 2      |

#### List of Exercises / Experiments :

| 1.  | Execute Basic SQL statements for creating and managing tables using DDL, DML, integrity constraints                          |
|-----|--|
| 2.  | Execute Basic SQL statements for DCL, TCL and DB object commands   |
| 3.  | Practice SQL Statements Single row, aggregate functions and set operations   |
| 4.  | Perform Joins & Sub queries for displaying data from multiple tables using SQL operators ,GROUPBY, HAVING and ORDERBY clause |
| 5.  | Write a simple PL/SQL programs   |
| 6.  | Write Functions and procedures using PL/SQL programs   |
| 7.  | Create and use Cursors in PL/SQL programs  |
| 8.  | Create Triggers and package in PL/SQL  |
| 9.  | Write PL/SQL programs to handle Exceptions   |
| 10. | Develop an application using front and backend connectivity  |

#### **REFERENCES/MANUAL/SOFTWARE:**

| 1. | Front End : Microsoft Visual Studio 6.0, Microsoft .NET Framework SDK v2.0, Java |
|----|--|
| 2. | Back End : ORACLE /MongoDB/ SQL Server / MYSQL                                   |
| 3. | Laboratory Manual  |

| COUR<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to |                                  |  |  |  |  |  |  |
|---------------|---|----------------------------------|--|--|--|--|--|--|
| CO1           | develop SQL and PL/SQL commands to create and manipulate databases            | Applying (K3),<br>Precision (S3) |  |  |  |  |  |  |
| CO2           | make use of the complex queries using SQL                                     | Applying (K3),<br>Precision (S3) |  |  |  |  |  |  |
| CO3           | solve real world problems using SQL and PL/SQL                                | Applying (K3),<br>Precision (S3) |  |  |  |  |  |  |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 1   |     |     | 1   |     |     |     |     |      |      |      | 1    | 1    |
| CO2             |   | 2   | 1   | 1   |     |     |     |     |     |      |      |      | 2    | 1    |
| CO3             |   | 1   | 2   | 2   |     |     |     |     |     |      |      |      | 3    | 1    |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

### 20MCT21 - OBJECT ORIENTED PROGRAMMING

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 2    | PC       | 3 | 0 | 0 | 3      |

Preamble To make Students to Write, Test, and Debug introductory level Object-Oriented Programming Concepts and Techniques in Java

#### Unit - I OOP and Basics in JAVA :

Programming Paradigms: Procedure Oriented and Object Oriented Programming - The History and Evolution of Java - An Overview of Java - Data Types, Variables, Type Conversions and Casting, Arrays - Operators - Control Statements.

#### Unit - II Classes and Objects, Overloading, Command Line Arguments:

Introducing Classes: Class Fundamentals - Declaring Objects - Methods - Constructors - this Keyword - Garbage Collection - Overloading Methods and Constructors - Object as Argument and Returning Objects - Array of Objects - Recursion - Understanding Static - Final - Nested and Inner Class - Command Line Arguments – Varargs.

#### Unit - III Inheritance, Packages and Interfaces:

Inheritance Basics - Using Super - Method Overriding - Dynamic Method Dispatch - Abstract Classes - Using Final with Inheritance - Packages Member Access - Importing Packages - Interfaces - Using Static Methods in an Interface.

### Unit - IV Exception Handling, Multithreading and I/O :

Exception Handling Fundamentals - Exception Types - Using Try and Catch - Multiple Catch Clauses - Nested Try - Throw – Throws – Finally - Built-in Exceptions - User Defined Exceptions - Multithreaded Programming: Main Thread - Creating Threads - Thread Priorities – Synchronization - InterThread Communication - Enumeration - Type Wrappers - Autoboxing - I/O Basics: BufferedInputStream - BufferedOutputStream - PrintStream – PrintWriter - Reading and Writing a File.

#### Unit - V Generics, String Handling and Collection Framework:

Generic Class - Bounded Types - Generic Methods - String Handling: String Class - StringBuffer and StringBuilderClass - Collection Frameworks: Collection Interfaces - Collection Classes: ArrayList - LinkedList - HashSet - TreeSet - PriorityQueue - Iterator - Map: Map Interfaces - Map Classes: HashMap – TreeMap - Comparators.

#### **REFERENCES:**

Total: 45

9

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9

## 1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, Oracle Press, McGraw-Hill Education, 2019.

2. Cay S. Horstmann, "Core Java Volume I-Fundamentals", 10<sup>th</sup> Edition, Prentice Hall, 2016..

3. Herbert Schildt, "Java: A Beginner's Guide", 7<sup>th</sup> Edition, Oracle Press, McGraw-Hill Education, 2017.

| COUR<br>On cor | SE OUTCOMES:<br>npletion of the course, the students will be able to  | BT Mapped<br>(Highest Level) |
|----------------|---|------------------------------|
| CO1            | implement the basic programming concepts in java                      | Applying (K3)                |
| CO2            | identify objects and design class with constructor and overloading    | Applying (K3)                |
| CO3            | create simple applications with inheritance, interface and package    | Applying (K3)                |
| CO4            | handle multiple threads and build exception-free codes                | Applying (K3)                |
| CO5            | utilize collection framework and generic for designing generic codes. | Applying (K3)                |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO2             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO4             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO5             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             |                       | ASSESSMENT              | PATTERN - TI       | HEORY               |                      |                    |            |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |
| CAT1                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |
| CAT2                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |
| CAT3                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |
| ESE                         | 20                    | 30                      | 50                 |                     |                      |                    | 100        |

#### 20MCT22 – PYTHON PROGRAMMING

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Programming in C                | 2    | PC       | 3 | 0 | 0 | 3      |

| Preamble                        | To make the students to be able to create and run scripts using Python for a real time applications.   |  |  |  |  |  |  |  |
|---------------------------------|--|--|--|--|--|--|--|--|
| Unit - I                        | Python Basics: 9   |  |  |  |  |  |  |  |
| Introduction t<br>Statements -  | htroduction to Python – Writing our First Python Program – Data types in python- operators in python – output statements – Input<br>Statements - command Line Arguments.   |  |  |  |  |  |  |  |
| Unit - II                       | Control Statements, Arrays and Strings: 9  |  |  |  |  |  |  |  |
| Control State<br>assert – retur | Control Statements: if – if else – if elif else – while Loop – for Loop - Infinite Loops- Nested loops – break – continue – pass –<br>assert – return. Arrays in python-strings and characters –Functions.               |  |  |  |  |  |  |  |
| Unit - III                      | Collections, Data Structures and Regular Expressions: 9  |  |  |  |  |  |  |  |
| Lists and Tup<br>– Quantifiers  | oles: List – Tuples –Dictionaries - Linked Lists – Stacks – Queues- Deques – Regular Expressions : Sequence characters – Special character – using Regular Expression on files – Retrieving Information from a HTML file |  |  |  |  |  |  |  |
| Unit - IV                       | Python Advances: 9   |  |  |  |  |  |  |  |
| Files: Types<br>unzipping file  | Files: Types - open, close and working file - Binary files- with statement - seek() and tell() methods- Access binary files - zipping and unzipping files - Date and Time - Python's Database Connectivity.              |  |  |  |  |  |  |  |
| Unit - V                        | Graphical User Interface and Data Science: 9   |  |  |  |  |  |  |  |
| Graphical Us                    | er Interface : GUI in Python -Root window -fonts and colors - containers -Canvas - Frame -Widgets : Button -Label -  |  |  |  |  |  |  |  |

Message – Text – Scrollbar – Check and Radio button – Spin and List box – Menu - Data Science Using Python: Data Frame - Data Visualization.

#### **REFERENCES:**

NageswaraRao R., "Core Python Programming", 2<sup>nd</sup> Edition, Dreamtech Press, New Delhi, 2018.
 Kenneth A. Lambert, "Fundamentals of Python – First Programs", 2<sup>nd</sup> Edition, Cengage Publication, New Delhi, 2019.

3. Paul Barry, "Head First Python", 2<sup>nd</sup> Edition, O'Reilly Media, Beijing, 2016.

| COUF<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to             |               |  |  |  |  |  |
|---------------|---|---------------|--|--|--|--|--|
| CO1           | demonstrate the fundamental concepts of python programming                                | Applying (K3) |  |  |  |  |  |
| CO2           | implement control statements, arrays, strings and functions concept in python programming | Applying (K3) |  |  |  |  |  |
| CO3           | develop python programs with collections, data structures and regular expressions         | Applying (K3) |  |  |  |  |  |
| CO4           | Manipulate files, database connectivity & date and time concepts in python                | Applying (K3) |  |  |  |  |  |
| CO5           | solve real world problems using GUI and Data Science.                                     | Applying (K3) |  |  |  |  |  |

|                 | Mapping of COs with POs and PSOs   |          |          |           |         |         |    |  |  |  |  |  |   |   |
|-----------------|--|----------|----------|-----------|---------|---------|----|--|--|--|--|--|---|---|
| COs/POs         | COs/POs         PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01         PS02 |          |          |           |         |         |    |  |  |  |  |  |   |   |
| CO1             | 3  | 3        | 2        | 2         | 1       |         |    |  |  |  |  |  | 3 | 1 |
| CO2             | 3  | 3        | 2        | 2         | 1       |         |    |  |  |  |  |  | 3 | 1 |
| CO3             | 3  | 3        | 2        | 2         | 1       |         |    |  |  |  |  |  | 3 | 1 |
| CO4             | 3  | 3        | 2        | 2         | 1       |         |    |  |  |  |  |  | 3 | 1 |
| CO5             | 3  | 3        | 2        | 2         | 1       |         |    |  |  |  |  |  | 3 | 1 |
| 1 – Slight, 2 – | Moderat  | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny |  |  |  |  |  |   |   |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |  |
| CAT1                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT2                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT3                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| ESE                         | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |  |  |  |  |  |

### 20MCT23 - MACHINE LEARNING

| Programme &<br>Branch | Master of Computer Applications          | Sem. | Category | L | т | Ρ | Credit |
|-----------------------|--|------|----------|---|---|---|--------|
| Prerequisites         | Artificial Intelligence and Applications | 2    | PC       | 3 | 0 | 0 | 3      |

| Preamble   | To enable students to apply machine learning concepts in real life problems.   |    |  |  |  |  |  |  |  |  |  |
|--|--|----|--|--|--|--|--|--|--|--|--|
| Unit - I   | Introduction to Machine Learning:  | 9  |  |  |  |  |  |  |  |  |  |
| Probability Th   | neory – Model Selection – The Curse of Dimensionality – Decision Theory – Information Theory.  |    |  |  |  |  |  |  |  |  |  |
| Unit - II  | Probability Distributions:   | 9  |  |  |  |  |  |  |  |  |  |
| Binary Variables - Multinomial Variables - The Gaussian Distribution - The Exponential Family- Nonparametric Methods.                                      |  |    |  |  |  |  |  |  |  |  |  |
| Unit - III   | Linear Models for Regression:  | 9  |  |  |  |  |  |  |  |  |  |
| Linear Basis<br>Evidence App   | Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison - Tl<br>proximation - Limitations of Fixed Basis Functions. | пe |  |  |  |  |  |  |  |  |  |
| Unit - IV  | Linear Models for Classification:  | 9  |  |  |  |  |  |  |  |  |  |
| Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models - The Laplace Approximation - Bayesian Logistic Regression. |  |    |  |  |  |  |  |  |  |  |  |
| Unit – V   | Neural Networks:   | 9  |  |  |  |  |  |  |  |  |  |
| Feed-forward<br>–Mixture Den   | Network Functions - Network Training - Error Back propagation - The Hessian Matrix - Regularization in Neural Networ<br>sity Networks - Bayesian Neural Networks.      | ĸs |  |  |  |  |  |  |  |  |  |

#### **REFERENCES:**

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Revised Edition, Springer, 2016.

2. EthemAlpaydin, "Introduction to Machine Learning", 4<sup>th</sup> Edition, MIT Press, 2020.

3. AurelienGeron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2<sup>nd</sup> Edition, O'Reilly, 2019.

| COUR<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to                                  |                    |  |  |  |  |  |  |
|---------------|--|--------------------|--|--|--|--|--|--|
| CO1           | acquire knowledge about basic concepts of Machine Learning   | Understanding (K2) |  |  |  |  |  |  |
| CO2           | summarize the relationship between possible values and their probability for a random variable.                | Understanding (K2) |  |  |  |  |  |  |
| CO3           | apply Linear Regression in real world problem like business to evaluate trends and make estimates or forecasts | Applying(K3)       |  |  |  |  |  |  |
| CO4           | solve the given problems using classification for prediction   | Applying(K3)       |  |  |  |  |  |  |
| CO5           | formalize the given problem, to solve it by using a neural network   | Applying (K3)      |  |  |  |  |  |  |

|                 | Mapping of COs with POs and PSOs   |          |          |           |         |         |    |  |  |  |  |  |  |  |
|-----------------|--|----------|----------|-----------|---------|---------|----|--|--|--|--|--|--|--|
| COs/POs         | COs/POs         PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01         PS02 |          |          |           |         |         |    |  |  |  |  |  |  |  |
| CO1 2 1         |  |          |          |           |         |         |    |  |  |  |  |  |  |  |
| CO2             | CO2 2 1  |          |          |           |         |         |    |  |  |  |  |  |  |  |
| CO3             | 3  | 2        | 1        | 1         |         |         |    |  |  |  |  |  |  |  |
| CO4             | 3  | 2        | 1        | 1         |         |         |    |  |  |  |  |  |  |  |
| CO5             | 3  | 2        | 1        | 1         |         |         |    |  |  |  |  |  |  |  |
| 1 – Slight, 2 – | Moderat  | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny |  |  |  |  |  |  |  |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |  |
| CAT1                        | 20                    | 80                      |                    |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT2                        | 15                    | 30                      | 55                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT3                        | 10                    | 20                      | 70                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| ESE                         | 15                    | 40                      | 45                 |                     |                      |                    | 100        |  |  |  |  |  |  |

## 20MCT24 - OPERATING SYSTEMS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Data Structures and Algorithms  | 2    | PC       | 3 | 1 | 0 | 4      |

| Preamble                               | To acquire the knowledge of how computer performs its internal processing.   |                 |
|--|--|-----------------|
| Unit - I                               | Operating Systems Overview:  | <del>)</del> +3 |
| Introduction:<br>Process – Pro         | Computer System Organization – Architecture – Structure – Operations – OS Structures: Services – System Ca<br>ocess Control – File – Device Management – Information Maintenance - Communication                                   | ills:           |
| Unit - II                              | Process Management:  | <del>}</del> +3 |
| Processes: F<br>Synchronizat<br>Robin. | Process concepts – Scheduling - Operations on Process – Inter Process Communication - Threads: Threading Model<br>ion: Peterson's Solution – Semaphores – Scheduling: Scheduling Criteria – Algorithms: FCFS – SJF – Priority – Ro | s –<br>und      |
| Unit - III                             | Deadlock:  | <del>)</del> +3 |
| Characterizat<br>Avoidance: B          | ion: Conditions – Resource Allocation Graph – Methods for Handling Deadlocks: Deadlock Prevention – Deadle anker's Algorithm – Deadlock Detection – Recovery from Deadlock.  | ock             |
| Unit - IV                              | Memory Management:   | <del>)</del> +3 |
| Main Memor<br>Demand Pag               | y: Contiguous Memory Allocation - Paging – Structure of Page Table – Segmentation - Virtual Memory: Swappin<br>ing – Copy on Write - Page Replacement Algorithms: FIFO, Optimal and LRU.   | g -             |
| Unit - V                               | Storage Management:  | <del>)</del> +3 |
| Mass Storage<br>Management             | e Structure: Disk Structure – Attachment – Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOC<br>- File System: Concepts – Access Methods – Directory Structure –Implementation: Allocation Methods.                     | )K–             |

#### **REFERENCES:**

## Lecture: 45, Tutorial:15, Total: 60

Abraham Silberschatz, Greg Gagne, Peter B. Galvin, "Operating System Concepts", 10th Edition, John Wiley & Sons Inc., USA, 1. 2018. 2. Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", 4<sup>th</sup> Edition, Pearson Education India, 2016.

3. William Stallings, "Operating Systems: Internals and Design Principles", 9<sup>th</sup> Edition, Pearson Education India, 2017.

## COURSE OUTCOMES:

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                          | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | recognize the knowledge of system organization and its structure.                             | Understanding (K2)           |
| CO2           | explain various process management strategies including synchronization and scheduling        | Applying (K3)                |
| CO3           | determine the existence of deadlock and evaluate the safe state                               | Applying (K3)                |
| CO4           | apply the principles of memory management techniques and various strategies                   | Applying (K3)                |
| CO5           | analyze and evaluate the disk scheduling policies with respect to different storage structure | Analyzing (K4)               |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      | 1    | 2    |
| CO2             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      | 1    | 2    |
| CO3             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      | 1    | 2    |
| CO4             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      | 1    | 2    |
| CO5             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      | 2    | 3    |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY              |    |                                    |    |                      |                    |            |  |  |  |  |  |  |
|-----------------------------|--|----|------------------------------------|----|----------------------|--------------------|------------|--|--|--|--|--|--|
| Test / Bloom's<br>Category* | Test / Bloom'sRememberingCategory*(K1) % |    | rstanding Applying<br>K2) % (K3) % |    | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |  |
| CAT1                        | 20                                       | 40 | 40                                 |    |                      |                    | 100        |  |  |  |  |  |  |
| CAT2                        | 20                                       | 20 | 60                                 |    |                      |                    | 100        |  |  |  |  |  |  |
| CAT3                        |  | 40 | 40                                 | 20 |                      |                    | 100        |  |  |  |  |  |  |
| ESE                         | 20                                       | 30 | 40                                 | 10 |                      |                    | 100        |  |  |  |  |  |  |

## 20MCL21 - OBJECT ORIENTED PROGRAMMING LABORATORY

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 2    | PC       | 0 | 0 | 4 | 2      |

#### List of Exercises / Experiments :

| 1.  | Write a Java Program to work with Operators and Control Structures.   |
|-----|---|
| 2.  | Design a Java Program with Class, Objects and Constructors.   |
| 3.  | Write a Java Program to implement Overloading in Java.  |
| 4.  | Write a Java Program on Inheritance.  |
| 5.  | Write a Java Program to implement Runtime Polymorphism and Interface.   |
| 6.  | Design a Java Program to implement the User-Defined Package.  |
| 7.  | Create a Java Program with Threads.   |
| 8.  | Write a Java Program to handle the Exception.   |
| 9.  | Design a Java Program to demonstrate the Collection classes ArrayList, LinkedList, HashSet, TreeSet, PriorityQueue. |
| 10. | Design a Java Program to demonstrate the Map classes HashMap and TreeMap.   |

#### **REFERENCES/MANUAL/SOFTWARE:**

| 1. | Operating System : Windows/Linux        |
|----|---|
| 2. | Software/IDE: Notepad/ Eclipse/Netbeans |
| 3. | Laboratory Manual                       |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to   | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | implement the basic Java Programming Concepts and Object Oriented Programming concepts like Encapsulation, Polymorphism and Inheritance. | Applying (K3)                |
| CO2           | apply Interface, User-Defined packages to develop simple applications and design Multiple Threads and Exception-free codes               | Applying (K3)                |
| CO3           | construct Applications by utilizing Collection and Map classes   | Applying (K3)                |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3                                | 2        | 1        | 1         | 1       |         |     |     |     |      |      |      |      |      |
| CO2             | 3                                | 2        | 1        | 1         | 1       |         |     |     |     |      |      |      |      |      |
| CO3             | CO3 3 2 1 1 1 1                  |          |          |           |         |         |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

## 20MCL22 - PYTHON PROGRAMMING LABORATORY

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Programming in C                | 2    | PC       | 0 | 0 | 4 | 2      |

#### List of Exercises / Experiments :

| 1.  | Explore the concept of control statement and functions in simple python programs. |
|-----|---|
| 2.  | Write a python code to perform various operations with strings and arrays         |
| 3.  | Perform various operations in tuple and list                                      |
| 4.  | Perform various operations in Dictionary  |
| 5.  | Show the performance Date and Time module in Python                               |
| 6.  | Design a python program to implement different types of file functions            |
| 7.  | Develop a Python code to interact with Databases                                  |
| 8.  | Show the performances of various controls in GUI Programming                      |
| 9.  | Practice the techniques in data science to extract the knowledge                  |
| 10. | Show the functions of Matplotlib to visualize the data                            |

#### **REFERENCES/MANUAL/SOFTWARE:**

| 1. | Operating System : Windows/Linux |   |  |  |  |  |  |  |  |
|----|----------------------------------|---|--|--|--|--|--|--|--|
| 2. | Software : Note                  | Software : NotePad++, Python Packages, IDE etc. |  |  |  |  |  |  |  |
| 3. | Laboratory Manual                |   |  |  |  |  |  |  |  |

## COURSE OUTCOMES

| COUF<br>On co | RSE OUTCOMES:<br>mpletion of the course, the students will be able to           | BT Mapped<br>(Highest Level)      |
|---------------|---|-----------------------------------|
| CO1           | use the fundamental features of the Python programming language                 | Analyzing (K4),<br>Precision (S3) |
| CO2           | compare the performance of various datastructures in python                     | Applying (K3),<br>Precision (S3)  |
| CO3           | develop real time applications using database programming ,GUI and Data science | Applying (K3),<br>Precision (S3)  |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      | 1    | 1    |
| CO2             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      | 2    | 1    |
| CO3             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      | 3    | 1    |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

Total: 60

## 20MCL23 - MACHINE LEARNING LABORATORY

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 2    | PC       | 0 | 0 | 4 | 2      |

#### List of Exercises / Experiments :

| 1.  | Write a program demonstrate the Find-S algorithm for finding most specific hypothesis   |
|-----|---|
| 2.  | For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples |
| 3.  | Write a program to demonstrate the working of the decision tree based ID3 algorithm   |
| 4.  | Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets   |
| 5.  | Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.  |
| 6.  | Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering     |
| 7.  | Write a program to implement k-Nearest Neighbor algorithm to classify the data set  |
| 8.  | Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs   |
| 9.  | Write a program to implement linear regression using statistics on the training data to estimate the coefficients required by the model to make predictions on new data   |
| 10. | Write a program to implement K-means algorithm to cluster a set of data   |

## Total: 60

#### **REFERENCES/MANUAL/SOFTWARE:**

| 1. | Operating System : Windows/Linux      |
|----|---------------------------------------|
| 2. | Software : Python packages, IDE etc., |
| 3. | Laboratory Manual                     |
|    |                                       |

| COUF<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to |                                     |  |  |  |  |  |  |
|---------------|---|-------------------------------------|--|--|--|--|--|--|
| CO1           | understand the implementation procedures for the machine learning algorithms  | Applying (K3),<br>Manipulation (S2) |  |  |  |  |  |  |
| CO2           | apply appropriate data sets to the machine learning algorithms                | Applying (K3),<br>Precision (S3)    |  |  |  |  |  |  |
| CO3           | identify and apply machine learning algorithms to solve real world problems   | Applying (K3),<br>Precision (S3)    |  |  |  |  |  |  |

| Mapping of COs with POs and PSOs |   |     |     |     |     |     |     |     |     |      |      |      |      |      |
|----------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs                          | P01   | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                              | 3   | 3   | 3   | 1   | 1   |     |     |     |     |      |      |      | 2    | 1    |
| CO2                              | 3   | 3   | 3   | 1   | 1   |     |     |     |     |      |      |      | 2    | 1    |
| CO3                              | 3   | 3   | 3   | 1   | 1   |     |     |     |     |      |      |      | 2    | 1    |
| 1 – Slight, 2 –                  | 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

#### 20GEL21 - PROFESSIONAL SKILLS TRAINING

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 2    | PC       | 0 | 0 | 4 | 2      |

| Preamble | This subject is to enhance the employability skills and to develop career competency |  |
|----------|--|--|
| Unit – I | Soft skills:   |  |

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work – environment-Need for change- Fears, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge up gradation-Self-confidence.

Professional grooming and practices: Basics of corporate culture-Key pillars of business etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language.

**Group discussions:** Advantages of group discussions-Structured GD- **Team work:** Value of team work in organizations- Definition of a team, why team-Elements of leadership, disadvantages of a team, stages of team formation- Group development activities. **Facing an interview:** Foundation in core subject- industry orientation / knowledge about the company- professional personality-Communication skills-Activities before Interview, upon entering interview room, during the interview and at the end Mock interviews.

#### Unit – II Quantitative Aptitude & Logical Reasoning

**Problem solving:** Number Systems - LCM/HCF - divisibility - Simple Equations - Ratio Proportion Variations - Percentages; Profit and Loss - Partnerships - Simple Interest Compound Interest - Averages - Mixtures and Allegations - Time and Work - Time and Distance - Data Interpretations-Tables - Bar Graph - Line Graph - Pie Chart - Caselets - Geometry - Mensuration - Permutation and Combinations - Probability - Quadratic Equations - Special Equations and Inequalities - Sequence and Series - Statistics - Logarithms - Data Sufficiency - Trigonometry - Coordinate Geometry.

**Logical reasoning:** Letter Series - Number Series - Blood Relations - Direction Sense - Coding-Decoding - Symbols and Notations - Clocks and Calendars - Puzzles - Seating Arrangement (Linear and Circular) - Selections and Distributions - Cubes - Venn Diagrams - Deductions/Syllogism - Cyrptogrithms - Flaw Detection - Binary Logic

#### Unit - III Written Communication & Verbal Aptitude

**Writing Skills:** Importance of Résumés Writing a Cover letter – Writing a fresher's CV / Résumés – Professional e-mail Writing – Technical Report writing – Interpretation of Technical Data (Transcoding) – Writing One-page Essays; **Verbal Aptitude:** Synonyms – Antonyms – Homonyms – One-word substitution – Idioms and Phrases – Paired words – Analogies – Spelling test – Cloze test; Spotting Errors – Sentence Correction and Formation – Grammar Based questions (Transformation: Active-Passive & Direct-Indirect); Rearranging Jumbled Sentences & Jumbled paragraphs, Identifying Facts, Inferences and Judgements statements; **Reading:** Reading comprehension – Descriptive, Inferential, & Argumentative reading passages – global reading/skimming for general understanding – scanning for specific information – understanding the development of an argument – identifying the writer's attitude and opinions; **Speaking:** Mock Interviews –Self-Introduction; Conversational Practices – Role Play – Short Talks / TED Talks –Extempore; Giving a Presentation on Various Topics – Technical / Non-Technical Topics – Project Review Presentation – Group Discussion –Skills Assessed – Telephonic Conversation & Etiquette

#### **REFERENCES:**

| 1. | Dr. Aggarwal R.S., "Quantitative Aptitude for Competitive Examinations", S. Chand Publications, 2017.   |
|----|---|
| 2. | Thorpe, Showick & Edgar Thorpe, "Objective English For Competitive Examination", 6th Edition, Pearson India Education Services Pvt. Ltd., 2017.               |
| 3. | Dr. Aggarwal R.S., "A Modern Approach to Logical Reasoning", S. Chand Publications, 2018.   |
| 4. | Bailey Stephen, "Academic Writing: A practical guide for students", Routledge, New York, 2011.  |
| 5. | Raman, Meenakshi and Sharma, Sangeeta, "Technical Communication- Principles and Practice", 3 <sup>rd</sup> Edition, Oxford University Press, New Delhi, 2015. |
| 6. | Thorpe, Showick and Edgar Thorpe, "Winning at Interviews", 5 <sup>th</sup> Edition, Pearson Education, India, 2013,   |



| COUF<br>On co | BT Mapped<br>(Highest Level)   |                                  |
|---------------|--|----------------------------------|
| CO1           | develop the soft skills to work efficiently in an organization as an individual and as a team                                | Applying (K3),<br>Precision (S3) |
| CO2           | solve the real time problems using numerical ability and logical reasoning   | Applying (K3),<br>Precision (S3) |
| CO3           | apply communication skills effectively to understand and deliver information for various academic and professional purposes. | Applying (K3),<br>Precision (S3) |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3                                | 2        | 0        | 0         | 0       | 3       | 3   | 0   | 3   | 0    | 3    | 2    |      |      |
| CO2             | 3                                | 2        | 0        | 0         | 0       | 3       | 3   | 0   | 3   | 0    | 3    | 2    |      |      |
| CO3             | 0                                | 2        | 0        | 0         | 0       | 3       | 3   | 0   | 3   | 3    | 3    | 2    |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |  |
| CAT1                        | 20                          | 40                      | 40                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT2                        |                             | 50                      | 50                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT3                        |                             | 50                      | 50                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| ESE                         | -                           | -                       | -                  | -                   | -                    | -                  | -          |  |  |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks)

#### 20MCT31 - DATA COMMUNICATION NETWORKS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 3    | PC       | 3 | 1 | 0 | 4      |

| Preamble   | To provide the basic concepts of wired and wireless networking model with different communication techniques protocols.   | s and           |
|--|---|-----------------|
| Unit – I   | Network Fundamentals:   | 9+3             |
| Introduction -<br>Transmission                   | Network Models: OSI Model - TCP/ IP Protocol Suite – Addressing. Data and Signals: Analog and Digital Sign Impairment.  | nals -          |
| Unit – II  | Transmission Media and Switching:   | 9+3             |
| Guided and<br>Correction: Ir<br>Controlled Ac    | Unguided Media - Circuit Switched Networks - Datagram Networks - Virtual Circuit Networks. Error Detection<br>troduction – Block Coding – Linear Block Codes – Cyclic Codes – Check Sum. Multiple Access: Random Acce<br>cess – Channelization. | n and<br>ess –  |
| Unit - III                                       | Logical Addressing:   | 9+3             |
| IPv4 - IPv6 A<br>Improve QoS                     | Addresses. Process to Process Delivery: UDP - TCP - Congestion Control – Quality of Service (QoS) – Techniqu  | ies to          |
| Unit - IV  | Wireless Communication:   | 9+3             |
| Introduction.<br>Division Multi<br>Multiple Acce | Spread Spectrum: Transmission - Multiplexing. Medium Access Control: Motivational for a Specialized MAC - S<br>ple Access (SDMA) - Frequency Division Multiple Access (FDMA) - Time Division Multiple Access (TDMA) - Code Div<br>ss (CDMA).    | Space<br>vision |
| Unit – V   | Mobile Telecommunication Systems:   | 9+3             |
| GSM Archited<br>(VANET): Ove                     | cture, Services and Protocols - Localization and Calling – Handover – Mobile IP – DHCP. Vehicular Ad Hoc Netwer<br>Prview – Applications.   | works           |

## Lecture:45, Tutorial:15, Total:60

#### **REFERENCES:**

| 1. | Forouzan Behrouz A.,     | "Data | Communication | and | Networking", | 5 <sup>th</sup> | Edition, | Tata | McGraw | Hill | Publishing | Company, | New | Delhi, |
|----|--------------------------|-------|---------------|-----|--------------|-----------------|----------|------|--------|------|------------|----------|-----|--------|
|    | 2018. (Unit I, II, III). |       |               |     |              |                 |          |      |        |      |            |          |     |        |

2. Schiller Jochen, "Mobile Communications", 2<sup>nd</sup> Edition, Pearson Education, New Delhi, 2012. (Unit IV, V)

3. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", 1<sup>st</sup> Edition, PHI Learning Pvt. Ltd, New Delhi, 2012

| COUR<br>On cor | COURSE OUTCOMES:<br>On completion of the course, the students will be able to   |                    |  |  |  |  |  |
|----------------|---|--------------------|--|--|--|--|--|
| CO1            | describe the network models, addresses and signals.   | Understanding (K2) |  |  |  |  |  |
| CO2            | use the different switching techniques and illustrate the various error and flow control mechanisms.                            | Applying (K3)      |  |  |  |  |  |
| CO3            | determine the logical addressing and discover an appropriate process delivery mechanism, congestion control techniques for QoS. | Applying (K3)      |  |  |  |  |  |
| CO4            | use the effective security mechanisms for Network Access Control and Cloud Security   | Applying (K3)      |  |  |  |  |  |
| CO5            | illustrate the generation of telecommunication systems in wireless networks.  | Understanding (K2) |  |  |  |  |  |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 1   |     |     |     |     |     |     |     |      |      |      | 1    | 2    |
| CO2             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      | 1    | 2    |
| CO3             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      | 1    | 2    |
| CO4             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      | 1    | 2    |
| CO5             | 2   | 1   |     |     |     |     |     |     |     |      |      |      | 2    | 3    |
| 1 – Slight, 2 – | - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |
| CAT1                        | 20                          | 60                      | 20                 |                     |                      |                    | 100        |
| CAT2                        | 20                          | 50                      | 30                 |                     |                      |                    | 100        |
| CAT3                        | 20                          | 50                      | 30                 |                     |                      |                    | 100        |
| ESE                         | 20                          | 50                      | 30                 |                     |                      |                    | 100        |

## 20MCT32 - CLOUD COMPUTING TECHNOLOGIES

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Data Communication Networks     | 3    | PC       | 3 | 0 | 0 | 3      |

| Duranut                          | To be survived a survey to a formul Analytic structure and Operation Markets   |       |
|----------------------------------|--|-------|
| Preamble                         | To learn the various concepts of cloud Architectures and Service Models  |       |
| Unit - I                         | Cloud Computing Fundamentals, Architecture:  | 9     |
| Define Cloud<br>Exploring the    | Computing – Cloud Types – Examining the Characteristics – Benefits, Disadvantages – Cloud Computing Architect Cloud Computing Stack - Connecting to the Cloud  | ure - |
| Unit - II                        | Understanding Services and Virtualization:   | 9     |
| Infrastructure<br>Virtualization | as a Services - Platform as a Service - Software as a Service - Identity as a Service – Compliance as a Servic<br>Technologies – Load Balancing and Virtualization - Understanding Hypervisors.      | ice – |
| Unit - III                       | Web Services and Microsoft Cloud Services:   | 9     |
| GoogleWeb S<br>Amazon Data       | Services - Amazon WebServices - Components – Working with the Elastic Compute Cloud – Amazon Storage Syste abase Services - Microsoft Cloud Services.  | •ms - |
| Unit - IV                        | Cloud Security and Web Mail Services:  | 9     |
| Securing the<br>Exploring the    | Cloud - Securing Data - Establishing Identity and Presence - Working with Productivity Software - Web Mail Serv<br>Cloud Mail Services - Exploring Instant Messages.                                 | ices: |
| Unit - V                         | Streaming Process and Mobile Cloud:  | 9     |
| Audio Strean<br>Using Smart      | ning - Working with VoIP Applications – Video Streaming - Working with Mobile Devices - Defining the Mobile Mar<br>shones with the Cloud - Research in Motion BlackBerry – Symbian - Windows Mobile. | ket - |

#### **REFERENCES:**

## Total: 45

1. Barrie Sosinsky, "Cloud Computing", 1<sup>st</sup> Edition, Wiley Publishing inc, Canada, 2018.

2. Rajkumar Buyya, Christian Vecchiola., ThamaraiSelvi.S, "Mastering Cloud Computing", 1<sup>st</sup> Edition, McGraw Hill, 2015.

 Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", 1<sup>st</sup> Edition, Morgan Kaufmann, Elsevier, 2012.

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                                      | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | acquire Knowledge on the features and development of cloud computing                                      | Understanding (K2)           |
| CO2           | execute the cloud services and the principles of virtualization   | Applying (K3)                |
| CO3           | discover the google App engine PaaS cloud service, Amazon web services                                    | Analyzing (K4)               |
| CO4           | learn the identity is used to allow secure cloud access   | Analyzing (K4)               |
| CO5           | operate the appropriate cloud computing solutions and recommendations according to the applications used. | Applying (K3)                |

|                 | Mapping of COs with POs and PSOs   |   |   |   |  |  |  |  |  |  |  |   |   |
|-----------------|--|---|---|---|--|--|--|--|--|--|--|---|---|
| COs/POs         | COs/POs         PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01         PS02 |   |   |   |  |  |  |  |  |  |  |   |   |
| CO1             | 2  | 2 |   |   |  |  |  |  |  |  |  | 1 | 1 |
| CO2             | 3  | 2 | 3 | 1 |  |  |  |  |  |  |  | 2 | 3 |
| CO3             | 3  | 3 |   |   |  |  |  |  |  |  |  | 1 | 1 |
| CO4             | 3  | 2 | 1 | 1 |  |  |  |  |  |  |  | 2 | 3 |
| CO5             | 3  | 3 | 2 | 2 |  |  |  |  |  |  |  | 2 | 1 |
| 1 – Slight, 2 – | - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy  |   |   |   |  |  |  |  |  |  |  |   |   |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |
| CAT1                        | 10                          | 30                      | 60                 |                     |                      |                    | 100        |
| CAT2                        | 10                          | 20                      | 30                 | 40                  |                      |                    | 100        |
| CAT3                        | 10                          | 20                      | 30                 | 40                  |                      |                    | 100        |
| ESE                         | 10                          | 20                      | 40                 | 30                  |                      |                    | 100        |

## 20MCL31 - CLOUD COMPUTING TECHNOLOGIES LABORATORY

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Data Communication Networks     | 3    | PC       | 0 | 0 | 4 | 2      |

#### List of Exercises / Experiments :

| 1.  | Install a C compiler in the virtual machine and execute a sample program  |
|-----|---|
| 2.  | Create popular websites using Drupal CMS  |
| 3.  | Create a Customer Relationship Management System (CRM) using salesforce.com portal.                                 |
| 4.  | Launching RDS Instance in AWS platform  |
| 5.  | Develop and deploy an application using Microsoft Azure   |
| 6.  | Design scheduler and personal information management using zohoworkerly   |
| 7.  | Implement the online office system in google cloud software   |
| 8.  | Create and use a repository using github  |
| 9.  | Design and develop an PaaS-based platform enabling users to configure and deploy database apps using wolf framework |
| 10. | Create visually appealing data visualizations and insightful dashboards using Zoho                                  |

#### **REFERENCES/MANUAL/SOFTWARE:**

| 1. | perating System : Windows/Linux |  |  |  |  |  |  |
|----|---------------------------------|--|--|--|--|--|--|
| 2. | Software : open source          |  |  |  |  |  |  |
| 3. | Laboratory Manual               |  |  |  |  |  |  |

| COUR<br>On cor | SE OUTCOMES:<br>mpletion of the course, the students will be able to | BT Mapped<br>(Highest Level)    |
|----------------|--|---------------------------------|
| CO1            | use and examine different cloud computing services                   | Applying(K3),<br>Precision (S3) |
| CO2            | design and develop cloud applications using productivity softwares   | Applying(K3),<br>Precision (S3) |
| CO3            | deploy an application on cloud platform                              | Applying(K3),<br>Precision (S3) |

|                 | Mapping of COs with POs and PSOs                                |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 3   | 3   |     | 2   | 3   |     |     |     |      |      |      | 2    | 1    |
| CO2             | 3   | 2   | 1   | 1   | 2   | 3   |     |     |     |      |      |      | 2    | 1    |
| CO3             | 3   | 2   | 1   | 1   | 3   | 3   |     |     |     |      |      |      | 2    | 1    |
| 1 - Slight, 2 - | 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

| Programme &<br>Branch | Master of Computer Applications  | Sem. | Category | L | Т | Р | Credit |
|-----------------------|--|------|----------|---|---|---|--------|
| Prerequisites         | Data Structures and Algorithms, Database<br>Technologies, Software Engineering Methodologies,<br>Programming Languages | 3    | EC       | 0 | 0 | 4 | 2      |

## 20MCP31 - MINI PROJECT

## List of Exercises / Experiments :

| <mark>1.</mark> | Identification of real time problem.                                 |  |
|-----------------|--|--|
| <mark>2.</mark> | Literature survey and exploring different solutions for the problem. |  |
| <mark>3.</mark> | System requirements and specification.                               |  |
| <mark>4.</mark> | Model development and Design methodologies                           |  |
| <mark>5.</mark> | Implementation and Testing.  |  |
| <mark>6.</mark> | Report preparation.  |  |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to   | BT Mapped<br>(Highest Level)             |
|---------------|--|--|
| CO1           | understand the programming language concepts or go through research activities.  | Understanding (K2),<br>Manipulation (S2) |
| CO2           | plan, analyze, design and implement a software project or gather knowledge over the field of research and design or plan about the proposed work.      | Analyzing (K4),<br>Precision (S3)        |
| CO3           | learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project. | Applying (K3),<br>Precision (S3)         |

|                 | Mapping of COs with POs and PSOs |           |          |           |         |        |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|-----------|----------|-----------|---------|--------|-----|-----|-----|------|------|------|------|------|
| COs/Pos         | PO1                              | PO2       | PO3      | PO4       | PO5     | P06    | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3                                | 2         | 1        | 1         | 2       | 2      | 2   |     | 1   | 1    | 1    | 1    | 1    | 1    |
| CO2             | 3                                | 2         | 1        | 1         | 2       | 2      | 2   |     | 1   | 1    | 1    | 2    | 2    | 1    |
| CO3             | 3                                | 2         | 1        | 1         |         |        |     | 3   | 3   | 3    | 3    | 3    | 3    | 1    |
| 1 – Slight, 2 – | Modera                           | te, 3 – S | ubstanti | al, BT- I | Bloom's | Taxono | my  |     |     |      |      |      |      |      |

## 20MCP41 - PROJECT WORK

| Programme &<br>Branch | Master of Computer Applications  | Sem. | Category | L | т | Р  | Credit |
|-----------------------|--|------|----------|---|---|----|--------|
| Prerequisites         | Data Structures and Algorithms, Database<br>Technologies, Software Engineering Methodologies,<br>Programming Languages | 4    | EC       | 0 | 0 | 24 | 12     |

## List of Exercises / Experiments :

| <mark>1.</mark> | <ul> <li>Preparing a brief project proposal including</li> <li>Problem Identification</li> <li>Literature Survey</li> <li>System requirements and specification</li> <li>Model Development and Design Methodologies</li> <li>Time Line activities</li> </ul> |
|-----------------|--|
| 2.              | A report highlighting the design finalization based on [functional requirements & standards (if any)].   |
| 3.              | <ul> <li>A presentation including the following:         <ul> <li>Implementation phase(Hardware/software/both)</li> <li>Testing &amp; Validation of the system</li> </ul> </li> </ul>  |
| 4.              | Consolidate report preparation.  |
| 5.              | Project Publications   |

| COUF<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to   | BT Mapped<br>(Highest Level)             |
|---------------|--|--|
| CO1           | understand programming language concepts or go through research activities.  | Understanding (K2),<br>Manipulation (S2) |
| CO2           | plan, analyze, design and implement a software project or gather knowledge over the field of research and design or plan about the proposed work.      | Analyzing (K4),<br>Precision (S3)        |
| CO3           | learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project. | Applying (K3),<br>Precision (S3)         |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3                                | 2        | 1        | 1         | 2       | 2       | 2   |     | 1   | 1    | 1    | 1    | 1    | 1    |
| CO2             | 3                                | 2        | 1        | 1         | 2       | 2       | 2   |     | 1   | 1    | 1    | 2    | 2    | 1    |
| CO3             | 3                                | 2        | 1        | 1         |         |         |     | 3   | 3   | 3    | 3    | 3    | 3    | 1    |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

## 20MCE01 - ARTIFICIAL INTELLIGENCE AND APPLICATIONS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 2    | PE       | 3 | 1 | 0 | 4      |

| Preamble                        | To provide an introduction to the basic principles and applications of Artificial Intelligence.   |      |
|---------------------------------|---|------|
| Unit - I                        | Introduction:   | 9+3  |
| The Foundat<br>Behaviour – I    | ions of Artificial Intelligence - History of AI - State of the Art - Intelligent Agents: Agents and Environments – Ge<br>Nature of Environments - Structure of Agents.                      | ood  |
| Unit - II                       | Problem Solving by Searching:   | 9+3  |
| Problem - So                    | lving Agents - Formulating Problems - Searching for Solutions - Uniformed Search Strategies – Heuristic Functions   |      |
| Unit - III                      | Logical Agents:   | 9+3  |
| Knowledge-B<br>Propositional    | Based Agents – The Wumpus World – Logic – Propositional Logic – Propositional Theorem Proving - Effec<br>Model Checking - Agents based on Propositional Logic.                              | tive |
| Unit - IV                       | Classical Planning and Knowledge Representation:  | 9+3  |
| Planning - Al<br>Representation | gorithms for Planning as State – Space Search – Planning Graphs – Other Classical Planning Approaches – Knowler<br>on – Ontological Engineering – Categories and Objects - Events.          | dge  |
| Unit - V                        | Learning:   | 9+3  |
| Forms of Lea<br>Learning – R    | arning - Supervised Learning – Learning Decision Trees – Evaluating and Choosing the Best Hypothesis – Theory egression and Classification with Linear Models – Artificial Neural Networks. | y of |

#### **REFERENCES:**

## Lecture: 45, Tutorial: 15, Total: 60

| 1. | Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3 <sup>rd</sup> Edition, Pearson Education Limited, 2016. |
|----|--|
| 2. | Calum Chace, "Surviving AI: The Promise and Peril of Artificial Intelligence", 2 <sup>nd</sup> Edition, Three CS publication, 2015.      |
| 3. | Joshi Prateek, "Artificial Intelligence with Python", 1 <sup>st</sup> Edition, Packt Publishing Ltd, 2017.                               |

| COUR<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to          |                    |  |  |  |  |  |
|---------------|--|--------------------|--|--|--|--|--|
| CO1           | recognize fundamental concepts of Artificial Intelligence                              | Understanding (K2) |  |  |  |  |  |
| CO2           | provide the techniques of Problem Solving in Artificial Intelligence                   | Applying (K3)      |  |  |  |  |  |
| CO3           | implement Logical Agents for real world problems                                       | Applying (K3)      |  |  |  |  |  |
| CO4           | gain research knowledge to develop Artificial Intelligence applications using Planning | Applying (K3)      |  |  |  |  |  |
| CO5           | model the various Learning features of Artificial Intelligence                         | Applying (K3)      |  |  |  |  |  |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1   | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 2   | 1   | 3   | 2   |     | 1   |     |     |      |      |      | 1    |      |
| CO2             | 3   | 3   | 2   | 3   | 1   |     | 2   |     |     |      |      |      | 2    | 1    |
| CO3             | 3   | 3   | 2   | 3   | 1   |     | 2   |     |     |      |      |      | 2    | 1    |
| CO4             | 3   | 3   | 2   | 3   | 1   |     | 2   |     |     |      |      |      | 2    | 1    |
| CO5             | 3   | 3   | 2   | 3   | 1   |     | 2   |     |     |      |      |      | 2    | 1    |
| 1 – Slight, 2 – | - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             |                       | ASSESSMENT              | PATTERN - T        | HEORY               |                      |                    |            |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |
| CAT1                        | 40                    | 60                      |                    |                     |                      |                    | 100        |
| CAT2                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |
| CAT3                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |
| ESE                         | 20                    | 30                      | 50                 |                     |                      |                    | 100        |

## 20MCE02 - ADVANCED DESIGN AND ANALYSIS OF ALGORITHMS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Data Structures and Algorithm   | 2    | PE       | 3 | 1 | 0 | 4      |

| Preamble                                   | To obtain a knowledge in algorithm design techniques.   |                  |
|--|---|------------------|
| Unit - I                                   | Introduction:   | 9+3              |
| Algorithm De<br>Algorithm E<br>Algorithms. | efinition - Fundamentals of Algorithmic Problem Solving - Important Problem Types - Fundamentals of the Analy fficiency: Analysis Frame Work -Asymptotic Notations - Mathematical Analysis for Non - Recursive and Recu | sis of<br>ursive |
| Unit - II                                  | Brute Force and Divide and Conquer Method:  | 9+3              |
| Selection So<br>Strassen's M               | ort – Bubble Sort – Sequential Search - String Matching - Divide and Conquer: Multiplication of Large Integers<br>Iatrix Multiplication – The Closest – Pair and Convex - Hull Problems.                                | s and            |
| Unit - III                                 | Dynamic Programming and Greedy Technique:   | 9+3              |
| Computing a<br>Memory Fun                  | a Binomial Coefficient - Warshall's and Floyd's Algorithms - Optimal Binary Search Trees - The Knapsack Problem<br>ctions - Greedy Technique: Prim's Algorithm - Kruskal's Algorithm.                                   | s and            |
| Unit - IV                                  | Iterative Improvement and Limitations of Algorithm Power:   | 9+3              |
| Iterative Imp<br>Decision Tre              | provement – The Maximum Flow Problem – Maximum Matching in Bipartite Graphs - Limitations of Algorithm P<br>es – P, NP and NP Complete Problems.  | ower:            |
| Unit - V                                   | Coping with the Limitations of Algorithm Power:   | 9+3              |
| Backtracking                               | g - Branch and Bound– Approximation Algorithms for NP - Hard Problems.  |                  |

#### **REFERENCES:**

## Lecture: 45, Tutorial: 15, Total: 60

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3<sup>rd</sup> Edition, Pearson Education, New Delhi, 2012. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2<sup>nd</sup> Edition, Galgotia 2. Publications, Hyderabad, 2011. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice 3. Hall of India, New Delhi, 2012.

## COURSE OUTCOMES:

| COUR  | SE OUTCOMES:   | BT Mapped          |
|-------|--|--------------------|
| On co | mpletion of the course, the students will be able to                       | (Highest Level)    |
| CO1   | understand the fundamental needs of algorithms in problem solving.         | Understanding (K2) |
| CO2   | solve a problem by applying brute force and divide and conquer techniques. | Applying (K3)      |
| CO3   | analyze the results by applying dynamic programming and greedy techniques. | Analyzing (K4)     |
| CO4   | identify the limitations of algorithms in problem solving                  | Applying (K3)      |
| CO5   | analyze the solution using backtracking and branch and bound techniques.   | Analyzing (K4)     |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 1   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO2             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 3   | 2   | 2   | 1   |     |     |     |     |      |      |      |      |      |
| CO4             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO5             | 3   | 3   | 2   | 2   | 1   |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |
| CAT1                        | 20                          | 40                      | 40                 |                     |                      |                    | 100        |
| CAT2                        | 20                          | 30                      | 40                 | 10                  |                      |                    | 100        |
| CAT3                        | 20                          | 30                      | 40                 | 10                  |                      |                    | 100        |
| ESE                         | 20                          | 33                      | 40                 | 7                   |                      |                    | 100        |

#### 20MCE03 - WEB TECHNOLOGIESxxxxxxxxxxx

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 2    | PE       | 3 | 1 | 0 | 4      |

| Preamble  | To be designed to create an interactive web based real time applications.  |                       |
|---|--|-----------------------|
| Unit - I  | Web Essentials:  | 9+3                   |
| Clients, Serve<br>Response Me<br>Semantics - H                | ers and Communication: The Internet - Basic Internet Protocols - The World Wide Web - HTTP Request Messa<br>essage -Web Clients - Web Servers - Markup Languages: HTML – History and Versions - Basic XHTML Syntax<br>ITML Elements - Relative URLs – Lists – Tables – Frames – Forms - XML - Creating HTML Documents.   | age -<br>c and        |
| Unit - II   | Style Sheets:  | 9+3                   |
| CSS – Featur<br>Flow Box Lay<br>Types - State                 | es - Core Syntax - Style Sheets and HTML - Style Rule Cascading and Inheritance - Text Properties - Box Model - No<br>yout - Client-Side Programming: The JavaScript Language - JavaScript in Perspective – Syntax - Variables and<br>ments - Operators – Literals – Functions – Objects – Arrays - Built-in Objects - JavaScript Debuggers.   | ormal<br>Data         |
| Unit - III  | Server Side Scripting:   | 9+3                   |
| DOM - DOM<br>Accommodati<br>Dynamic Con                       | History and Levels - Intrinsic Event Handling - Modifying Element Style -The Document Tree - DOM Event Hand<br>ng Noncompliant Browsers - Properties of Window - Server-Side Programming: Java Servlets - Architecture -Gener<br>tent - Life Cycle - Parameter Data – Sessions – Cookies.  | ling -<br>ating       |
| Unit - IV   | XML and JSP:   | 9+3                   |
| XML - Docur<br>Processing -<br>Transformatic<br>Basic JSP - T | nents and Vocabularies - Versions and Declaration - Namespaces - JavaScript and XML: Ajax - DOM based<br>Event-Oriented Parsing: SAX - Transforming XML Documents - Selecting XML Data: XPATH - Template b<br>ons: XSLT - Displaying XML Documents in Browsers - JSP Technology - JSP and Servlets - Running JSP Applicati<br>ag Libraries and Files - Model-View-Controller Paradigm. | XML<br>based<br>ons - |
| Unit - V  | Web Services:  | 9+3                   |
| JAX-RPC – (<br>Representing                                   | Concepts - Writing a Java Web Service - Writing a Java Web Service Client - Describing Web Services: WS Data Types: XML Schema - Communicating Object Data: SOAP.  | SDL -                 |

## Lecture: 45, Tutorial: 15, Total: 60

#### **REFERENCES:**

1. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", 1<sup>st</sup> Edition, Pearson Education, 2012.

2. Robert. W. Sebesta, "Programming the World Wide Web", 4<sup>th</sup> Edition, Pearson Education, 2016..

3. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", 5<sup>th</sup> Edition, Pearson Education, 2011.

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to             | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | design the Document by applying necessary HTML elements.                         | Applying (K3)                |
| CO2           | develop the Programs by applying scripting Language along with CSS Presentation. | Applying (K3)                |
| CO3           | create Dynamic web pages using server side scripting Technologies.               | Applying (K3)                |
| CO4           | create a web application using JSP Technology                                    | Applying (K3)                |
| CO5           | implement the Web Service using various kinds of web service language.           | Applying (K3)                |

| Mapping of COs with POs and PSOs |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs                          | P01 | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                              | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |

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| Mapping of COs with POs and PSOs            |   |   |   |   |  |  |  |  |  |  |  |
|---|---|---|---|---|--|--|--|--|--|--|--|
| CO2   | 3   | 2 | 1 | 1 |  |  |  |  |  |  |  |
| CO3   | 3   | 2 | 1 | 1 |  |  |  |  |  |  |  |
| CO4   | 3   | 2 | 1 | 1 |  |  |  |  |  |  |  |
| CO5         3         2         1         1 |   |   |   |   |  |  |  |  |  |  |  |
| 1 – Slight, 2 –                             | 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |   |   |   |  |  |  |  |  |  |  |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |
| CAT1                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |
| CAT2                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |
| CAT3                        | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |
| ESE                         | 20                    | 30                      | 50                 |                     |                      |                    | 100        |  |  |

#### 20MCE04 - RESEARCH METHODOLOGIES

|  | Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Ρ | Credit |
|--|-----------------------|---------------------------------|------|----------|---|---|---|--------|
|--|-----------------------|---------------------------------|------|----------|---|---|---|--------|

| Prerequisites | NIL | 2 | PE | 3 | 1 | 0 | 4 |
|---------------|-----|---|----|---|---|---|---|
|               |     |   |    |   |   |   |   |

| Preamble  | o familiarize the fundamental perceptions and methods adopted in research and to provide knowledge in intellectual roperty and patenting laws.   |  |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|--|--|
| Unit - I  | Research Methodology: 9+3  |  |  |  |  |  |  |  |  |
| Overview of<br>Collection and   | Research Methodology: Introduction – Mathematical Tool for Analysis - Types of Research - Research Process - Data<br>d Presentation: Introduction – Primary Data – Secondary Data – Data Presentation  |  |  |  |  |  |  |  |  |
| Unit - II   | Measures: 9+3  |  |  |  |  |  |  |  |  |
| Review of Ba<br>Attitude Meas<br>for Stimuli – F  | Review of Basic Statistical Measures: Introduction- Measures of Central Tendency – Measures of Variation – Measures of Skewness -<br>Attitude Measurement and Scales: Introduction – Measurement – Fundamental of Data Collections Methods – Types of Scale – Scales<br>for Stimuli – Probability Distributions: Introduction – Approaches to Probability – Probability Distributions. |  |  |  |  |  |  |  |  |
| Unit - III  | Algorithmic Research and Simulation: 9+3   |  |  |  |  |  |  |  |  |
| Algorithmic Research: Introduction - Algorithmic Research Problems - Types of Algorithmic Research Problems – Types of Solution<br>Procedure / Algorithm – Steps of Development of Algorithm - Steps of Algorithmic Research – Design of Experiments and Comparison<br>of Algorithms – Meta Heuristics for Combinatorial Problem. Simulation: Introduction – Need for Simulation - Types of Simulation –<br>Simulation Languages - Simulation of a Season Ticket Issuing Counter of a Transport Corporation – A Case Study. |  |  |  |  |  |  |  |  |  |
| Unit - IV   | Report Writing and Presentation, SPSS: 9+3   |  |  |  |  |  |  |  |  |
| Report Writing and Presentation: Introduction - Types of Report – Guidelines for Reviewing Draft – Report Format - Typing Instructions<br>– Oral Presentation. SPSS: Introduction – Sample Session for Data Creation – Reports - Descriptive Statistics – Tables - Compare<br>Means – Non Parametric Test – Graphs.   |  |  |  |  |  |  |  |  |  |

#### Unit - V Intellectual Property and Patent Law:

Introduction to Intellectual Property Law: Intellectual Property Law Basics - Types of Intellectual Property - Agencies Responsible for Intellectual Property Registration - International Organizations, Agencies, and Treaties - The Increasing Importance of Intellectual Property Rights. Foundations of Patent Law: Introduction - Rights under Federal Law - U.S. Patent and Trademark Office – Patentability - Design Patents - Plant Patents - Double Patenting.

Lecture: 45, Tutorial: 15, Total: 60

#### **REFERENCES:**

- 2. Deborah E. Bouchoux, "Intellectual property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", 4<sup>th</sup> Edition, Delmar Cengage Learning, New York, 2013. (Unit V)
- 3. Kothari C.R., GauravGarg, "Research Methodology: Methods and Techniques", 3<sup>rd</sup> Edition, New Age International Publishers, New Delhi, 2016.

| COUR<br>On co | BT Mapped<br>(Highest Level)   |                    |
|---------------|--|--------------------|
| CO1           | interpret the research problem and suggest suitable tool for the given problem | Understanding (K2) |
| CO2           | identity the suitable measures for the given problem                           | Applying (K3)      |
| CO3           | apply the algorithmic research and simulation for the given case study         | Applying (K3)      |
| CO4           | utilize the interpretation and write the report for the given problem          | Applying (K3)      |
| CO5           | explain the intellectual property and patent law for the given case study      | Understanding (K2) |

9+3
|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1   | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 1   | 3   | 2   | 1   |     |     |     |     |     |      |      |      | 1    | 1    |
| CO2             | 2   | 3   | 2   | 1   |     |     |     |     |     |      |      |      | 1    | 1    |
| CO3             | 3   | 3   | 3   | 3   |     |     |     |     |     |      |      |      | 2    | 1    |
| CO4             | 2   | 3   | 2   | 1   |     |     |     |     |     |      |      |      | 1    | 1    |
| CO5             | 1   | 3   | 2   | 1   |     |     |     |     |     |      |      |      | 1    | 1    |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |
| CAT1                        | 20                    | 40                      | 40                 |                     |                      |                    | 100        |  |
| CAT2                        | 10                    | 30                      | 60                 |                     |                      |                    | 100        |  |
| CAT3                        | 10                    | 50                      | 40                 |                     |                      |                    | 100        |  |
| ESE                         | 12                    | 43                      | 45                 |                     |                      |                    | 100        |  |

## 20MCE05 - STATISTICAL DATA ANALYTICS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 2    | PE       | 3 | 1 | 0 | 4      |

| Preamble                                 | provide knowledge and skills in statistics for analysis and interpretation of data.   |                |  |  |  |  |  |  |
|--|---|----------------|--|--|--|--|--|--|
| Unit - I                                 | Probability and Random Variable: 9+3  |                |  |  |  |  |  |  |
| Sample Spa<br>Baye's Theo<br>Mathematica | Sample Spaces and Events – Probability – Axioms of Probability – Some Elementary Theorems – Conditional Probability – Baye's Theorem - Random Variable: Discrete Random Variable - Continuous Random Variable - Distribution Function - Mathematical Expectation - Binomial Distribution - Poisson Distribution - Normal Distribution (only simple problems). |                |  |  |  |  |  |  |
| Unit - II                                | Descriptive statistics:   | 9+3            |  |  |  |  |  |  |
| Statistical Av<br>Demerits of            | erages - Arithmetic Mean - Properties of Arithmetic Mean - Merits and Demerits of Arithmetic Mean - Median - Merit<br>Median - Mode - Merits and Demerits of Mode - Dispersion: Range - Quartile Deviations - Mean Deviation - Sta  | s and<br>ndard |  |  |  |  |  |  |



## Deviation - Coefficient of Variance - Skewness: Karl Pearson Coefficient of Skewness.

| Unit - III   | Multivariate Analysis:   | 9+3              |  |  |  |
|--|--|------------------|--|--|--|
| Correlation: E<br>Correlation -<br>Association -   | Bivariate Data - Correlation between Two Variables - Covariance between Two Variables - Karl Pearson's Coeffici Rank Correlation. Regression Analysis: Simple Linear Regression - Regression Equations. Attributes - Coeffici $\chi^2$ test for Goodness of Fit - Test for Independence. | ent of<br>ent of |  |  |  |
| Unit - IV  | Inference Concerning Means and Variances:  | 9+3              |  |  |  |
| Test of Hypo<br>Inference Co   | othesis – Null Hypothesis – Hypothesis Concerning One Mean – Relation between Tests and Confidence Inter-<br>ncerning Two Means - Hypothesis Concerning One Variance – Hypothesis Concerning Two Variances.  | vals –           |  |  |  |
| Unit - V   | Analysis of Variance:  | 9+3              |  |  |  |
| Some General Principles – Completely Randomized Designs – Randomized – Block Designs – Some Further Experimental Design. |  |                  |  |  |  |
|  | Lecture: 45, Tutorial: 15, Tot   | al: 60           |  |  |  |

## **REFERENCES:**

| 1. | Erwin Miller and John E.Freund, "Probability and Statistics for Engineers", 7 <sup>th</sup> Edition, Pearson Education, India, 2017. (Unit I, IV,V) |
|----|---|
| 2. | James T. McClave and Terry Sincich, "Statistics", 12 <sup>th</sup> Edition, Pearson Education, India, 2013. (Unit II, III)                          |
| 3. | Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 11 <sup>th</sup> Edition, Sultan Chand & Sons, India, 2007.                    |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to   | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | understand Baye's theorem and also summarize discrete and continuous probability distributions   | Understanding (K2)           |
| CO2           | analyze statistical data using measures of central tendency and dispersion.  | Analyzing(K4)                |
| CO3           | compute and interpret the results of Bivariate Regression and Correlation Analysis, for forecasting and also apply the appropriate Chi-Squared test for independence and goodness of fit | Applying (K3)                |
| CO4           | perform hypotheses tests of means, proportions and variances using both one-and two-sample data sets.  | Applying (K3)                |
| CO5           | design experiments by choosing the experimental units, treatments, factors, randomization and blocking.  | Applying(K3)                 |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO2             | 3                                | 3        | 2        | 2         | 1       |         |     |     |     |      |      |      |      |      |
| CO3             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| CO4             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| CO5             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |
| CAT1                        | 15                          | 50                      | 10                 | 25                  |                      |                    | 100        |  |  |
| CAT2                        | 10                          | 20                      | 35                 | 35                  |                      |                    | 100        |  |  |
| CAT3                        | 10                          | 20                      | 70                 | -                   |                      |                    | 100        |  |  |

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| ESE                   | 10   | 20 | 50 | 20 |  |  | 100 |  |  |  |
|-----------------------|--|----|----|----|--|--|-----|--|--|--|
| * ±3% may be varied ( | * ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks) |    |    |    |  |  |     |  |  |  |

# 20MCE06 - NATURAL LANGUAGE PROCESSING

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble  | To understand the role of N-grams and part of speech tagging and get knowledge about phonetics & speech synthesis   |  |  |  |  |  |  |  |
|---|---|--|--|--|--|--|--|--|
| Unit - I  | Introduction: 9   |  |  |  |  |  |  |  |
| Knowledge ir<br>Regular Exp<br>Deterministic<br>- Regular Lar   | Knowledge in Speech and Language Processing – Ambiguity- Models and Algorithms - Regular Expressions & Finite State Automata:<br>Regular Expressions – Automata - Disjunction, Grouping, and Precedence- Advanced Operators - Formal Languages - Non-<br>Deterministic FSAs - sing an NFSA to Accept Strings - Recognition as Search - Relating Deterministic and Non-Deterministic Automata<br>Regular Languages and FSAs.   |  |  |  |  |  |  |  |
| Unit - II   | Words and Transducers: 9  |  |  |  |  |  |  |  |
| Survey of En<br>Agreement -<br>Transducers<br>and Sentence<br>Morphologica  | Survey of English Morphology - Inflectional Morphology - Derivational Morphology – Cliticization - Non-Concatenative Morphology – Agreement - Finite-State Morphological Parsing - Construction of a Finite-State Lexicon - Finite-State Transducers - Sequential Transducers and Determinism - FSTs for Morphological Parsing - Transducers and Orthographic Rules – Lexicon-Free FSTs: Word and Sentence Tokenization - Segmentation in Chinese -Detection and Correction of Spelling Errors - Minimum Edit Distance - Human Morphological Processing |  |  |  |  |  |  |  |
| Unit - III  | N-Grams and part of Speech Tagging: 9   |  |  |  |  |  |  |  |
| Word Counting in Corpora - Simple (Unsmoothed) <i>N</i> -grams - Training and Test Sets - <i>N</i> -gram Sensitivity to the Training Corpus -<br>Unknown Words: Open Versus Closed Vocabulary Tasks - Evaluating <i>N</i> -grams - Perplexity - Smoothing - Laplace Smoothing. <b>Part-of-Speech Tagging:</b> Rule-Based Part-of-Speech Tagging - HMM Part-of-Speech Tagging - Transformation-Based Tagging - |   |  |  |  |  |  |  |  |



### Evaluation and Error Analysis - Advanced Issues in Part-of-Speech Tagging.

### Unit - IV Phonetics and Speech Synthesis:

Speech Sounds and Phonetic Transcription - Articulatory Phonetics - Phonological Categories and Pronunciation Variation - Acoustic Phonetics and Signals - Phonetic Resources - Advanced: Articulatory and Gestural Phonology. Speech Synthesis: Text Normalization - Phonetic Analysis - Prosodic Analysis - Diphone Waveform synthesis - Unit Selection (Waveform) Synthesis.

## Unit - V Automatic Speech Recognition and Syntactic Parsing:

Speech Recognition Architecture - Feature Extraction: MFCC vectors - Acoustic Likelihood Computation - The Lexicon and Language Model - Search and Decoding - Context-Dependent Acoustic Models: Triphones - Modeling Variation. Computational Phonology: Finite-State Phonology - Learning Phonology and Morphology. Syntactic Parsing: Parsing as Search - Search in the Face of Ambiguity -Dynamic Programming Parsing Methods - Partial Parsing

Total: 45

9

9

### **REFERENCES:**

| 1. | Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2 <sup>nd</sup> Edition, Pearson Publication, India, 2014. |
|----|--|
| 2. | Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", 1 <sup>st</sup> Edition, OReilly Media, 2009.   |
| 3. | Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", 2 <sup>nd</sup> Edition, Chapman and Hall/CRC Press, 2010.   |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                    | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | understand about the application of Finite state automata and regular expression in NLP | Understanding (K2)           |
| CO2           | apply Human Morphological Processing  | Applying (K3)                |
| CO3           | implement N-grams and part of speech tagging in NLP                                     | Applying (K3)                |
| CO4           | apply phonetics & speech synthesis in real world problems                               | Applying (K3)                |
| CO5           | to understand automatic speech recognition & syntactic parsing                          | Understanding (K2)           |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO2             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| CO3             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| CO4             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| CO5             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |
| CAT1                        | 15                          | 50                      | 35                 |                     |                      |                    | 100        |  |  |  |  |
| CAT2                        | 15                          | 25                      | 60                 |                     |                      |                    | 100        |  |  |  |  |

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| CAT3 | 15 | 40 | 45 |  | 100 |
|------|----|----|----|--|-----|
| ESE  | 15 | 38 | 47 |  | 100 |

### 20MCE07 - INTERNET OF THINGS

| Programme &<br>Branch | Master of Computer Applications                 | Sem. | Category | L | т | Р | Credit |
|-----------------------|---|------|----------|---|---|---|--------|
| Prerequisites         | Data Communication Networks, Python Programming | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble   | To learn about the basics of IOT Patterns, Architectures and protocols and implementation strategies and testing.   |  |  |  |  |  |  |  |  |  |
|--|---|--|--|--|--|--|--|--|--|--|
| Unit - I   | Introduction: 9   |  |  |  |  |  |  |  |  |  |
| Various Technologies Used in IoT - IoT Revolution - Benefits of IoT - IoT Frameworks: Value Chain - Frameworks and Platforms - AWS IoT - WastonIoT Platform-IoT Ecosystems - Elements for IoT Implementation - Case Studies: E-Health System - Environmental Monitoring. |   |  |  |  |  |  |  |  |  |  |
| Unit - II  | Design Patterns and Architectures Choice: 9   |  |  |  |  |  |  |  |  |  |
| Various Desig<br>- Core Modul  | Various Design Patterns - Challenges and Solutions Designing Architecture for IoT - Four Layer Architecture - Seven Layer Architecture - Core Modules: Protocols – Sensors – Endpoints - Data Communication - IoT Data Managements - Analytic.  |  |  |  |  |  |  |  |  |  |
| Unit - III   | IoT Implementation and Testing: 9   |  |  |  |  |  |  |  |  |  |
| IoT Implement<br>Testing Chall   | ntation Strategies: Challenges and Solutions - Things to Know Before an IoT Implementation - Types of Testing in IoT -<br>enges and Tools - Testing Smart Wearable - Impact of AI, Data Analytics and Machine Learning in IoT.  |  |  |  |  |  |  |  |  |  |
| Unit - IV  | Raspberry Pi Programming: 9   |  |  |  |  |  |  |  |  |  |
| Introduction<br>Communicati<br>Purpose Inpu  | to the Platform - RPi Hardware - Accessories – HATs - Linux on the Raspberry Pi - Connecting to a Network -<br>ing with the RPi - Controlling and Configuring the RPi - Interacting with OnboardLEDs - Interfacing to RPi Buses: General<br>it/Outputs - Enhancing the I/O Interfaces: I <sup>2</sup> C Hardware - SPI Hardware - The RPi UART. |  |  |  |  |  |  |  |  |  |
| Unit - V   | Cloud and IoT Security: 9   |  |  |  |  |  |  |  |  |  |
| Cloud Protoc<br>Software Def   | Cloud Protocols - Cloud Service Models - Fog Computing - IoT Security: Anatomy of Cyber Attacks - Physical and Hardware Attacks -<br>Software Defined Perimeter - Blockchains and Cryptocurrencies in IoT - IoT Security Best Practices.  |  |  |  |  |  |  |  |  |  |

Total: 45

### **REFERENCES:**

<u>Mayur Ramgir</u>, "Internet of Things- Architecture, Implementation, and Security", 1<sup>st</sup> Edition, Pearson Publication, 2019. (Unit I,II,III)
 Derek Molloy, "Exploring Raspberry Pi Interfacing to the Real World with Embedded Linux", 1<sup>st</sup> Edition, John Wiley & Sons, Inc.,



## 2016. (Unit IV)

3. Perry Lea, "Internet of Things for Architects: Architecting IoT solutions by implementing Sensor Communication Infrastructure, Edge Computing, Analytics and Security", 1<sup>st</sup> Edition, Packt Publisher, 2018. (Unit V)

| COUF<br>On co | RE OUTCOMES:<br>mpletion of the course, the students will be able to | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | understand various framework and platforms available for IoT         | Understanding (K2)           |
| CO2           | understand design patterns and architectures choice                  | Understanding (K2)           |
| CO3           | empoy the various implementation and testing strategies              | Applying (K3)                |
| CO4           | design a portable IoT applications using Raspberry Pi                | Applying (K3)                |
| CO5           | understanding the funcaionalities of cloud and securities in IoT     | Understanding (K2)           |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3      | PO4       | PO5     | P06     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        | 1        | 1         | 1       |         |     |     |     |      |      |      | 1    | 1    |
| CO2             | 2                                | 1        | 1        | 1         | 1       |         |     |     |     |      |      |      | 1    | 1    |
| CO3             | 3                                | 2        | 2        | 2         | 3       |         |     |     |     |      |      |      | 2    | 1    |
| CO4             | 3                                | 3        | 3        | 2         | 3       |         |     |     |     |      |      |      | 2    | 1    |
| CO5             | 2                                | 1        | 1        | 1         | 1       |         |     |     |     |      |      |      | 1    | 1    |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |
| CAT1                        | 20                    | 80                      |                    |                     |                      |                    | 100        |  |  |  |
| CAT2                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |  |  |
| CAT3                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |  |  |
| ESE                         | 20                    | 40                      | 40                 |                     |                      |                    | 100        |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20MCE08 - LINUX ADMINISTRATION

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble                                  | To know about the Linux commands, Installation along with Network configuration procedure.   |                  |
|---|--|------------------|
| Unit - I                                  | Introduction:  | 9                |
| Linux Operat<br>Command Li<br>Permissions | ting System – Advantages of Open Source Software – Understanding the Differences between Windows and Li<br>ne: An Introduction to Bash – Command Line Shortcuts – Documentation Tools – File, File types, File Ownership an<br>– File Management and Manipulation – Editors – Miscellaneous Tools. | nux –<br>Id File |
| Unit - II                                 | Single Host Administration:  | 9                |
| Managing Us<br>Down – File S              | sers and Groups: User Information – User Management Tools – Users and Access Permissions – Booting and Sh<br>Systems.  | nutting          |
| Unit - III                                | Networking and Security:   | 9                |
| TCP / IP for S<br>Closing Conr            | System Administrators: Layers and Headers – A Complete TCP Connection – Opening a Connection – Transferring<br>nection – Working with ARP – ARP Header - Local Security – Network Security.  | Data -           |
| Unit - IV                                 | Internet Services:   | 9                |
| DNS: Hosts I<br>Key Characte              | File – DNS Works – Types of DNS Server – DNS Records Types – DNS Toolbox – File Transfer Protocol – Secure<br>eristics – SSHD Configuration File – Secure using OpenSSH.   | Shell:           |
| Unit - V                                  | Intranet Services:   | 9                |
| Network File<br>System – Ade              | System: Components of NFS – NFS Server and Clients – Common Uses for NFS – Printing: Terminologies – d ding Printers – Routine CUPS Administration – Client-Side Printing Tools.   | CUPS             |
|   | Tot  | al: 45           |

### **REFERENCES:**

| 1. | Wale Soyinka."Linux Administration: A Beginner's Guide", 7 <sup>th</sup> Edition, McGraw Hill Education, New York, 2016.                                    |
|----|---|
| 2. | Mark G. Sobell, "A Practical Guide to Linux Commands, Editors, and Shell Programming", 2 <sup>nd</sup> Edition, Pearson Education, United States, 2010.     |
| 3. | Eve Nemeth, Garth Snyder, Trent R.Hein, Ben Whaley, "Unix and Linux System Administration Handbook", 4 <sup>th</sup> Edition, Pearson Education, USA, 2011. |

| COUR<br>On cor | COURSE OUTCOMES:<br>On completion of the course, the students will be able to |                    |  |  |  |  |  |
|----------------|---|--------------------|--|--|--|--|--|
| CO1            | learn the basic commands of Linux Operating System.                           | Understanding (K2) |  |  |  |  |  |
| CO2            | make use of the Linux commands to perform User and file access permissions.   | Applying (K3)      |  |  |  |  |  |
| CO3            | configure the network and provide a security in network.                      | Understanding (K2) |  |  |  |  |  |

| CO4 | understand working principal of Domain Name System.          | Understanding (K2) |
|-----|--|--------------------|
| CO5 | make use of commands and tools to perform Intranet Services. | Applying (K3)      |

|                 | Mapping of COs with POs and PSOs                                |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 1   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO2             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO3             | 2   | 1   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO4             | 2   | 1   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO5             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | I – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |
| CAT1                        | 20                          | 50                      | 30                 |                     |                      |                    | 100        |  |  |
| CAT2                        | 20                          | 50                      | 30                 |                     |                      |                    | 100        |  |  |
| CAT3                        | 20                          | 50                      | 30                 |                     |                      |                    | 100        |  |  |
| ESE                         | 20                          | 50                      | 30                 |                     |                      |                    | 100        |  |  |

## 20MCE09 - SOFTWARE PROJECT MANAGEMENT

| Programme &<br>Branch | Master of Computer Applications    | Sem. | Category | L | т | Р | Credit |
|-----------------------|------------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Software Engineering Methodologies | 3    | PE       | 3 | 0 | 0 | 3      |

Preamble To perform various activities for successful completion of a project in spite of all the risks. Unit - I Introduction To Software Project Management: 9 Software Project Definition - Software Projects Versus Other Types of Projects - Contract Management and Technical Project Management - Activities Covered by Software Project Management – Plans, Methods and Methodologies – Categorizing Software Projects - Stakeholders - Setting Objectives - Business Case - Project Success and Failure - Management Control. Unit - II **Project Evaluation and Program Management:** 9 Project Portfolio Management - Evaluation of Individual Projects - Cost Benefit Evaluation - Risk Evaluation - Managing the Allocation of Resources within Programmes - Strategic Program Management - Benefits Management. Unit - III Software Effort Estimation: 9 Introduction-Where are Estimates are Done - Problem with Over and Under Estimates - The Basis for Software Estimating - Software Effort Estimation Techniques - Bottom up Estimating - The Top Down Approach and Parametric Models - Expert Judgement -Estimating by Analogy - Function Points. Unit - IV Activity Planning and Risk Management: 9

Activity Planning - Objectives - Project Schedules - Sequencing and Scheduling Activities - Network Planning Models - Formulation of a Network Model - Forward Pass - Backward Pass - Critical Path - Activity Float - Shortening Project Duration - Activity on Arrow Networks - Risk Management Models - Identifying Risks – Assessment, Planning and Management – Evaluating the Risks – PERT Technique - Monte Carlo Simulation - Critical Chain Concepts.

### Unit - V Managing Contracts and Software Quality:

Managing Contracts - Types of Contracts - Stages in Contract Placement - Contract Management – Acceptance - The Place of Software Quality in Project Planning - Importance of Software Quality - Defining Software Quality - Product versus Process Quality Management - Quality Management Systems - Process Capability Models - Techniques to Help Enhance Software Quality – Testing - Quality Plans.

Total: 45

9

### **REFERENCES:**

| 1 | Bob Hughes, Mike Cotterell & Rajib Mall, "Software Project Management", 6th Edition, McGraw Hill, New Delhi, 2017                                   |    |
|---|---|----|
| 2 | Robert.T.Futrell, Donald F.Shafer and Lindal.Shafer, "Quality Software Project Management", 1 <sup>st</sup> Edition, Prentice Hall, Ne Delhi, 2002. | ew |
| 3 | PankajJalote, "Software Project Management in Practice", 1 <sup>st</sup> Edition, Addison Wesley, Boston, 2002.                                     |    |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                  | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | select the appropriate life cycle for an application                                  | Understanding (K2)           |
| CO2           | outline software projects evaluation and control software deliverables                | Understanding (K2)           |
| CO3           | apply adequate knowledge about cost and effort estimation of the software development | Applying (K3)                |
| CO4           | analyze the activities and the risks involved in various project.                     | Analyzing (K4)               |
| CO5           | review quality of software and managing contracts                                     | Understanding (K2)           |

## Mapping of COs with POs and PSOs

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1   | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 1   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO2             | 2   | 1   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      |      |      |      |
| CO4             | 3   | 3   | 2   | 2   | 1   |     |     |     |     |      |      |      |      |      |
| CO5             | 2   | 1   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |
| CAT1                        | 40                    | 60                      |                    |                     |                      |                    | 100        |  |
| CAT2                        | 20                    | 50                      | 30                 |                     |                      |                    | 100        |  |
| CAT3                        | 20                    | 30                      | 30                 | 20                  |                      |                    | 100        |  |
| ESE                         | 10                    | 40                      | 30                 | 20                  |                      |                    | 100        |  |

## 20MCE10 - DATA VISUALIZATION TECHNIQUES

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Machine Learning                | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble | To impart the fundamental concepts of data visualization techniques and to practice of translating information into a context. | visual |
|----------|--|--------|
| Unit - I | Introduction and Foundations:  | 9      |

Why Visualization – Visualization Process – Role of Cognition – Pseudocode Conventions – Scatter Plot - Data Foundation: Types of Data - Structure within and between Records - Data Preprocessing – Human Perceptions and Information Processing – Visualization Foundations..

#### Unit - II Tree, Graph, Networks, Text and Document:

Displaying Hierarchical Structure – Displaying Arbitrary Graphs/Networks – Other Issues - Visualization Techniques for Tree - Graph and Networks - Levels of Text Representation – Vector Space Model – Single Document Visualization – Document Collection Visualization - Extended Text Visualization.

#### Unit - III Designing Effective Visualization:

Steps in Designing Visualization – Problems in Designing Effective Visualization – Comparing and Evaluating Visualization Techniques – Visualization Systems.

### Unit - IV Spatial and Geospatial Data:

Visualization Techniques for Spatial Data: One, two, and three Dimensional Data – Dynamic Data - Combining Techniques - Visualization Techniques for Geospatial Data : Visualizing Spatial Data - Visualization of Point Data - Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization.

### Unit - V Time-Oriented and Multivariate Data:

Visualization Techniques for Time - Oriented: Introduction - Characterizing Time - Oriented Data - Visualizing Time - Oriented Data -TimeBench: A Data Model and Software Library for Visual Analytics of Time - Oriented Data - Visualization Techniques for Multivariate Data: Point-Based Techniques – Line-Based Techniques - Region-Based Techniques - Combinations of Techniques.

Total: 45

9

9

9

9

#### **REFERENCES:**

| 1. | Matthew O. Ward, Georges Grinstein, Daniel Keim "Interactive Data Visualization: Foundations, Edition, CRC Press, United States, 2015 | Techniques, and Applications", 2 <sup>nd</sup>  |
|----|---|---|
| 2. | Stephen Few, "Now you see it: Simple Visualization Techniques for Quantitative Analysis",   | 1 <sup>st</sup> Edition, Analytics Press, 2009. |
| 3. | David Baldwin, "Mastering Tableau", 1 <sup>st</sup> Edition, Packt Publishing, Mumbai, 2016.  |   |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to          | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | describe principles of visual perception                                      | Understanding (K2)           |
| CO2           | apply visualization techniques for various data analysis tasks                | Applying (K3)                |
| CO3           | employ the designing Visualization techniques for various data analysis tasks | Applying (K3)                |
| CO4           | design effective visualization techniques for Spatial and Geospatial Data     | Applying (K3)                |
| CO5           | explore the visualization techniques for Time-Oriented and Multivariate Data  | Applying (K3)                |

|         | Mapping of COs with POs and PSOs |     |     |     |     |     |     |     |     |      |      |      |      |      |
|---------|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/Pos | PO1                              | PO2 | PO3 | PO4 | PO5 | P06 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1     | 2                                | 1   | 1   | 1   | 1   |     |     |     |     |      |      |      | 2    | 1    |
| CO2     | 3                                | 2   | 2   | 3   | 3   |     |     |     |     |      |      |      | 3    | 1    |
| CO3     | 3                                | 2   | 2   | 3   | 3   |     |     |     |     |      |      |      | 3    | 1    |
| CO4     | 3                                | 2   | 2   | 3   | 3   |     |     |     |     |      |      |      | 3    | 1    |



|   | Mapping of COs with POs and PSOs |  |   |   |   |   |  |  |  |  |  |  |  |   |   |
|---|----------------------------------|--|---|---|---|---|--|--|--|--|--|--|--|---|---|
| CO5   | 3                                |  | 2 | 2 | 3 | 3 |  |  |  |  |  |  |  | 3 | 1 |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |                                  |  |   |   |   |   |  |  |  |  |  |  |  |   |   |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |
| CAT1                        | 20                    | 50                      | 30                 |                     |                      |                    | 100        |  |  |  |  |  |
| CAT2                        | 10                    | 30                      | 60                 |                     |                      |                    | 100        |  |  |  |  |  |
| CAT3                        | 10                    | 30                      | 60                 |                     |                      |                    | 100        |  |  |  |  |  |
| ESE                         | 10                    | 35                      | 55                 |                     |                      |                    | 100        |  |  |  |  |  |

### 20MCE11 - MOBILE APPLICATION DEVELOPMENT

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Object Oriented Programming     | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble   | To understand the process of developing software for the mobile and to create mobile applications for real problems.  | world           |
|--|---|-----------------|
| Unit - I   | Android Fundamentals:   | 9               |
| How Java an<br>First Android<br>Comments –       | d Android Work Together - The Development Environment – Android Resources – Structure of Android's Java Code<br>App - Java – First Contact: Examining the Project Assets and Code - Improving our App and Deploying Again –<br>Writing the First Java Code.   | - Our<br>Java   |
| Unit - II  | Building Application Framework:   | 9               |
| Exploring And<br>Layouts: Exp<br>Layouts: Scro   | droid Studio: Parts of the UI – Transforming the Editor into a Design Studio – Project Folder and File Structure – Desi<br>loring Android UI Design - Structure of a UI Design – Real-World Layouts: Building a Real - World UI: Creating Emula<br>ollview and Linear Layout – RelativeLayout - The Life and Times of an Android App. | gning<br>ator — |
| Unit - III                                       | Exploring Android UI Objects:   | 9               |
| Everything's<br>Dialog Windo                     | a Class – Exploring Android UI Objects - Exploring the Palette – Android Permissions - The Widget Exploration Mini A<br>ws - Building the Project and Gathering Resources – Coding the Dialog designs.  | ۹p –            |
| Unit - IV  | Handling Data:  | 9               |
| ListView and<br>Settings Page<br>Capturing Image | BaseAdapter – Handling and Displaying Notes to Self – Android Intent : Switching Activity and Passing Data – Adc<br>e to the Note to Self App - Making the Note to Self apps' Setting Persist – Fragments –Lifecycle – Working Fragm<br>ages: Capturing Images using the Camera – The Capturing Images Mini App.                      | ling a<br>ent – |
| Unit - V   | Advances in Android Development:  | 9               |
| Using SQLite<br>Google Maps                      | Databases – Database 101 – The SQL Syntax Primer - The Android SQLite API – The Database Mini App – Integrand GPS Locations: Global Positioning System – the GPS Mini App – the Google Maps Mini App - Publishing Apps.   | rating          |
|  | Tota  | al: 45          |
| REFERENCE  | ES:   |                 |
| 1 John Ho  | ton "Android Programming for Reginners" 1 <sup>st</sup> Edition, Rockt Publishing, India, 2015  |                 |

| Į | 1. | John Horton, "Android Programming for Beginners", 1 <sup>st</sup> Edition, Packt Publishing, India, 2015.  |
|---|----|--|
|   | 2. | Paul Deitel, Harvey Deitel and Alexander Wald, "Android 6 for Programmers an App-Driven Approach", 3 <sup>rd</sup> Edition, Pearson Education India, New Delhi, 2015 |
|   | 3. | Reto Meier, "Professional Android™ 4 Application Development", 1 <sup>st</sup> Edition, John Wiley & Sons, New York, 2012  |

| COUF<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to |                    |  |  |  |  |
|---------------|---|--------------------|--|--|--|--|
| CO1           | understanding the android development environment concepts                    | Understanding (K2) |  |  |  |  |
| CO2           | exploring the building application framework for the android platform         | Applying (K3)      |  |  |  |  |
| CO3           | applying android UI objects to designing android applications                 | Applying (K3)      |  |  |  |  |
| CO4           | practice the methods to handling the data for an android application          | Applying (K3)      |  |  |  |  |
| CO5           | explore and creating android applications using android APIs                  | Analyzing (K4)     |  |  |  |  |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        | 1        | 1         | 1       |         |     |     |     |      |      |      | 1    | 1    |
| CO2             | 3                                | 2        | 2        | 2         | 3       |         |     |     |     |      |      |      | 1    | 1    |
| CO3             | 3                                | 3        | 3        | 2         | 3       |         |     |     |     |      |      |      | 1    | 1    |
| CO4             | 3                                | 2        | 2        | 2         | 3       |         |     |     |     |      |      |      | 1    | 1    |
| CO5             | 3                                | 3        | 3        | 2         | 3       |         |     |     |     |      |      |      | 1    | 1    |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |



|  | ASSESSMENT PATTERN - THEORY |    |    |    |  |  |     |  |  |  |  |  |  |
|--|-----------------------------|----|----|----|--|--|-----|--|--|--|--|--|--|
| Test / Bloom's<br>Category*Remembering<br>(K1) %Understanding<br>(K2) %Applying<br>(K3) %Analyzing<br>(K4) %Evaluating<br>(K5) %Creating<br>(K6) % |                             |    |    |    |  |  |     |  |  |  |  |  |  |
| CAT1   | 20                          | 60 | 20 |    |  |  | 100 |  |  |  |  |  |  |
| CAT2   | 20                          | 20 | 60 |    |  |  | 100 |  |  |  |  |  |  |
| CAT3   | 10                          | 20 | 40 | 30 |  |  | 100 |  |  |  |  |  |  |
| ESE  | 10                          | 30 | 50 | 10 |  |  | 100 |  |  |  |  |  |  |

## 20MCE12 - CRYPTOGRAPHY AND NETWORK SECURITY

| Programme &<br>Branch | Master of Computer Applications                               | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---|------|----------|---|---|---|--------|
| Prerequisites         | Data Communication Network, Data Structures and<br>Algorithms | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble  | To understand the Basic Cryptographic primitives, applications of cyber security and other contrender enforcement mechanisms.  | ract |  |  |  |  |  |
|---|--|------|--|--|--|--|--|
| Unit - I  | Computer and Network Security Concepts:  | 9    |  |  |  |  |  |
| OSI Security Architecture - Security Attacks – Security Services – Security Mechanism – A Model for Network<br>Security. Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques - Transposition<br>Techniques. |  |      |  |  |  |  |  |
| Unit - II   | Unit - II Block Ciphers and Data Encryption Standards:   |      |  |  |  |  |  |
| Block Cip<br>Standard: S<br>Multiple E  | Block Ciphers Structure - Data Encryption Standard – Cipher Design Principles. Advanced Encryption<br>Standard: Structure – Transformation Functions – Key Expansions – Implementations. Block Cipher Operation:<br>Multiple Encryption and Triple DES - Electronic Codebook - Cipher Block Chaining Mode. |      |  |  |  |  |  |
| Unit - III  | Principles of Public Key Cryptosystem:   | 9    |  |  |  |  |  |
| RSA Algo  | rithm – Diffie-Hellman Key exchange, Cryptographic Hash Functions: Applications of Cryptogram  | ohic |  |  |  |  |  |

Hash Functions - Two Simple Hash Functions - Requirements and Security - Hash Functions Based on Cipher Block Chaining - Secure Hash Algorithm (SHA). Message Authentication Codes: Message Authentication Requirements - Message Authentication Functions - Requirements for Message Authentication Codes.

# Unit - IV Digital Signatures:

Elgamal Digital Signature Scheme - Schnorr Digital Signature Scheme - NIST Digital Signature Algorithm.

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Network Access Control: Network Access Control - Extensible Authentication Protocol - Cloud Computing - Cloud Security Risks and Countermeasures - Data Protection in the Cloud - Cloud Security as a Service.

# Unit - V Wireless Network Security:

Wireless Security - Mobile Device Security. Electronic Mail Security: Internet Mail Architecture - Email Formats - Email Threats and Comprehensive Email Security - DNSSEC - DNS-Based Authentication of Named Entities. IP Security Overview: IP Security Overview - IP Security Policy.

Total: 45

9

## **REFERENCES:**

| 1. | William Stallings, "Cryptography and Network Security – Principles and Practices", 7 <sup>th</sup> Edition, Pearson Education Limited, 2017.           |
|----|--|
| 2. | Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 3 <sup>rd</sup> Edition, Tata McGraw-Hill Education Pvt. Ltd, 2015. |
| 3. | Atul Kahate, "Cryptography and Network Security", 3 <sup>rd</sup> Edition, Tata McGraw-Hill Education Pvt. Ltd, 2013.                                  |

| COUR<br>On cor | SE OUTCOMES:<br>npletion of the course, the students will be able to   | BT Mapped<br>(Highest Level) |
|----------------|--|------------------------------|
| CO1            | to understand the Network Security Concepts and Encryption Techniques  | Understanding (K2)           |
| CO2            | to know the various Cipher Techniques, Encryption Standards to achieve the Block Cipher Operations.                              | Understanding (K2)           |
| CO3            | implementing the Authentication using Public Key Cryptosystem, Hash Functions and Message Authentication for different problems. | Applying (K3)                |
| CO4            | understand about the Digital Signatures and use the effective security mechanisms for Network Access Control and Cloud Security. | Understanding (K2)           |
| CO5            | illustrate the importance of Wireless Network Security, Electronic Mail and IP Security.   | Understanding (K2)           |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO2             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO3             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| CO4             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO5             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |             |               |          |           |            |          |       |  |  |  |  |
|-----------------------------|-------------|---------------|----------|-----------|------------|----------|-------|--|--|--|--|
| Test / Bloom's              | Remembering | Understanding | Applying | Analyzing | Evaluating | Creating | Total |  |  |  |  |
| Category*                   | (K1) %      | (K2) %        | (K3) %   | (K4) %    | (K5) %     | (K6) %   | %     |  |  |  |  |



| CAT1 | 40 | 60 |    |  | 100 |
|------|----|----|----|--|-----|
| CAT2 | 20 | 50 | 30 |  | 100 |
| CAT3 | 40 | 60 |    |  | 100 |
| ESE  | 30 | 50 | 20 |  | 100 |

## 20MCE13 - C# and ASP.NET

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 3    | PE       | 3 | 0 | 0 | 3      |

| Unit – I | Basic in C#:  | 9    |
|----------|---|------|
| Preamble | To make the student to understand the object oriented aspects of C#, the Technologies of the framework and to develop Web based applications on .NET (ASP.NET). | .NET |

Philosophy of .Net –Anatomy of C# Program – Data Types and Keywords – String Data – Type Conversions – Implicitly Typed Local Variable – Iteration – Decision Constructs – Methods and Parameter Modifiers -Arrays – Enum– Structure – Value and Reference Types–Nullable Types.

## Unit – II Object Oriented Concepts:

Encapsulation – Inheritance and Polymorphism – Structured Exception Handling: Role of Exception Handling, Processing Multiple Exceptions, Unhandled Exceptions – Interfaces: Types, Defining and Implementing Custom Interfaces – Interface as Parameters and Return Values – Designing Interface Hierarchies.

## Unit - III Advanced C# Features:

Collection and Generics - Delegates, Events and Lamba Expressions– Indexer methods –Operator Overloading – LINQ to Objetcs : Specific Programming Constructs - Role of LINQ - LINQ Queries to Primitive Arrays and Collection Objects - Result of a LINQ Query - C# LINQ Query Operators –Internal representation of LINQ query statements- Object Lifetime - Garbage Collection - Finalizable and Disposable Objects.

# Unit - IV .NET Assemblies and ADO.NET:

Building and Configuring Class Libraries: Custom Namespaces, Role of .NET Assemblies, Format of .Net Assembly, Private and Shared Assemblies - ADO.NET: The Connected Layer: Definition of ADO.Net - DataProviders, Connected Layer - DataReaders - The Disconnected Layer: DataSet, DataColumns, DataRows, DataTables- Binding DataTable Objects to Windows Forms GUIs – DataAdapters.

## Unit – V ASP.NET Web Forms:

Introducing ASP.NET web forms: The Role of HTTP, HTML and Client Side Scripting - Posting Back to the Web Server- Interacting with the Incoming HTTP Request and Outgoing HTTP Response - The Life Cycle of an ASP.NET Web Page - ASP.NET Web Controls, Master Pages and Themes.

Total: 45

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## **REFERENCES:**

1. Andrew Troelsen, Philip Japikse, "C# 6.0 and the .NET 4.6 Framework", 7<sup>th</sup> Edition, Apress, 2015.

2. Herbert Schildt, "The Complete Reference: C# 4.0", 1<sup>st</sup> Edition, Tata McGraw Hill, 2012.



3. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# 2012 with .NET 4.5", 1<sup>st</sup> Edition, Wiley, India, 2013.

| COUR<br>On cor | SE OUTCOMES:<br>npletion of the course, the students will be able to | BT Mapped<br>(Highest Level) |
|----------------|--|------------------------------|
| CO1            | build simple applications using basic concepts of C#.                | Applying (K3)                |
| CO2            | design applications using object oriented programming concepts in C# | Applying (K3)                |
| CO3            | apply advanced features of C# in programming.                        | Applying (K3)                |
| CO4            | create windows applications with database access using ADO.NET.      | Applying (K3)                |
| CO5            | construct web forms using ASP.NET                                    | Applying (K3)                |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3                                | 2        | 1        | 1         | 1       |         |     |     |     |      |      |      |      |      |
| CO2             | 3                                | 2        | 1        | 1         | 1       |         |     |     |     |      |      |      |      |      |
| CO3             | 3                                | 2        | 1        | 1         | 1       |         |     |     |     |      |      |      |      |      |
| CO4             | 3                                | 2        | 1        | 1         | 1       |         |     |     |     |      |      |      |      |      |
| CO5             | 3                                | 2        | 1        | 1         | 1       |         |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |  |
| CAT1                        | 20                          | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT2                        | 20                          | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| CAT3                        | 20                          | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |  |  |
| ESE                         | 20                          | 30                      | 50                 |                     |                      |                    | 100        |  |  |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 20MCE14 - SOFTWARE TESTING AND QUALITY ASSURANCE

| Programme &<br>Branch | Master of Computer Applications    | Sem. | Category | L | Т | Р | Credit |
|-----------------------|------------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Software Engineering Methodologies | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble | To implement proper software quality assurance processes and software testing processes, methods and technique projects | ues in |
|----------|---|--------|
| Unit - I | Fundamentals of Software Testing:   | 9      |

Principles of Testing – Phases of Software Project – Quality Assurance and Control – Verification and Validation - White Box Testing: Static Testing – Structural Testing – Challenges.

### Unit - II Black Box Testing and Levels of Testing:

Black Box Testing: Requirements based Testing – Positive and Negative Testing – Boundary Value Analysis – Decision Tables – Equivalence Class Partitioning – State Based Testing – Compatibility Testing – User Documentation Testing – Domain Testing. Levels of Testing: Integration Testing – System and Acceptance Testing.

### Unit - III Performance, Regression and Ad-hoc Testing:

Factors – Methodology – Tools – Challenges. Regression Testing: Types – Methods. Internationalization Testing – Ad-hoc Testing: Buddy and Pair Testing – Exploratory Testing – Iterative Testing – Agile and Extreme Testing. Usability and Accessibility Testing.

## Unit - IV Life Cycle Based Testing:

Waterfall Testing - Testing in Iterative Life Cycles - Agile Testing – Agile Model – Driven Development. Model Based Testing: Testing Based on Models. Object-Oriented Testing: Issues in Testing Object Oriented Software.

### Unit - V Test-Driven Development:

Automated Test Execution - All Pairs Testing: The All Pairs Technique. Evaluating Test Cases: Mutation Testing. Software Technical Reviews: Roles in a Review - Types of Reviews - Contents of an Inspection Packet - An Industrial - Strength Inspection Process.

#### Total: 45

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#### **REFERENCES**:

| 1. | Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing Principles and Practices", 1 <sup>st</sup> Edition, Pearson Education, New Delhi, 2016. (Unit I,II,III).        |
|----|--|
| 2. | Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", 4 <sup>th</sup> Edition, CRC Press (Auerbach) Publications, 2014, ISBN-13: 978-1-4665-6068-0. (Unit IV and V) |
| 3. | William E. Derny "Effective Methods for Software Testing" 3 <sup>rd</sup> Edition, Wiley India, New York, 2017   |

William E. Perry, "Effective Methods for Software Testing", 3" Edition, Wiley India, New York, 2017.

| COUR  | SE OUTCOMES:  | BT Mapped          |
|-------|---|--------------------|
| On co | mpletion of the course, the students will be able to  | (Highest Level)    |
| CO1   | to study fundamental concepts in software testing and white box Testing which includes objectives, processes, criteria, strategies, challenges. | Understanding (K2) |



# Kongu Engineering College, Perundurai, Erode – 638060, India

| CO2 | to learn how to planning a test project, conduct testing operations, manage software defects, generate a testing report using Black box testing techniques, integration and system testing. | Applying (K3)      |
|-----|---|--------------------|
| CO3 | to discuss various software testing issues and solutions in Performance testing, Regression testing and Ad-hoc testing.   | Understanding (K2) |
| CO4 | to expose the advanced software testing topics, such as Life Cycle Based Testing and object-<br>oriented software testing methods, software testing issues, challenges, and solutions.      | Understanding (K2  |
| CO5 | to understand software test automation and to learn how to maintain the Quality software.   | Understanding (K2) |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 1   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO2             | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO3             | 2   | 1   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO4             | 2   | 1   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO5             | CO5 2 1   |     |     |     |     |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |
| CAT1                        | 30                          | 50                      | 20                 |                     |                      |                    | 100        |
| CAT2                        | 30                          | 60                      | 10                 |                     |                      |                    | 100        |
| CAT3                        | 40                          | 50                      | 10                 |                     |                      |                    | 100        |
| ESE                         | 30                          | 50                      | 20                 |                     |                      |                    | 100        |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

### 20MCE15 - DIGITAL IMAGE PROCESSING

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 3    | PE       | 3 | 0 | 0 | 3      |

Preamble To Improvement of pictorial information for human interpretation and processing of image data for



storage, transmission, and representation for autonomous machine perception. Stating complex algorithms in step-by-step Procedures.

# Unit - I Digital Image Fundamentals:

Elements of Visual Perception - Light and the Electromagnetic Spectrum - Image Sensing and Acquisition - Image Sampling and Quantization - Basic Relationship between Pixels - Introduction to Mathematical Tool Used in Digital Image Processing.

# Unit - II Intensity Transformations and Spatial Filtering:

Basic Intensity Transformation Functions - Histogram Processing - Fundamentals of Spatial Filtering - Smoothing Spatial Filters - Sharpening Spatial Filters.

# Unit - III Filtering in the Frequency Domain:

Sampling and the Fourier Transform of Sampled Functions - The Discrete Fourier Transform (DFT) of One Variable and Two Variable - The Basics of Filtering in the Frequency Domain - Smoothing using Frequency Domain Filters - Sharpening using Frequency Domain Filters - Selective Filtering.

## Unit - IV Image Compression and Morphological Image Processing:

Fundamentals Data Compression - Basic Compression Methods. Dilation and Erosion - Basic Morphological Algorithms – Gray-Scale Morphology.

# Unit - V Segmentation and Representation:

Segmentation: Point, Line, and Edge Detection – Thresholding - Region-Based Segmentation. Image Representation: Chain Codes – Polygonal Approximations – Signatures – Boundary Segments – Skeletons – Boundary Descriptors - Regional Descriptors.

Total: 45

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## **REFERENCES:**

1. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", 4<sup>th</sup> Edition, Pearson Education, New Delhi, 2018.

 Rafael C.Gonzalez, Richard E.Woods and Steven Eddins, "Digital Image Processing using MATLAB", 2<sup>nd</sup> Edition, Gatesmark Publisher, 2017.

3. Jain Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi, 2015.

| COUR<br>On co | COURSE OUTCOMES:<br>On completion of the course, the students will be able to          |                    |  |  |  |  |
|---------------|--|--------------------|--|--|--|--|
| CO1           | learn images are formed, sampled, quantized and represented digitally                  | Remembering (K1)   |  |  |  |  |
| CO2           | understand the images are enhanced to improve subjective perception to spatial domain. | Understanding (K2) |  |  |  |  |
| CO3           | apply images are enhanced to improve subjective perception frequency domain.           | Applying (K3)      |  |  |  |  |
| CO4           | analyze the fundamental concepts of compression and Morphological Image Processing     | Analyzing (K4)     |  |  |  |  |
| CO5           | evaluate the need of image segmentation and representation.                            | Evaluating (K5)    |  |  |  |  |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   | 2   |     |     |     |     |     |     |      |      |      |      |      |
| CO2             | 2   | 1   | 2   |     |     |     |     |     |     |      |      |      |      |      |
| CO3             | 3   | 1   | 2   |     |     |     |     |     |     |      |      |      |      |      |
| CO4             | 3   | 2   | 2   |     |     |     |     |     |     |      |      |      |      |      |
| CO5             | 3   | 1   | 2   |     |     |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |
| CAT1                        | 20                          | 20                      | 40                 | 10                  | 5                    | 5                  | 100        |
| CAT2                        | 15                          | 20                      | 45                 | 10                  | 5                    | 5                  | 100        |
| CAT3                        | 20                          | 20                      | 40                 | 10                  | 5                    | 5                  | 100        |
| ESE                         | 20                          | 30                      | 35                 | 5                   | 5                    | 5                  | 100        |

## 20MCE16 - BIOINFORMATICS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Machine Learning                | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble                                       | To understand basic concepts of molecular biology and genetics and their application in Computer Science  |
|--|---|
| Unit - I                                       | Introduction: 9   |
| Need for Bioi<br>Primary Reso<br>- The Role of | nformatics Technologies – Overview of Bioinformatics Technologies - Overview of Structural Bioinformatics: Organisation -<br>ource- Secondary Resources and Applications - Integration over Multiple Resources - The Impact of Structural Genomics<br>Structural Bioinformatics in Systems Biology. |
| Unit - II                                      | Data warehousing and Data mining in Bioinformatics: 9   |
| Database Wa                                    | arehousing in Bioinformatics: Bioinformatics Data - Transforming Data to Knowledge - Data Warehousing - Data Ware   |



Housing Architecture – Data Quality – Data Mining for Bioinformatics: Biomedical Data Analysis – DNA Data Analysis – Protein Data Analysis – Machine Learning in Bioinformatics : Artificial Neural Network – Neural Network Architecture and Applications - Genetic Algorithm - Fuzzy System.

#### Unit - III Modeling For Bioinformatics:

Hidden Markov Modeling for Biological Data Analysis – Sequence Identification – Sequence Classification – Multiple Alignment Generation – Comparative Modeling – Probabilistic Modeling - Molecular Modeling - Systems Biotechnology: Introduction - Tools for Systems Biotechnology.

### Unit - IV Pattern Matching And Visualization:

Pattern Matching for Motifs: Introduction - Gene Regulation – Motif Recognition - Motif Detection Strategies Single Gene, Multi-Species Approach - Multi-Genes, Multi-Species Approach - Visualization and Fractal Analysis of Biological Sequences: Introduction – Fractal Analysis – DNA Walk Models – One Dimension – Two Dimension – Higher Dimension – Chaos Game Representation of Biological Sequences – DNA, Protein, Amino Acid Sequences.

#### Unit - V Microarray Analysis:

Microarray Technology for Genome Expression Study – Image Analysis for Data Extraction – Image Preprocessing – Block Segmentation – Automatic Gridding, Spot Extraction, Background Correction, Data Normalization and Filtering, and Missing Value Estimation -Data Analysis for Pattern Discovery.

Total: 45

**BT** Manned

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#### **REFERENCES:**

1. Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", 1<sup>st</sup> Indian Reprint, Springer Verlag, 2007.

2. Bryan Bergeron, "Bio Informatics Computing", 1<sup>st</sup> Edition, Pearson Education, New Delhi, 2015.

3. Andreas Baxevanis and Francis Ouellette, "Bioinformatics- A practical guide to the Analysis of Genes and proteins", 2<sup>nd</sup> Edition, Wiley India, 2001.

## COURSE OUTCOMES:

| On co | (Highest Level)   |                    |
|-------|---|--------------------|
| CO1   | understanding the fundamental concepts of bioinformatics                              | Understanding (K2) |
| CO2   | implement datamining and Machine Learning techniques in bioinformatics                | Applying (K3)      |
| CO3   | learn the concepts of computer science that relate to problems in biological sciences | Applying (K3)      |
| CO4   | manipulate pattern matching and visualization concepts in bioinformatics              | Applying (K3)      |
| CO5   | apply to use microarray analysis tool for biomedical research                         | Applying (K3)      |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3      | PO4       | PO5     | P06     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 1                                | 3        | 2        | 2         | 1       |         |     |     |     |      |      |      | 3    | 1    |
| CO2             | 1                                | 3        | 2        | 2         | 1       |         |     |     |     |      |      |      | 3    | 1    |
| CO3             | 1                                | 3        | 2        | 2         | 1       |         |     |     |     |      |      |      | 3    | 1    |
| CO4             | 1                                | 3        | 2        | 2         | 1       |         |     |     |     |      |      |      | 3    | 1    |
| CO5             | 1                                | 3        | 2        | 2         | 1       |         |     |     |     |      |      |      | 3    | 1    |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |
| CAT1                        | 20                          | 50                      | 30                 |                     |                      |                    | 100        |  |  |  |  |
| CAT2                        | 10                          | 20                      | 70                 |                     |                      |                    | 100        |  |  |  |  |

M.C.A - Master of Computer Applications, Regulation, Curriculum and Syllabus - R2020



| CAT3 | 10 | 20 | 70 |  | 100 |
|------|----|----|----|--|-----|
| ESE  | 10 | 30 | 60 |  | 100 |

## 20MCE17 - BUSINESS INTELLIGENCE

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Ρ | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble                                      | To recognize the Business Intelligence as expert information, knowledge and technologies, for the management of organizational and individual business in an efficient manner.   |   |  |  |  |  |  |  |  |  |
|---|--|---|--|--|--|--|--|--|--|--|
| Unit – I                                      | Overview of Business Intelligence, Analytics and Decision Support:   | 9 |  |  |  |  |  |  |  |  |
| Changing Bus<br>Use, and Bl<br>Brief Introduc | Changing Business Environments and Computerized Decision Support - A Framework for Business Intelligence - Intelligence Creation,<br>Use, and BI Governance - Transaction Processing Versus Analytic Processing - Successful BI Implementation - Analytics Overview -<br>Brief Introduction to Big Data Analytics.                             |   |  |  |  |  |  |  |  |  |
| Unit – II                                     | Business Reporting, Visual Analytics and Business Performance Management:  | 9 |  |  |  |  |  |  |  |  |
| Business Re<br>Emergence o<br>Measuremen      | Business Reporting Definitions and Concepts - Data and Information Visualization – Different Types of Charts and Graphs - The Emergence of Data Visualization and Visual Analytics - Performance Dashboards - Business Performance Management - Performance Measurement - Balanced Scorecards – Six Sigma as a Performance Measurement System. |   |  |  |  |  |  |  |  |  |
| Unit - III                                    | Data Mining:   | 9 |  |  |  |  |  |  |  |  |
| Data Mining<br>Software Too                   | Data Mining Concepts and Applications - Data Mining Applications - Data Mining Process - Data Mining Methods - Data Mining Software Tools - Data Mining Privacy Issues, Myths and Blunders.  |   |  |  |  |  |  |  |  |  |
| Unit - IV Text and Web Analytics:             |  |   |  |  |  |  |  |  |  |  |
| Text Analytic<br>Analysis - We                | ext Analytics and Text Mining Overview - Natural Language Processing - Text Mining Applications - Text Mining Process - Sentiment<br>Analysis - Web Mining Overview - Search Engines - Web Usage Mining - Social Analytics.  |   |  |  |  |  |  |  |  |  |



## Unit – V Emerging Trends and Future Impacts in Business Analytics:

Location Based Analytics for Organizations - Analytics Applications for Consumers - Recommendation Engines - The Web 2.0 Revolution and Online Social Networking - Cloud Computing and BI - Impacts of Analytics in Organizations -Issues of Legality, Privacy and Ethics - An Overview of the Analytics Ecosystem.

Total: 45

9

### **REFERENCES:**

| 1. | Ramesh Sharda, Dursun Delen and Efraim Turban "Business Intelligence – A Managerial Perspective on Analytics", 3 <sup>rd</sup> Edition, Pearson Education, India, 2018. |
|----|---|
| 2. | Efraim Turban, Ramesh Sharda and Dursun Delen, "Decision Support and Business Intelligence Systems", 9 <sup>th</sup> Edition, Pearson Education, India, 2017            |
| 3. | David Loshin, "Business Intelligence – The Savvy Manager's Guide", 2 <sup>nd</sup> Edition, Morgan Kaufmann Publishers, USA, 2013.                                      |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to   | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | explain the overview of analytics and decision support for business applications.                                | Understanding (K2)           |
| CO2           | organize the business reporting, visual analytics and business performance management for business applications. | Applying (K3)                |
| CO3           | utilize the data mining concepts for business intelligence.  | Applying (K3)                |
| CO4           | examine the text and web analytics with respect to business intelligence.  | Analyzing (K4)               |
| CO5           | assess the emerging trends and future impacts in business analytics.   | Evaluating (K5)              |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3      | PO4       | PO5     | P06     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             |                                  |          |          |           |         |         | 1   | 1   | 1   |      | 1    | 1    |      |      |
| CO2             |                                  |          |          |           | 2       | 1       | 1   |     |     | 3    |      | 2    |      |      |
| CO3             | 2                                | 3        | 1        | 1         | 2       |         |     |     |     |      |      |      | 2    |      |
| CO4             | 2                                | 3        | 3        | 3         |         |         |     |     |     |      |      |      | 2    |      |
| CO5             | 1                                | 3        | 3        | 3         |         |         |     | 3   |     |      |      | 3    | 1    |      |
| 1 - Slight, 2 - | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |
| CAT1                        | 10                          | 60                      | 30                 |                     |                      |                    | 100        |  |  |  |  |  |
| CAT2                        |                             | 20                      | 80                 |                     |                      |                    | 100        |  |  |  |  |  |
| CAT3                        |                             | 20                      | 20                 | 30                  | 30                   |                    | 100        |  |  |  |  |  |
| ESE                         | 4                           | 33                      | 43                 | 10                  | 10                   |                    | 100        |  |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



### 20MCE18 - BIG DATA ANALYTICS

| Programme &<br>Branch | Master of Computer Applications         | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---|------|----------|---|---|---|--------|
| Prerequisites         | Database Technologies, Machine Learning | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble                        | To focus on concepts, principles, and techniques applicable to any technology environment and industry for handling b data analytics.   | big   |
|---------------------------------|---|-------|
| Unit - I                        | Introduction To Big Data:   | 9     |
| Introduction -<br>and Storing - | <ul> <li>Big Data – Scalability and Parallel Processing – Designing Data Architecture – Data Sources, Quality, Pre-Proces</li> <li>Data Storage and Analysis – Big Data Analytics Applications and Case Studies.</li> </ul> | sing  |
| Unit - II                       | Hadoop Ecosystem:   | 9     |
| Introduction -<br>Hadoop Yarn   | <ul> <li>Hadoop and its Ecosystem – Hadoop Distributed File System – MapReduce Framework and Programming Mod</li> <li>Hadoop Ecosystem Tools.</li> </ul>  | el –  |
| Unit - III                      | MapReduce, Hive and Pig:  | 9     |
| Introduction -<br>Algorithms -  | - MapReduce Map Tasks, Reduce Tasks and Map Reduce Execution – Composing Map-Reduce for Calculations Hive – HiveQL – Pig.   | and   |
| Unit - IV                       | Spark and Big Data Analytics:   | 9     |
| Introduction -<br>ETL Process   | <ul> <li>Spark – Introduction to Data Analysis with Spark – Downloading Spark , and Programming using RDDs and MLIB – I</li> <li>– Introduction to Analytics, Reporting and Visualizing.</li> </ul>                         | Data  |
| Unit - V                        | NoSQL Big Data Management, MongoDB and Cassandra:   | 9     |
| Introduction -<br>Big Data Tas  | <ul> <li>NoSQL Data Store - NoSQL Data Architecture Patterns – NoSQL to Manage Big Data – Shared Nothing Architecture<br/>ks – MongoDB Database – Cassandra Databases.</li> </ul>   | e for |
|                                 | Total   | I: 45 |

## **REFERENCES:**

1. <u>Raj Kamal</u>, Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education; 1<sup>st</sup> Edition, 2019.

2. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley, 2<sup>nd</sup> Edition, 2019.



3. DT Editorial Services, "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization", Dreamtech Press; 1<sup>st</sup> Edition, 2016.

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | recognize how to leverage the insights from big data analytics       | Understanding (K2)           |
| CO2           | analyze the kinds of knowledge on Hadoop related tools               | Analyzing (K4)               |
| CO3           | apply the MapReduce and Hive technology associated with Big Data     | Analyzing (K4)               |
| CO4           | examine spark with Big Data analytics                                | Applying (K3)                |
| CO5           | apply NoSQL to handle Big Data problems                              | Applying (K4)                |

|                 | Mapping of COs with POs and PSOs                                |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01   | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2   | 2   |     |     |     |     |     |     |     |      |      |      | 1    |      |
| CO2             | 3   | 3   | 3   | 3   | 1   |     |     |     |     |      |      |      | 1    |      |
| CO3             | 2   | 2   |     |     |     |     |     |     |     |      |      |      | 1    |      |
| CO4             | 2   | 2   | 2   | 2   | 2   |     |     |     |     |      |      |      | 1    |      |
| CO5             | 2   | 2   | 2   | 2   | 2   |     |     |     |     |      |      |      | 1    |      |
| 1 – Slight, 2 – | I – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |
| CAT1                        | 20                          | 20                      | 30                 | 30                  |                      |                    | 100        |  |
| CAT2                        | 15                          | 25                      | 40                 | 20                  |                      |                    | 100        |  |
| CAT3                        | 10                          | 25                      | 40                 | 25                  |                      |                    | 100        |  |
| ESE                         | 15                          | 20                      | 35                 | 30                  |                      |                    | 100        |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



### 20MCE19 - ACCOUNTING AND FINANCIAL MANAGEMENT

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | NIL                             | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble                          | To deal with managing the monetary transactions in an organization that enables in taking useful financial and costing related decisions by providing scientific tools and techniques.                             |
|-----------------------------------|--|
| Unit - I                          | Financial Accounting: 9  |
| Meaning and Conventions           | Scope of Accounting – Classifications of Accounts – Accounting Cycle, Golden Rule - Fundamental Concepts and – Preparation of Journal – Ledger - Trial Balance – Trading, Profit and Loss Account - Balance Sheet. |
| Unit - II                         | Ratio Analysis: 9  |
| Introduction t<br>Liquidity Ratio | o Financial Statement Analysis – Advantages, Limitations of Ratio Analysis– Classification of Ratios: Profitability and<br>p.  |
| Unit - III                        | Cost Accounting: 9   |
| Meaning and                       | Objectives – Classification of Cost – Elements of Costs – Preparation and Interpretation of Cost Sheet.  |
| Unit - IV                         | Budgetary Control: 9   |
| Introduction -<br>Budget - Flex   | <ul> <li>Types of Budgets – Preparation and Interpretation of Functional Budgets: Sales Budget, Production Budget, Cash<br/>ible Budget.</li> </ul>  |
| Unit - V                          | Financial Management: 9  |
| Introduction -                    | - Objectives and Functions – Time Value of Money Concepts - Discounting and Compounding Techniques (Theory Only).  |
|                                   | Total: 45  |

### **REFERENCES**:

| 1 | 1. Dr.<br>Pu | S.N.Maheswari, Dr.Suneel K Maheswari, CA Sharad K Maheswaeri, "An Introduction to Accountancy", 12 <sup>th</sup> Edition, Vikas blishing House Pvt Ltd., 2018. (Unit I, II) |
|---|--------------|---|
| 2 | 2. R.S       | S.N.Pillai, Bagavathi, "Management Accounting", Revised Edition, Sultan Chand and Company Ltd., 2017. (Unit III, IV)  |
| 3 | 3. Pra       | asanna Chandra, "Financial Management: Theory and Practice", 10 <sup>th</sup> Edition, Tata McGraw Hill, 2019. (Unit V)   |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                                      | BT Mapped<br>(Highest Level) |
|---------------|---|------------------------------|
| CO1           | illustrate journal, ledgers and trail balance, trading account and balance sheet for various transactions | Applying (K3)                |
| CO2           | apply financial statement analysis for the given balance sheet  | Applying (K3)                |
| CO3           | demonstrate the concepts of cost accounting in preparing cost sheet                                       | Applying (K3)                |

M.C.A – Master of Computer Applications, Regulation, Curriculum and Syllabus – R2020

| CO4 | implement the various budgets using budgetary control  | Applying (K3)      |
|-----|--|--------------------|
| CO5 | classify the various functions in financial management | Understanding (K2) |

|                 | Mapping of COs with POs and PSOs                              |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs         | PO1   | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      | 1    |      |      |
| CO2             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      | 1    |      |      |
| CO3             | 3   | 2   | 1   | 1   | 1   |     |     |     |     |      |      | 1    |      |      |
| CO4             | 3   | 2   | 1   | 1   |     |     |     |     |     |      | 2    | 1    |      |      |
| CO5             | 2   | 2   | 1   |     |     |     |     |     |     |      | 1    |      |      |      |
| 1 – Slight, 2 – | – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |
| CAT1                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |
| CAT2                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |
| CAT3                        | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |
| ESE                         | 20                    | 20                      | 60                 |                     |                      |                    | 100        |  |

## 20MCE20 - NETWORK MANAGEMENT SYSTEM

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | Т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Data Communication Networks     | 3    | PE       | 3 | 0 | 0 | 3      |

| Preamble                              | To understand the principles of network management, different standards and protocols used in managing complex networks. |          |
|---------------------------------------|--|----------|
| Unit - I                              | Data Communication and Network Management Overview:  | 9        |
| Analogy of <sup>-</sup><br>Management | Telephone Network Management - Communications Protocols and Standards - Case Histories of Networking a                   | nd<br>NS |



| Platform - Cu | rrent Status and Fut | ure of Network | Management. |
|---------------|----------------------|----------------|-------------|
|---------------|----------------------|----------------|-------------|

### Unit - II Information Network and Technology:

Network Topology – Local Area Networks – Network Node Components – Wide Area Networks – Transmission Technology – Integrated Services.

## Unit - III SNMP AND Network Management:

Basic Foundations: Network Management Standards, Models – Organization Model – Information Model – Communication Model – Encoding Structure - Macros – Functional Model.

### Unit - IV SNMP Management:

RMON AND TMN Remote Monitoring – RMON SMI and MIB – RMON1 – ATM Remote Monitoring – TMN: Conceptual Model – Standards – Architecture.

### Unit - V Network Management Applications:

Configuration Management – Fault Management – Performance Management – Event Correlation Techniques – Security Management. Total: 45

### **REFERENCES:**

| 1. | Mani Subramanian, "Network Management: Principles and Practices", 2 <sup>nd</sup> Edition, Pearson Education India, 2010          |
|----|---|
| 2. | Mark Burgess, "Principles of Network and System Administration", 2 <sup>nd</sup> Edition, Wiley India Pvt. Ltd., New Delhi, 2008. |
| 3. | Nelson L.S. da Fonseca, Raouf Boutaba, "Cloud Services, Networking, and Management", John Wiley & Sons Inc, USA, 2015.            |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                               | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | acquire the knowledge about network management standards (OSI and TCP/IP)                          | Understanding (K2)           |
| CO2           | acquire the knowledge about various information and technology to use them in monitoring a network | Understanding (K2)           |
| CO3           | determine the basic foundations of SNMP and network Management                                     | Applying (K3)                |
| CO4           | evaluate various commercial network management systems and open network management systems         | Applying (K3)                |
| CO5           | analyze and interpret the various applications of network management                               | Analyzing (K4)               |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3      | PO4       | PO5     | PO6     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      | 1    | 2    |
| CO2             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      | 1    | 2    |
| CO3             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      | 1    | 2    |
| CO4             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      | 1    | 2    |
| CO5             | 3                                | 3        | 2        | 2         | 1       |         |     |     |     |      |      |      | 2    | 3    |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |
| CAT1                        | 40                    | 60                      |                    |                     |                      |                    | 100        |  |  |  |

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| CAT2 | 20 | 30 | 50 |    | 100 |
|------|----|----|----|----|-----|
| CAT3 |    | 20 | 60 | 20 | 100 |
| ESE  | 20 | 40 | 30 | 10 | 100 |

#### 20MCE21 - DEEP LEARNING

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Python Programming              | 4    | PE       | 3 | 0 | 0 | 3      |

| Preamble  | To provide an exposure to the details of neural networks as well as deep learning architectures and to develop end-to-<br>end models for such tasks. This course also provides the learning practice and acquires knowledge on deep learning<br>tools.      |
|---|---|
| Unit - I  | Neural Network: 9   |
| Building Intel<br>Limitations -<br>Neural Netwo | ligence Machine - Expressing Linear Perceptron as Neurons - Feed Forward Neural Netwoks - Linear Neurons and their<br>Sigmoid, Tanh and ReLU Neurons - Softmax Output Layers - Training Feed - Forward Neural Networks - Implementing<br>ork in TensorFlow. |
| Unit - II                                       | Convolution Neural Network: 9   |

Introduction - Filter and Feature Maps - Full Description of CNN - Max Pooling - Full Architectural Description of CNN - Image Preprocessing Pipeline Enable More Roburst Models - Accelerating Training with Batch Normalization - Visualizing Learning with Convolution Network - Leveraging and Learning Convolution Filters.

### Unit - III Embedding and Representational Learning:

Learning Lower Dimensional Representation - Principal Component Analysis - Motivating the Autoencoder Architecture - Implementing Autoencoder in TensorFlow - Denoising to Force Robust Representations - Sparsity in Autoencoders - Implementing the Skip-Gram Architecture.

### Unit - IV Memory Augmented Neural Networks:

Neural Turing Machine - Attention based Memory Access - NTM Memory Addressing Mechanisms - Differentiable Neural Computers – Interference-Free Writing in DNCs - DNC Memory Reuse - Temporal Linking - Understanding the DNC Read Head - DNC Controller Network – Visualizing - Implementing in TensorFlow.

## Unit - V Deep Reinforcement Learning:

Markov Decision Processes - Explore versus Exploit - Policy versus Value Learning – Pole-Cart with Policy Gradients - Q Learning and Deep Q Networks - Improving and Moving Beyond DQN.

Total: 45

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#### **REFERENCES:**

- 1. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", 1<sup>st</sup> Edition, O'Reilly Media, 2017.
- 2. Sudharsan Ravichandiran, "Hands-on Deep Learning Algorithms with Python", 1<sup>st</sup> Edition, Packt Publishing Limited, 2019.

3. Francois Chollet, "Deep Learning with Python", 1<sup>st</sup> Edition, Manning Publications Co, 2018.

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to               | BT Mapped<br>(Highest Level) |  |  |
|---------------|--|------------------------------|--|--|
| CO1           | describe the various fundamental concepts of Neural Network                        | Applying (K3)                |  |  |
| CO2           | apply Convolution Neural Network techniques to solve problems in image processing  | Applying (K3)                |  |  |
| CO3           | summarize the characteristics of Embedding and Representational Learning           | Understanding (K2)           |  |  |
| CO4           | comprehend the role of Memory Augmented Neural Networks                            | Understanding (K2)           |  |  |
| CO5           | interpret the concepts of Deep Reinforcement Learning to solve real world problems | Understanding (K2)           |  |  |

|                   | Mapping of COs with POs and PSOs |          |           |           |         |         |     |     |     |      |      |      |      |      |
|-------------------|----------------------------------|----------|-----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs           | P01                              | PO2      | PO3       | PO4       | PO5     | P06     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1               | 3                                | 3        | 2         | 3         | 1       |         | 2   |     |     |      |      |      | 2    | 1    |
| CO2               | 3                                | 3        | 2         | 3         | 1       |         | 2   |     |     |      |      |      | 2    | 1    |
| CO3               | 2                                | 2        | 2         | 1         | 3       | 2       |     | 1   |     |      |      |      | 1    | 1    |
| CO4               | 2                                | 2        | 2         | 1         | 3       | 2       |     | 1   |     |      |      |      | 1    | 1    |
| CO5               | 2                                | 2        | 2         | 1         | 3       | 2       |     | 1   |     |      |      |      | 1    | 1    |
| 1 – Slight, 2 – I | Moderat                          | e, 3 – S | ubstantia | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |
| CAT1                        | 10                    | 30                      | 60                 |                     |                      |                    | 100        |  |  |  |  |
| CAT2                        | 20                    | 40                      | 40                 |                     |                      |                    | 100        |  |  |  |  |
| CAT3                        | 20                    | 80                      |                    |                     |                      |                    | 100        |  |  |  |  |
| ESE                         | 10                    | 50                      | 40                 |                     |                      |                    | 100        |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 20MCE22 - BLOCKCHAIN TECHNOLOGY

|   | Programme &<br>Branch  | Master of Computer Applications | Sem. | Category | L | Т | Р        | Credit |  |  |
|---|--|---------------------------------|------|----------|---|---|----------|--------|--|--|
| Ν | C.A – Master of Computer Applications, Regulation, Curriculum and Syllabus – R2020 |                                 |      |          |   |   | Page 103 |        |  |  |

| Prerequisites Data Structures and Algorithms, Cryptography and Network Security | 4 | PE | 3 | 0 | 0 | 3 |
|---|---|----|---|---|---|---|
|---|---|----|---|---|---|---|

| <b>D</b>                                     |  |                    |
|--|--|--------------------|
| Preamble                                     | To know about the Basics in Blockchain Technology and its Applications with different Platforms.   |                    |
| Unit - I                                     | Blockchain:  | 9                  |
| Growth - Dist<br>Contracts - P               | tributed System - History - Types of Blockchain - Consensus - Decentralization: Methods - Routes - Ecosystems -<br>latforms for Decentralization.  | Smart              |
| Unit - II                                    | Symmetric Cryptography:  | 9                  |
| Introduction -<br>Functions.                 | Cryptographic Primitives - Public Key Cryptography: Asymmetric Cryptography - Private and Public Keys:   | Hash               |
| Unit - III                                   | Blockchain Outside of Currencies:  | 9                  |
| IOT - Govern                                 | ment - Health - Finance - Scalability and other Challenges.  |                    |
| Unit - IV                                    | Bitcoin:   | 9                  |
| Introduction -<br>Spending the               | How Bitcoin Works: Bitcoin Transactions - Constructing a Transaction - Bitcoin Mining - Mining Transactions in B e Transaction - Bitcoin Client: Bitcoin Core - Using JSON- RPC API - Alternative Clients, Libraries and Toolkits.   | locks -            |
| Unit - V                                     | Keys, Addresses and Wallets:   | 9                  |
| Introduction<br>Mnemonics (<br>orphan transa | <ul> <li>Bitcoin Addresses - Implementing Keys and Addresses in Python -Wallets: Random Wallets - Seeded Wa</li> <li>Code Words - Hierarchical Deterministic Wallets-Transaction: Life Cycle - Structure - Inputs and Outputs - Chainin</li> <li>actions – Script- Standard Transactions.</li> </ul> | illets -<br>ig and |

Total: 45

## **REFERENCES:**

| 1. | Imran Bashir, "Mastering Blockchain", 2 <sup>nd</sup> Edition, Packt Publication, Mumbai, 2018. (Unit I, II and III).  |
|----|--|
| 2. | Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 1 <sup>st</sup> Edition, O'Reilly Media Inc, USA, 2015. (Unit IV and V).   |
| 3. | Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Leveraging Blockchain Programming', 1 <sup>st</sup> Edition, Create Space Independent Publishing Platform, 2017. |

| COUR<br>On cor | SE OUTCOMES:<br>npletion of the course, the students will be able to                              | BT Mapped<br>(Highest Level) |
|----------------|---|------------------------------|
| CO1            | describe the Basics of Blockchain Technology concepts and its applications.                       | Understanding (K2)           |
| CO2            | how various security services are provided with the help of symmetric and asymmetric cryptography | Applying (K3)                |
| CO3            | summarize the Blockchain scalability and challenges in other domains                              | Understanding (K2)           |
| CO4            | providing the details about the Bitcoin clients and programming APIs                              | Understanding (K2)           |
| CO5            | explain the technical concepts related to Bitcoin Cryptocurrencies in detail.                     | Understanding (K2)           |

|                 | Mapping of COs with POs and PSOs |          |          |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3      | PO4       | PO5     | P06     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO2             | 3                                | 2        | 1        | 1         |         |         |     |     |     |      |      |      |      |      |
| CO3             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO4             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| CO5             | 2                                | 1        |          |           |         |         |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstanti | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |



|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |
| CAT1                        | 30                          | 60                      | 10                 |                     |                      |                    | 100        |  |  |  |  |  |
| CAT2                        | 30                          | 50                      | 20                 |                     |                      |                    | 100        |  |  |  |  |  |
| CAT3                        | 40                          | 60                      |                    |                     |                      |                    | 100        |  |  |  |  |  |
| ESE                         | 30                          | 50                      | 20                 |                     |                      |                    | 100        |  |  |  |  |  |

### 20MCE23 – DISTRIBUTED DATABASE SYSTEMS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Database Technologies           | 4    | PE       | 3 | 0 | 0 | 3      |

| Preamble   | To introducing the concepts and techniques of distributed database including principles, architectures, des implementation and major domain of application   | sign, |  |  |  |  |  |  |  |
|--|--|-------|--|--|--|--|--|--|--|
| Unit - I   | Introduction:  | 9     |  |  |  |  |  |  |  |
| Distributed Database System - History of Distributed DBMS - Data Delivery Alternatives - Promises of Distributed DBMSs - Design<br>Issues - Distributed DBMS Architecture – Distributed and Parallel Database Design - Data Fragmentation - Allocation - Distributed Data<br>Control - View Management - Access Control.                             |  |       |  |  |  |  |  |  |  |
| Unit - II  | - II Distributed query and Transaction Processing:   |       |  |  |  |  |  |  |  |
| Overview - Data Localization - Join Ordering in Distributed Queries - Distributed Cost Model - Distributed Query Optimization - Adaptive<br>Query Processing - Distributed Concurrency Control - Distributed Concurrency Control Using Snapshot Isolation - Distributed DBMS<br>Reliability-Modern Approaches to Scaling Out Transaction Management. |  |       |  |  |  |  |  |  |  |
| Unit - III   | Data Replication and Database Integration - Multidatabase Systems:   | 9     |  |  |  |  |  |  |  |
| Consistency and Failures   | of Replicated Databases - Update Management Strategies - Replication Protocols - Group Communication - Replica<br>- Database Integration - Multidatabase Query Processing.                           | ation |  |  |  |  |  |  |  |
| Unit - IV  | Parallel Database Systems:   | 9     |  |  |  |  |  |  |  |
| Parallel Archi   | tectures - Data Placement - Parallel Query Processing - Load Balancing - Fault-Tolerance - Database Clusters.  |       |  |  |  |  |  |  |  |
| Unit - V   | Peer-to-Peer Data Management and NoSQL: 9  |       |  |  |  |  |  |  |  |
| Infrastructure<br>Value Stores   | nfrastructure - Schema Mapping in P2P Systems - Querying Over P2P Systems - Replica Consistency - Motivations for NoSQL - Key-<br>/alue Stores - Document Stores - Wide Column Stores - Graph DBMSs. |       |  |  |  |  |  |  |  |

Total: 45

## **REFERENCES:**

1. M. Tamer Ozsu, Patrick Valduriez. "Principles of Distributed Database Systems", 4<sup>th</sup> Edition, Springer, 2019.



Saeed K Rahimi, Frank S Haug. "Distributed Database Management Systems: A Practical Approach", 1<sup>st</sup> Edition, Wiley-IEEE 2. Computer Society, 2010.

3. Stefano Ceri, Giuseppe Pelagatti, "Distributed Databases: Principles and Systems", 1<sup>st</sup> Edition, McGraw Hill Education, 2017.

## COURSE OUTCOMES:

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                   | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | explain the architecture of a system based on distributed databases.                   | Understanding (K2)           |
| CO2           | make us of Query and Transaction processing on local sites                             | Applying (K3)                |
| CO3           | compare different approaches to data replication and presented Protocols.              | Analyzing (K4)               |
| CO4           | examine the multiprocessor computers to run to improve performance                     | Analyzing (K4)               |
| CO5           | illustrate the massive distribution and inherent heterogeneity in distributed systems. | Understanding (K2)           |

|                 | Mapping of COs with POs and PSOs |          |           |           |         |         |     |     |     |      |      |      |      |      |
|-----------------|----------------------------------|----------|-----------|-----------|---------|---------|-----|-----|-----|------|------|------|------|------|
| COs/POs         | P01                              | PO2      | PO3       | PO4       | PO5     | P06     | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1             | 2                                | 2        | 1         |           |         |         |     |     |     |      |      |      | 1    | 2    |
| CO2             | 2                                | 1        | 3         |           |         |         |     |     |     |      |      |      | 2    | 2    |
| CO3             | 2                                | 2        | 2         |           |         |         |     |     |     |      |      |      | 2    | 1    |
| CO4             | 2                                | 3        | 1         |           |         |         |     |     |     |      |      |      | 1    | 3    |
| CO5             | 1                                | 2        | 2         |           |         |         |     |     |     |      |      |      | 2    | 1    |
| 1 – Slight, 2 – | Moderat                          | e, 3 – S | ubstantia | al, BT- E | Bloom's | Taxonor | ny  |     |     |      |      |      |      |      |

|                             | ASSESSMENT PATTERN - THEORY |                         |                    |                     |                      |                    |            |  |  |  |  |  |
|-----------------------------|-----------------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) %       | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |  |
| CAT1                        | 30                          | 45                      | 25                 |                     |                      |                    | 100        |  |  |  |  |  |
| CAT2                        | 20                          | 25                      | 30                 | 25                  |                      |                    | 100        |  |  |  |  |  |
| CAT3                        | 15                          | 20                      | 35                 | 30                  |                      |                    | 100        |  |  |  |  |  |
| ESE                         | 20                          | 30                      | 30                 | 20                  |                      |                    | 100        |  |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

# 20MCE24 - DECISION SUPPORT SYSTEMS

| Programme &<br>Branch | Master of Computer Applications                              | Sem. | Category | L | т | Р | Credit |
|-----------------------|--|------|----------|---|---|---|--------|
| Prerequisites         | Software Engineering Methodologies, Database<br>Technologies | 4    | PE       | 3 | 0 | 0 | 3      |

| Preamble                                    | To combine the use of models or analytic techniques with traditional data access and retrieval functions  |
|---|---|
| Unit - I                                    | Decision Support Systems and Database Models and Systems: 9   |
| Introduction -<br>Database Sy               | <ul> <li>Subsystems in DSS - Computer Hardware for DSS - Group Decision Support Systems - Information Characteristics - Pre<br/>stems – Database models - Database Languages - Data Dictionary - Database Administrator.</li> </ul> |
| Unit - II                                   | Model Base Management Subsystem: 9  |
| Representati<br>Software for                | on of Models - Benefits of Modelling a Problem - Stages in Model Development - Classification of Models - Computer DSS Models.  |
| Unit - III                                  | Dialogue Management Subsystems and Technologies for DSS: 9  |
| Classification<br>Computing.                | of Users - Major Factors - Interface Styles - Storage Technologies - Advancements in Output Devices - New Directions in   |
| Unit - IV                                   | Business Intelligence: 9  |
| The Nature a<br>Organization<br>Datamining. | and Sources of Data – Data Collection, Problems and Quality –Database Management Systems in DSS – Database and Structure – Data Warehousing – Datamarts, Business Intelligence – Online Analytical Processing(OLAP) -               |
| Unit - V                                    | Impacts of MSS: 9   |
| Overview - II                               | mpacts on Organization Individuals-Decision Making and the Manager's Joh – Issues of Legality, Privacy and Ethics   |

Total: 45

### **REFERENCES:**

| 1. | Janakiraman V.S. and Sarukesi K., "Decision Support Systems", 1 <sup>st</sup> Edition, Prentice Hall of India, 2009. (Units I, II and III)                     |
|----|--|
| 2. | Efraim Turban and Jay E.Aronson, "Decision Support System and Intelligent Systems", 7 <sup>th</sup> Edition, Prentice Hall International, 2007.(Unit IV and V) |
| 3. | George M.Marakas, "Decision Support Systems in the 21 <sup>st</sup> Century", 2 <sup>nd</sup> Edition, Prentice Hall, 2003.                                    |

| COUR<br>On co | SE OUTCOMES:<br>mpletion of the course, the students will be able to                             | BT Mapped<br>(Highest Level) |
|---------------|--|------------------------------|
| CO1           | explore the different phases, Methodologies and Technologies to develop decision support systems | Remembering (K1)             |
| CO2           | obtain knowledge of designing DSS/ for specific problems   | Understanding (K2)           |
| CO3           | use different MSS modeling techniques  | Applying (K3)                |
| CO4           | show the relation between DSS and other information systems                                      | Analyzing (K4)               |
| CO5           | comprehend the need for computerized support of managerial decision making                       | Analyzing (K4)               |

| Mapping of COs with POs and PSOs |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs                          | P01 | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                              | 2   |     | 3   |     |     | 2   | 3   |     |     |      |      | 2    | 3    |      |
| CO2                              | 2   | 2   | 3   |     |     |     | 2   |     |     |      |      | 2    |      | 2    |

M.C.A – Master of Computer Applications, Regulation, Curriculum and Syllabus – R2020



|                   | Mapping of COs with POs and PSOs                                |   |   |  |  |   |   |  |  |  |   |   |   |
|-------------------|---|---|---|--|--|---|---|--|--|--|---|---|---|
| CO3               | 2   |   | 3 |  |  | 2 | 3 |  |  |  | 2 | 2 | 3 |
| CO4               | 1   | 3 | 2 |  |  |   |   |  |  |  | 2 |   |   |
| CO5               | 3   | 3 | 2 |  |  |   |   |  |  |  | 2 | 3 | 3 |
| 1 – Slight, 2 – I | I – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |   |   |  |  |   |   |  |  |  |   |   |   |

| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |
| CAT1                        | 40                    | 60                      |                    |                     |                      |                    | 100        |  |  |
| CAT2                        | 20                    | 50                      | 30                 |                     |                      |                    | 100        |  |  |
| CAT3                        | 20                    | 30                      | 30                 | 20                  |                      |                    | 100        |  |  |
| ESE                         | 10                    | 40                      | 30                 | 20                  |                      |                    | 100        |  |  |

# 20MCE25 - SOCIAL NETWORK ANALYSIS

| Programme &<br>Branch | Master of Computer Applications | Sem. | Category | L | т | Р | Credit |
|-----------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites         | Natural Language Processing     | 4    | PE       | 3 | 0 | 0 | 3      |

| Preamble   | To provide a core knowledge of Social network analysis along with real world data.  |                             |  |  |  |  |  |  |
|--|---|-----------------------------|--|--|--|--|--|--|
| Unit - I   | Social Network Data Analytics:  | 9                           |  |  |  |  |  |  |
| Introduction - Statistical Properties of Social Networks: Preliminaries – Static Properties - Dynamic Properties – Random Walks of Graphs: Background – Random Walk based Proximity Measures - Other Graph - Based Proximity Measures – Graph - Theore Measures for Semi-Supervised Learning - Clustering with Random Walk based Measures - Related Work: Applications.                            |   |                             |  |  |  |  |  |  |
| Unit - II  | Community Discovery and Node Classification in Social Networks:   |                             |  |  |  |  |  |  |
| Communities<br>Spectral Algo<br>Networks: Pr<br>Large Social   | in Context - Core Methods: Quality Functions - The Kernighan -Lin(KL) Algorithm – Agglomerative / Divisive Algorit<br>rithms - Multi-Level Graph Partitioning - Markov Clustering – Emerging Fields and Problems - Node Classification in<br>oblem Formulation - Methods using Local Classifiers - Random Walk based Methods - Applying Node Classificat<br>Networks Variations on Node Classification. | thms -<br>Social<br>tion to |  |  |  |  |  |  |
| Unit - III   | A Survey of Social Influence Analysis, Expert Location and Link Prediction in Social Networks:  | 9                           |  |  |  |  |  |  |
| Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Expert Location in Social Networks: Expert Location without Graph Constraints - Expert Location with Score Propagation – Expert Team Formation – Line Prediction in Social Networks: Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models. |   |                             |  |  |  |  |  |  |
| Unit - IV  | Visualizing and Mining in Social Networks:  | 9                           |  |  |  |  |  |  |


Introduction – Taxonomy of Visualizations - Structural Visualization - Semantic and Temporal Visualization - Statistical Visualization – Data Mining Methods for Social Media - Text Mining in Social Networks: Keyword Search - Query Semantics and Answer Ranking - Keyword Search over XML and Relational Data - Keyword Search over Graph Data - Classification Algorithms - Clustering Algorithms – Transfer Learning in Heterogeneous Networks.

## Unit - V Multimedia Information Networks & Social Tagging:

Multimedia Information Networks in Social Media: Introduction – Ontology based Learning – Links from Community Media – Network of Personal Photo Albums – Network of Geographical Information – Inference Methods – An Overview of Social Tagging and Applications : Introduction – Tags – Tag Generation Models – Tagging System Design – Tag Analysis – Visualization of Tags – Tag Recommendations – Applications of Tag – Tagging Problems.

Total: 45

9

| REFERENCES: |  |  |  |  |  |  |  |  |
|-------------|--|--|--|--|--|--|--|--|
| 1.          | Charu C. Aggarwal, "Social Network Data Analytics", 1 <sup>st</sup> Edition, Springer, US, 2011.                     |  |  |  |  |  |  |  |
| 2.          | Peter Mika. "Social Networks and the Semantic Web", 1 <sup>st</sup> Edition, Springer, New York, 2007.               |  |  |  |  |  |  |  |
| 3.          | Borko Furht. "Handbook of Social Network Technologies and Applications", 1 <sup>st</sup> Edition, Springer, US, 2010 |  |  |  |  |  |  |  |

| COUF<br>On co | RSE OUTCOMES:<br>mpletion of the course, the students will be able to  | BT Mapped<br>(Highest Level) |  |  |
|---------------|--|------------------------------|--|--|
| CO1           | understand the Statistical properties and various measures of the social network.  | Understanding (K2)           |  |  |
| CO2           | apply different methods and algorithms for social networks to predict interaction among the different network communities. | Applying (K3)                |  |  |
| CO3           | get a Survey of Social Influence Analysis along with Expert location and Link Prediction in Social Networks                | Analyzing (K4)               |  |  |
| CO4           | apply the various visualization and Mining Techniques in Social networks.  | Applying (K3)                |  |  |
| CO5           | make use of Multimedia Information Networks in social media.   | Analyzing (K4)               |  |  |

| Mapping of COs with POs and PSOs                                |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs   | P01 | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1   | 2   | 1   |     |     |     |     |     |     |     |      |      |      |      |      |
| CO2   | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO3   | 3   | 3   | 2   | 2   | 1   |     |     |     |     |      |      |      |      |      |
| CO4   | 3   | 2   | 1   | 1   |     |     |     |     |     |      |      |      |      |      |
| CO5   | 3   | 3   | 2   | 2   | 1   |     |     |     |     |      |      |      |      |      |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy |     |     |     |     |     |     |     |     |     |      |      |      |      |      |



| ASSESSMENT PATTERN - THEORY |                       |                         |                    |                     |                      |                    |            |  |  |  |  |
|-----------------------------|-----------------------|-------------------------|--------------------|---------------------|----------------------|--------------------|------------|--|--|--|--|
| Test / Bloom's<br>Category* | Remembering<br>(K1) % | Understanding<br>(K2) % | Applying<br>(K3) % | Analyzing<br>(K4) % | Evaluating<br>(K5) % | Creating<br>(K6) % | Total<br>% |  |  |  |  |
| CAT1                        | 20                    | 40                      | 40                 |                     |                      |                    | 100        |  |  |  |  |
| CAT2                        | 20                    | 30                      | 40                 | 10                  |                      |                    | 100        |  |  |  |  |
| CAT3                        | 20                    | 30                      | 40                 | 10                  |                      |                    | 100        |  |  |  |  |
| ESE                         | 20                    | 33                      | 40                 | 7                   |                      |                    | 100        |  |  |  |  |

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)