BABA MASTNATH UNIVERSITY

Faculty of Management & Commerce

Department of Computer Science & Applications

Ordinance, Scheme of Examination & Syllabus of

Master of Computer Applications

(MCA-Regular Mode)

(Duration :02 Years Post Graduate Course under CBCS System)

From the Academic session

2022-23

Grand Total Credits= 104

BABA MASTNATH UNIVERSITY

Faculty of Management & Commerce

Department of Computer Science & Applications

Master of Computer Applications

ACADEMIC SESSION:2022-23 (CBCS)

ORDINANCE FOR MCA UNDER CHOICE BASED CREDIT SYSTEM

1. Definitions of Key Words:

- **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the prescribed courses (Core, elective or soft skill courses). It provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.
- **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- **Course:** Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/tutorials/laboratory work/field work/outreach activities/project work/vocational training/viva/seminars/term papers/assignments/presentations/self-study etc. or a combination of some of these.
- **Credit (c):** A unit by which the course work is measured. It determines the numberof hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.
- **Credit Point:** It is the product of grade point and number of credits for a course.
- **Grade Point (g):** It is a numerical weight allotted to each letter grade on a 10-point scale.
- **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F. means a letter grade assigned to a student on the basis of evaluation of a course on a ten point scale.
- **Programme:** An educational programme leading to the award of a Degree, Diploma or Certificate.
- **Credit Based Semester System (CBSS):** Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.
- **Semester:** Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December

and even semester from January to June.

- **The credit based semester system** provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.
- **Semester Grade Point Average (SGPA):** It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during thatsemester. It shall be expressed up to two decimal places.
- **Cumulative Grade Point Average (CGPA):** It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.
- **Transcript/ Grade Card or Certificate:** Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

2. Eligibility for admission:

a) Passed BCA/B.Sc.(Hons.) Computer Science/ B.E. or B.Tech.(CSE/IT)/ B.Voc.(Software Development/IT) or an equivalent degree with having at least 50% marks (45% for SC/ST candidates of Haryana only) in aggregate.

OR

b) Passed B.Sc/ B.Com/ B.A with Mathematics at 10+2 level or at Graduation level with having at least 50% marks(45% for SC/ST candidates of Haryana only) in aggregate, along with the students admitted with this eligibility will have to simultaneously undertake additional ****Bridge Course*** as prescribed by the University during the first semester.

Note: * It is compulsory for each student to pass out Bridge Course (two additional theory papers and two practical as prescribed in scheme of examination of Bridge Course) as per University norms during the 1st year of MCA-2 year course and the degree will be awarded after the completion of Bridge Course. However, these papers under Bridge Course will be taught only in the 1st semester of the course.

3. **Credits:**

Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus, in each course, credits are assigned on the basis of the number of lectures/tutorials/laboratory work/field work and other forms of learning required completing the contents in a 15 week schedule. 2 hours of laboratory work/field work is generally considered equivalent to 1 hour of lecture.

- 1 credit = 1 hour of instruction per week (1 credit course = 15 hours of instruction per semester)
- 3 credits = 3 hours of instruction per week (3 credit course = 45 hours of instruction per Semester)

A Core/elective courses may carry 3 to 4 credits; Self-study Course will not normally carry more than 3 credits. However, a dissertation/ project work/ field work may carry up to 6 credits; and a semester-long Dissertation/project work/field work may carry up to 24 credits.

Examination and Assessment:

The sessional work and the end semester examination shall have the weightage of 40% and 60% respectively.

Sessional Evaluation:

Sessional evaluation shall be done on a continuous basis, taking into account the student's class performance, fulfillment of assignments and performance at the two compulsory sessional tests to be conducted in a semester. For uniformity, particularly for interdepartmental transfer of credits, there shall be a uniform procedure of examination to be adopted by all faculty members. There shall be minimum two sessional tests and one end-semester examination in each course during every semester.

Sessional Test 1 shall be held during the sixth week of the semester for the syllabi covered till then.

Sessional Test 2 shall be held during the twelfth week for the syllabi covered between seventh and twelfth week.

Sessional tests may employ one or more assessment tools such as objective tests, assignments, paper presentation, laboratory work, etc. suitable to the course.

The pattern of assessment of sessional work, including the weightages to be given to different elements like class performance, assignments and the sessional tests, for each course shall be prescribed by the School Board on the recommendation of the Board of Studies of the Department concerned and shall be made known to the students at the commencement of each semester.

In special circumstances, a student can be allowed to repeat one sessional test, if his/her application in this regard is considered by the Head of the Department.

The 40% weightage allotted to sessional work shall consist of 50% for class performance and assignments and the remaining 50% for the two compulsory sessional tests i.e. 15% weightage to each compulsory session assignment/test out of total 40% weightage assigned to sessional assessment. Out of the total 40% weightage for sessionals, maximum 10% weightage may be assigned to overall participation of the student during the semester. Depending upon the nature of the course, the division of the weightage of sessional marks may be defined accordingly by the concerned School Board.

A student clears the sessional work in a course if he/she has participated in the sessional work and secured P or higher grade in it.

A student is required to qualify sessionals and end-semester examinations separately with minimum 'P' grade. A student can appear in end-semester examination provided he/she has qualified requirements of sessional assessment with minimum 'P' grade.

End-Semester Examination:

End semester Examinations covering the entire syllabus prescribed for the course and carrying 60% of weightage shall be conducted by the examination branch in consultation with the Dean of the concerned faculty.

Examiners or Board of Examiners shall be appointed for each course by the faculty/department

Board on the recommendation of the Board of Studies of the Department concerned.

The distribution of weightage for the valuation of semester-long project works dissertation shall be:

i) Periodic presentation : 20%
ii) Concise dissertation : 60%
iii) Viva voce : 20%
iv) Or as decided by the Boardof Studies of the Department concerned.

Hall tickets/admit cards shall be issued to the student on the recommendations of the Head of the Department on submission of the following documentsby the student:

I. Certificate indicating fulfilment of the requirements of sessional evaluation including sessional tests, attendance, assignments etc. (to be issued by theHOD)
II. No dues certificate on the prescribed format

Letter Grades and Grade points:

Absolute Grading system shall be adopted to grade the students.

Under the absolute grading system, marks are converted to grades based on pre-determined class intervals.

In the End-semester theory or practical examinations, examiners shall award the marks and these marks will be further converted into grades/grade points by the examination branch in accordance with the provisions of the ordinance.

Detailed Marks Sheet issued at the end of the semester or the program shall carry marks/percentage and equivalent grades both.

University shall adopt the 10-point grading system with the letter grades as given under:

Letter Grade	Grade Point	ClassInterval (in %)
O (outstanding)	10	90 and above
A+ (excellent)	9	75 and < 90
A (very good)	8	60 and< 75
B+ (good)	7	55 and< 60
B (above average)	6	50 and< 55
C (average)	5	45 and< 50

P (pass)	4	40 and< 45
F (fail)	0	< 40
Ab (absent)	0	Absent

Note:

I. F= Fail, and the students graded with 'F' in a programme or course shall be required to re-appear in the examination

II. Minimum qualifying marks for a course or programme is 40% i.e. 'P' grade.

III. 'B' grade is 50 % or less than 55%

IV. 'B+' grade is 55 % or less than 60%

V. Students shall have to qualify the sessionals (tests, assignments, attendance, presentations etc.) and end-semester examinations separately and the student failing to qualify either of the components shall not be considered as qualified in any case. However, student failing to qualify the sessionals shall not be permitted to take the end-semester examinations.

VI. Students shall be allowed to improve their grades during the maximum duration of the programme of study

VII. There shall be no rounding of SGPA/CGPA.

VIII. The SGPA/CGPA obtained by a student is out of a maximum possible 10 points.

IX. A student in order to be eligible for the award of the Master's degree of the University must have obtained CGPA of 4 at the end of the programme.

The Cumulative Grade Point Average (CGPA) obtained by a student shall be classified into the following divisions:

CGPA	Class/ Division
10	Outstanding
9 and above, but less than 10	First Class with distinction
8 and above, but less than 9	First
7 and above, but less than 8	High Second
6 and above, but less than 7	Second
4 and above, but less than 6	Third

Assessment:

The assessment of the theoretical component towards the end of the semester shall be undertaken by the examiners from within the university. These examiners may be appointed by the concerned Board of Studies on the basis of the specialisation of the faculty. In such courses, suitable eligible faculty shall be assigned the responsibility of setting of the question papers and the evaluation of the answer scripts by the concerned HOD.

In case of the practical component of core courses, assessment shall be jointly carried out by the internal and external examiners. For the assessment of practical component, half of the examiners in the team shall be invited from outside the University from amongst the panel of examiners (not belowthe rank of Associate Professor) approved by the competent authority.

In case of the project reports/thesis/dissertation etc. the assessment shall be jointly carried out by the internal and external examiners. External examinersshall be invited from amongst the panel of examiners (not below the rank ofAssociate Professor) approved by the competent authority.

Minimum Credit requirements:

For a two-year Master's programme, the credit requirements for the Master's degree shall be 80 credits (±10%), including a minimum of 18 credits from elective courses (of which at least 6 credits shall be from elective courses offered by other Departments).

Computation of SGPA and CGPA:

University follows the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and sum of the number of credits of all the courses undergone by a student, i.e.

SGPA (Si)= $\sum(Ci \times Gi)/\sum Ci$

where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA=$\sum(Ci \times Si)/\sum Ci$

where Si is the SGPA of the i^{th} semester and Ci is the total no. of credits in that semester. The SGPA and CGPA shall be rounded off to 2 decimal points.

Illustration of the computation of SGPA and CGPA:

Illustration of SGPA computation:

Course	Credit	Grade Letter	Grade Point	Credit Point
Course I	3	A	8	3 x 8=24
Course II	4	B+	7	4 x 7= 28
Course III	3	B	6	3 x 6= 18
Course IV	3	O	10	3 x 10=30
	Total credits for the semester=13			Total Credit points earned= 100

Thus SGPA= 100/13= 7.69

Illustrations for CGPA:

Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI
Credit: 20	Credit: 22	Credit: 25	Credit: 26	Credit: 26	Credit: 25
SGPA: 6.9	SGPA: 7.8	SGPA: 5.6	SGPA: 6.0	SGPA: 6.3	SGPA= 8.0

$$\text{Thus, CGPA}=\frac{(20 \times 6.9) + (22 \times 7.8) + (25 \times 5.6) +(26 \times 6.0) + (26 \times 6.3) +(25 \times 8.0)}{144} = 6.73$$

Transcript (Format): Based on the above, letter grades, grade points and SGPA and CGPA, Transcripts/DMCs shall be issued for each semester and a consolidated transcript indicating the performance in all semesters.

Removal of name of a student from the program:

The name of a student falling under the following categories shall automatically stand removed from the rolls of the University:

(a) A student who fails to fulfill the minimum grade point requirements prescribed for the program during the maximum duration of the program.

(b) A student who has already exhausted the maximum duration allowed for completion of the Program and has not fulfilled the requirements for the

award of the degree / diploma.

(c) A student who is found involved in misconduct/forgery/indiscipline or offensive conduct upon recommendation of the Discipline committee/ Proctorial Board.

(d) A student who fails to attend 75% of classes. However, in special circumstances, considering the merit of the case on the recommendations of the department, Vice Chancellor may relax the condition by 15%.

The University, on the recommendation of the Board of Studies of the Department concerned, may remove the name of a student from the programme of study if-

(e) He/ she fails to clear at least 50% of the prescribed core courses at the end of the 1st semester.

(f) He / she has still to clear courses which cannot possibly be cleared within the maximum duration of the programme or in the remaining period of the programme which he/ she is allowed to register for the normal load in the said period.

(g) He/she fails to qualify the sessional requirements (sessional tests, attendance, assignments etc.) and end-semester examinations of the minimum required courses (core or elective) separately.

Indiscipline and Unfair Means in Examinations:

There shall be zero- tolerance against use of unfair means and unfair practices in connection with examination and each examinee shall be required to strictly adhere to the instructions for taking examination.

Non adherence to such instructions shall attract disciplinary action. Use of unfair means is strictly prohibited and shall invite serious disciplinary action for anyone found using unfair means during any examination. Indiscipline, Unfair practices and Unfair means relating to examination shall mean and include:

BABA MASTNATH UNIVERSITY
Faculty of Management & Commerce
Department of Computer Science & Applications
Master of Computer Applications
ACADEMIC SESSION:2022-23 (CBCS)

NAME OF PROGRAMME : MASTER OF COMPUTER APPLICATIONS (MCA)
DURATION : 02 (TWO) YEARS

ELIGIBILITY FOR ADMISSION TO TWO YEARS MASTER OF COMPUTER APPLICATIONS (MCA) PROGRAMME :

a) Passed BCA/B.Sc.(Hons.) Computer Science/ B.E. or B.Tech.(CSE/IT)/ B.Voc.(Software Development/IT) or an equivalent degree with having at least 50% marks (45% for SC/ST candidates of Haryana only) in aggregate.

OR

b) Passed B.Sc/ B.Com/ B.A with Mathematics at 10+2 level or at Graduation level with having at least 50% marks(45% for SC/ST candidates of Haryana only) in aggregate, along with the students admitted with this eligibility will have to simultaneously undertake additional ***Bridge Course*** as prescribed by the University during the first semester.

Note: * It is compulsory for each student to pass out Bridge Course (two additional theory papers and two practical as prescribed in scheme of examination of Bridge Course) as per University norms during the 1st year of MCA-2 year course and the degree will be awarded after the completion of Bridge Course. However, these papers under Bridge Course will be taught only in the 1st semester of the course.

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NAME OF PROGRAMME : MASTER OF COMPUTER APPLICATIONS (MCA)

DURATION : 02 (TWO) YEARS.

Scheme of Examinations and Syllabus for Bridge Course to Regular MCA 2- year programme with effect from the Session 2022-23(CBCS).

PROGRAMME SPECIFIC OUTCOMES

The students upon completion of bridge course will be able to:

PO1: To scale up the knowledge and understanding to be able to continue MCA 2-year Programme.

PO2: Apply knowledge of computing fundamentals for understanding problems that may be solved using computers.

PO3: Analyze scenarios that require integrated solutions using one or more Programming Languages.

PO4: Create basic computing skills to undertake more specialized courses offering emerging technologies with ease.

PO5 : Advance their career in the domain of Computer Science by acquiring higher order skills.

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NAME OF PROGRAMME : MASTER OF COMPUTER APPLICATIONS (MCA)
SCHEME OF EXAMINATION & SYLLABUS FOR *BRIDGE COURSE* FOR 02(TWO) YEARS REGULAR MASTER OF COMPUTER APPLICATIONS (MCA) .

COURSE/PAPER CODE	COURSE/PAPER TITLE	CREDITS	TEACHING HOUR/WEEK			EXAMINATIONS		
			LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	INTERNAL ASSESSMENT(IA)	SEMESTER ENDING EXAMINATION(SEE)	TOTAL
MCA-BC10	FUNDAMENTALS OF COMPUTER & C LANGUAGE	3	3	-	-	20	80	100
MCA-BC 11	OBJECT ORIENTED PROGRAMMING USING C++	3	3	-	-	20	80	100
MCA-BC 12	LAB ON C LANGUAGE (MCA-BC10)	2	-	-	4	20	80	100
MCA-BC 13	LAB ON C++(MCA-BC 11)	2	-	-	4	20	80	100
TOTAL		**10**	**06**	**-**	**8**	**80**	**320**	**400**

Note: It is compulsory for each student to pass out Bridge Course (two additional theory papers and two practical as prescribed in scheme of examination of Bridge Course) as per University norms during the 1st year of MCA-2 year course and the degree will be awarded after the completion of Bridge Course. However, these papers under Bridge Course will be taught only in the 1st semester of the course.

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NAME OF PROGRAMME : MASTER OF COMPUTER APPLICATIONS (MCA)

DURATION : 02 (TWO) YEARS

PROGRAMME OUTCOMES (POs)

PO 1. Knowledge Capable of demonstrating comprehensive disciplinary knowledge gained during course of study.

PO 2. Research Aptitude Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis.

PO 3. Communication Ability to communicate effectively on general and scientific topics with the scientific community and with society at large.

PO 4. Problem Solving Capability of applying knowledge to solve scientific and other problems.

PO 5. Individual and Team Work Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.

PO 6. Investigation of Problems Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.

PO 7. Modern Tool usage Ability to use and learn techniques, skills and modern tools for scientific practices.

PO 8. Science and Society Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.

PO 9. Life-Long Learning Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life.

PO 10. Ethics Capability to identify and apply ethical issues related to one's work, avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work.

PO 11. Project Management Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects.

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PROGRAMME SPECIFIC OUTCOMES (PSOs)

The objective of the curriculum designed for MCA course is to nurture the technical aptitude of students for professional competency in the IT industry.

PSO 1. Develop competency to administer knowledge and awareness in the computing discipline along with learning aptitude for lifelong endurance in professional realm.

PSO 2. Develop proficiency to adapt to contemporary technologies, skills and models for computing practice.

PSO 3. Acquire expertise to adopt skills realized during research, experimentation and trending technology cognizance to solve industrial problems.

PSO 4. Promote professional competence to aspire careers in Commercial/ Government Sectors, Academics/ consultancy/ Research and Development for technological innovations, and collateral fields related to Computer Science and Information Technology.

PSO 5. Foster analytical skills for programming and adept computer based designing of systems in the domains concordant to Algorithm Design, System Software, Web and Application Designing, Data Science & Analytics, Artificial Intelligence & Machine Intelligence, Graphics and Visualization, and Networking Services.

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NAME OF PROGRAMME : MASTER OF COMPUTER APPLICATIONS (MCA)

MCA : 01 YEAR. I Semester

COURSE/PAPER CODE	COURSE/PAPER TITLE	CREDITS	TEACHING HOUR/WEEK			EXAMINATIONS		
			LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	INTERNAL ASSESSMENT(IA)	SEMESTER ENDING EXAMINATION(SEE)	TOTAL
MCA-22110	SOFTWARE ENGINEERING(CORE-1)	4	4	-	-	20	80	100
MCA-22111	ADVANCED COMPUTER NETWORKING(CORE-2)	4	4	-	-	20	80	100
MCA-22112	JAVA PROGRAMMING(CORE-3)	4	4	-	-	20	80	100
MCA-22113	(ELECTIVE-1)	4	4	-	-	20	80	100
MCA-22114	(ELECTIVE-2)	4	4	-	-	20	80	100
MCA-22115	LAB ON JAVA (MCA-22112)	2	-	-	4	20	80	100
MCA-22116	LAB ON WEB DESIGNING (MCA-22113)	2	-	-	4	20	80	100
MCA-22117	LAB ON DATABASE (MCA-22114)	2	-	-	4	20	80	100
TOTAL		**26**	**20**	**-**	**12**	**160**	**640**	**800**

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NAME OF PROGRAMME : MASTER OF COMPUTER APPLICATIONS (MCA)

MCA : 01 YEAR. II Semester

COURSE/PAPER CODE	COURSE/PAPER TITLE	CREDITS	TEACHING HOUR/WEEK			EXAMINATIONS		
			LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	INTERNAL ASSESSMENT(IA)	SEMESTER ENDING EXAMINATION(SEE)	TOTAL
MCA-22120	MACHINE LEARNING AND PYTHON PROGRAMMING(CORE-5)	4	4	-	-	20	80	100
MCA-22121	(ELECTIVE FOUNDATION COURSE-3)	4	4	-	-	20	80	100
MCA-22122	(ELECTIVE-4)	4	4	-	-	20	80	100
MCA-22123	COMPUTER SYSTEM ARCHITECTURE(CORE-6)	4	4	-	-	20	80	100
MCA-22124	(ELECTIVE-5)	4	4	-	-	20	80	100
MCA-22125	LAB ON PYTHON (MCA-22120))	1	-	-	2	20	80	100
MCA-22126	LAB ON DATA STRUCTURES (MCA-22122)	1	-	-	2	20	80	100
MCA-22127	LAB ON ARTIFICIAL INTELLIGENCE (MCA-22124)	1	-	-	2	20	80	100
TOTAL		**23**	**20**	**-**	**6**	**160**	**640**	**800**

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NAME OF PROGRAMME : MASTER OF COMPUTER APPLICATIONS (MCA)

MCA : 02 YEAR. III Semester

COURSE/PAPER CODE	COURSE/PAPER TITLE	CREDITS	TEACHING HOUR/WEEK			EXAMINATIONS		
			LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	INTERNAL ASSESSMENT(IA)	SEMESTER ENDING EXAMINATION(SEE)	TOTAL
MCA-22210	ADVANCEMENT IN CYBER SECURITY(CORE-7)	4	4	-	-	20	80	100
MCA-22211	ADVANCED OPERATING SYSTEMS(CORE-8)	4	4	-	-	20	80	100
MCA-22212	PROFESSIONAL COMMUNICATION(COMPULSORY FOUNDATION COURSE)	4	4	-	-	20	80	100
MCA-22213	COMPUTER GRAPHICS(CORE-9)	4	4	-	-	20	80	100
MCA-22214	(ELECTIVE-6)	4	4	-	-	20	80	100
MCA-22215	LAB ON OPERATING SYSTEMS (MCA-22211)	1	-	-	2	20	80	100
MCA-22216	LAB ON PROFESSIONAL COMMUNICATIONS (MCA-22212)	1	-	-	2	20	80	100
MCA-22217	LAB ON COMPUTER GRAPHICS (MCA-22213)	1	-	-	2	20	80	100
MCA-22218	INDUSTRIAL TRAINING	-	-	-	2	20	80	100
TOTAL		**23**	**20**	**-**	**8**	**180**	**720**	**900**

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MCA : 02 YEAR. IV Semester

COURSE/PAPER CODE	COURSE/PAPER TITLE	CREDITS	TEACHING HOUR/WEEK			EXAMINATIONS		
			LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	INTERNAL ASSESSMENT(IA)	SEMESTER ENDING EXAMINATION(SEE)	TOTAL
MCA-22220	MOBILE APPLICATION DEVELOPMENT(CORE-10)	4	4	-	-	20	80	100
MCA-22221	DATA WAREHOUSING & DATA MINING(CORE-11)	4	4	-	-	20	80	100
MCA-22222	(ELECTIVE-7)	4	4	-	-	20	80	100
MCA-22223	(ELECTIVE-8)	4	4	-	-	20	80	100
MCA-22224	LAB ON ANDROID PROGRAMMING,(MCA-22220).	1	-	-	2	20	80	100
MCA-22225	LAB ON INTERNET OF THINGS (MCA-22221)	1	-	-	2	20	80	100
MCA-22226	PROJECT WORK	1	-	-	2	100	300	400
TOTAL		**23**	**20**	**-**	**6**	**140**	**560**	**1000**

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LIST OF ELECTIVES

MCA-22113. ELECTIVE – 1

(i)HYPERTEXT PREPROCESSOR (PHP) & WEB DESIGNING.

(ii)MIXED REALITY & WEARABLE COMPUTING.

(iii)NATURAL LANGUAGE PROCESSING AND SPEECH RECOGNITION.

MCA-22114. ELECTIVE – 2

(i)ADVANCED DATABASE MANAGEMENT SYSTEM.

(ii)BIOINFORMATICS COMPUTING.

(iii)INTERNET OF THINGS & SENSOR NETWORKS.

MCA-22121. ELECTIVE FOUNDATION COURSE – 3

(i)DIGITAL MARKETING.

(ii)STRESS MANAGEMENT.

(iii)DTP PACKAGES.

MCA-22122. ELECTIVE – 4

(i)ADVANCED DATA STRUCTURES & ALGORITHMS.

(ii)CYBER SECURITY AND BLOCKCHAIN TECHNOLOGY.

(iii)EDGE & FOG COMPUTING.

MCA-22124. ELECTIVE – 5

(i) ARTIFICIAL INTELLIGENCE.

(ii) LINUX & SHELL PROGRAMMING.

(iii)COMPILER DESIGN.

MCA-22214. ELECTIVE – 6

(i)SOFTWARE TESTING & QUALITY ASSURANCE.

(ii)THEORY OF COMPUTATION.

(iii)CLOUD COMPUTING & INTERNET OF THINGS.

MCA-22222. ELECTIVE – 7

(i)SOFTWARE PROJECT MANAGEMENT.

(ii)BIG DATA & PATTERN RECOGNITION.

(iii)DIGITAL IMAGE PROCESSING.

MCA-22223. ELECTIVE – 8

(i)SOFT COMPUTING.

(ii)OPTIMIZATION TECHNIQUES.

(iii)COMPUTER VISION.

BABA MASTNATH UNIVERSITY

Faculty of Management & Commerce

Department of Computer Science & Applications

List of Open Electives For the Postgraduate Students from other departments.

COURSE/PAPER CODE	COURSE/PAPER TITLE	CREDITS	SEMESTER
MCA-22214	(i)SOFTWARE TESTING AND QUALITY ASSURANCE	4	III
	(ii)CLOUD COMPUTING & INTERNET OF THINGS	4	III

BRIDGE COURSE

MCA-BC10 FUNDAMENTALS OF COMPUTER & C LANGUAGE

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand computer basics and role of operating system.

CO2: Learn about concept of computer network, Internet and social impacts of IT.

CO3: Gain understanding of PC Software Tools – Word, Excel and Power-Point.

CO4: Design an algorithm and draw flowchart for simple problems.

CO5: Develop C programs implementing all features of C.

UNIT-I

Computer Fundamentals: Concept of data and information, Historical evolution of computers, Block Diagram of Computer and working, Characteristics, Classification of Computers, Advantages and Limitations of Computer, Applications of Computer, I/O Devices, Memory and Storage Devices; **Computer Software:** System and Application Software.

Operating System: Characteristics, bootstrapping, types of Operating System, Operating System as resource manager. **Programming Languages**: Machine, Assembly, High Level Language, 4GL. Language Translator, System Utilities- Editor, Linker, Loader, File Manager.

Computer Network Concepts: Definition, Types of Network, Topology, Protocols, Intranet, Extranet, Internet, WWW, Search Engine, Web Browsers, Services of Internet. IT and Social Impacts of IT: Positive and Negative Impacts, Computer Crimes, Viruses and their remedial solutions.

UNIT-II

MS-Word: Introduction, Windows Interface, Customizing the Word Application, Document Views, Basic Formatting in MS Word, Advanced Formatting, Navigating through a Word

Document, Performing a Mail Merge, A Quick Look at Macros, Printing Documents, Print Preview

MS-Excel: Introduction, Workbook, Worksheet, Formatting in excel, Advanced formatting in Excel, Working with formulas, Printing worksheets

MS-PowerPoint: Introduction, Creating a Presentation, Basic Formatting in PowerPoint, Advanced Formatting, Using Templates, Inserting charts, Inserting tables, Printing presentations.

UNIT-III

Problem Solving: Problem Identification, Analysis, Algorithms, Flowcharts, Pseudo codes, Decision Tables, Program Coding, Program Testing and Execution.

C Programming Fundamentals: Basic Concepts, Structure of a C program, Operators & Expressions; Library Functions, Decision making using if…else, Else If Ladder; Switch, break, Continue and Goto statements, Control Statements: Looping using while, do…while, for statements, Nested loops.

Arrays & Functions: Declaration and Initialization, Multidimensional Arrays, String: Operations of Strings, Functions: Defining & Accessing User defined functions, Function Prototype, Passing Arguments, Passing array as argument, Recursion, Use of Library Functions, Macro vs. Functions.

UNIT-IV

Pointers: Declarations, Operations on Pointers, Passing to a function, Pointers & Arrays, Array of Pointers, Array accessing through pointers, Pointer to functions, Function returning pointers, Dynamic Memory Allocations.

Structures and Union: Defining and Initializing Structure, Array within Structure, Array of Structure, Nesting of Structure, Pointer to Structure, Passing structure and its pointer to Functions, Unions: Introduction to Unions and its Utilities.

File Handling: Opening and closing file in C, Create, Read and Write data to a file, Modes of Files, Operations on file using C Library Functions, Working with Command Line Arguments, Program Debugging and types of errors.

Suggested Readings:

1. Gill Nasib Singh: Computing Fundamentals and Programming in C, Khanna Books Publishing Co., New Delhi.
2. Kenneth. A.: C problem solving and programming, Prentice Hall.
3. Gottfried, B.: Theory and problems of Programming in C, Schaum Series.
4. Gill, Nasib Singh: Handbook of Computers, Khanna Books Publishing Co., New Delhi.
5. Sanders, D.: Computers Today, Tata McGraw-Hill.
6. Rajender Singh Chhillar: Application of IT to Business, Ramesh Publishers, Jaipur.
7. Cooper, Mullish: The spirit of C, An Introduction to Modern Programming, Jaico Publ. House, New Delhi.
8. Kernighan & Ritchie: The C Programming Language, PHI.
9. Gottfried, B.: Theory and problems of Programming in C, Schaum Series.
10. E. Balaguruswamy: Programming in C, Tata McGraw Hill.
11. H. Schildt: C-The Complete Reference, Tata McGraw Hill.
12. Y. Kanetkar: Let us C, BPB Publication
13. Any other book(s) covering the contents of the paper in more depth.

MCA-BC11. OBJECT ORIENTED PROGRAMMING USING C++

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1- Understand the concept of object orientation and programming skills in C++ language and develop simple computer program in C++

CO2- Understand the concept of Boolean algebra and corresponding electronics.

CO3- Understand the working of computer system through its organization in terms of components.

UNIT– I

Introduction : What is object oriented programming? Why do we need object oriented. Programming characteristics of object-oriented languages. C and C++.

C++ Programming basics : Output using cout. Directives. Input with cin. Type bool. The setw manipulator. Type conversions.

Functions : Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference.

UNIT–II

Object and Classes : Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor. Object as function arguments. The default copy constructor, returning object from function. Structures and classes. Classes objects and memory static class data. Const and classes.

Arrays and string arrays fundamentals. Arrays as class Member Data : Arrays of object, string, The standard C++ String class

Operator overloading : Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords. Explicit and Mutable.

UNIT-III

Inheritance : Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation : Classes within classes, inheritance and program development.

Pointer : Addresses and pointers. The address of operator and pointer and arrays. Pointer and Faction pointer and C-types string. Memory management : New and Delete, pointers to objects, debugging pointers.

Virtual Function : Virtual Function, friend function, Static function, Assignment and copy initialization, this pointer, dynamic type information.

UNIT-IV

Streams and Files : Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, overloading the extraction and insertion operators, memory as a stream object, command line arguments, and printer output.

Templates and Exceptions : Function templates, Class templates Exceptions

The Standard Template Library : Introduction algorithms, sequence containers, iteators, specialized iteators, associative containers, strong user-defined object, function objects.

Suggested Readings:

1. Herbert Schildts : C++ - The Complete Reference, Tata McGraw Hill Publications.
2. Balaguru Swamy : C++, Tata McGraw Hill Publications.
3. Balaguruswamy : Object Oriented Programming and C++, TMH.
4. Shah & Thakker : Programming in C++, ISTE/EXCEL.
5. Johnston : C++ Programming Today, PHI.
6. Object Oriented Programming and C++, Rajaram, New Age International.
7. Samanta : Object Oriented Programming with C++ & JAVA, PHI.
8.Latest and additional good books may be suggested and added from time to time.

MCA-BC12. LAB ON C LANGUAGE

Will be conducted by the concerned faculty member.

MCA-BC13. LAB ON C++ LANGUAGE

Will be conducted by the concerned faculty member.

SEMESTER – I

MCA-22110. SOFTWARE ENGINEERING(CORE-1)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1- Understand basic concept of Software Engineering and the phases in a software project.
CO2- Comprehend fundamental concepts of requirements engineering and SRS document. Know about software design process and design methodologies.
CO3- Learn various software testing level and software project management activities.
CO4: Learn software maintenance types and software configuration management activities.

UNIT-I

Introduction to Software Engineering: Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models. Software Project Management: Management activities, Project planning, Project scheduling, Risk management activities.

UNIT-II

Software Requirements Engineering: Requirements Engineering Processes, Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management; Software Requirements: Functional and non-functional requirements, User requirements, System Requirements, Interface specification, software requirement specification document; IEEE Standards for SRS, CCC for Requirements.

Software Metrics and Measure: Process Metrics, Project metrics, Halestead's Software Science, Function Point (FP), Cyclomatic Complexity Measures; Software Project Estimation Models- Empirical, Putnam, COCOMO models.

UNIT-III

Software Design Process: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and

Bottom-Up Design, Interface Design, Coding, Computer Aided Software Engineering (CASE), CASE Tools.

Software Testing: Software Reliability, Levels of Testing, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Verification vs. Validation.

UNIT-IV

Software Maintenance Activities: Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, Software Reuse, Software Evolution, Software Quality Attributes, Software Quality Assurance – plans & activities, Software Documentation.

Suggested Readings:

1. Pressman: Software Engineering, TMH.
2. Gill, Nasib Singh: Software Engineering, Khanna Book Publishing Co.(P) Ltd, N. Delhi
3. Jalote, Pankaj: An Integrated Approach to Software Engineering, Narosa Publications.
4. Chhillar Rajender Singh: Software Engineering: Testing, Faults, Metrics, Excel Books, New Delhi.
5. Ghezzi, Carlo: Fundaments of Software Engineering, PHI.
6. Fairley, R.E.: Software Engineering Concepts,McGraw-Hill.
7. Lewis, T.G.: Software Engineering, McGraw-Hill..
8. Shere: Software Engineering & Management, Prentice Hall.
9. Deutsch, Willis: Software Quality Engineering : A Total Technical and Management Approach, Prentice Hall.

MCA-22111. ADVANCED COMPUTER NETWORKING(CORE-2)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1- Understand basic concepts data communication and computer networks.
CO2- Gain understanding about OSI model and TCP/IP.
CO3- Develop understanding about working of different layers of TCP/IP and OSI model.
CO4: Understand about concept Distributed Systems and Synchronization.

UNIT-I

Data Communication: Theoretical basis of data communication; analog and digital signals; asynchronous and synchronous transmission; data encoding and modulation, techniques, broadband and base band transmission; pulse code modulation, bandwidth, channel, baud rate of transmission; multiplexing; transmission medium.

UNIT-II

Network Classification: Local area networks, metropolitan area network, wide area network, and wireless network, Internetworking Devices: Hub, Repeaters, Bridge, Switch, Router and Gateway.

Network Reference Models: Layered architectures, protocol hierarchies, interface and services: ISO- OSI reference model, TCP/IP reference model; internet protocol stacks.

UNIT-III

Data link Layer Functions and Protocols: Framing, error-control, flow -control; sliding window protocol; HDLC, Error detection and correction, Data link layer of internet.

Medium Access Sub layer: CSMA/CD protocol, IEEE standards for LAN and MAN; satellite networks, X.25, frame relay, narrow band and broad band ISDN, asynchronous transfer modes.

UNIT-IV

Network functions and protocols: Switching mechanism: Circuit switching, message switching, packet switching, cell switching, routing and congestion control.

Transport Layer: UDP, TCP, Frame Format of TCP and UDP.

Network Applications: File Transfer Protocol, electronic mail, World Wide Web.

Suggested Readings:

1. A.S. Tanenbaum: Computer Networks, Prentice-Hall of India.
2. W. Tomasi: Introduction to Data Communications and Networking, Pearson Education.
3. P.C. Gupta: Data Communications and Computer Networks, Prentice-Hall of India.
4. Behrouz Forouzan and S.C. Fegan: Data Communications and Networking, McGraw Hill.
5. L. L. Peterson and B. S. Davie: Computer Networks: A Systems Approach, Morgan Kaufmann.
6. William Stallings: Data and Computer Communications, Pearson Education.
7. Any other book(s) covering the contents of the paper in more depth.

MCA-22112. JAVA PROGRAMING(CORE-3)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1- Understand computer basics and role of operating system.
CO2- Learn about concept of computer network, Internet and social impacts of IT.
CO3- Gain understanding of PC Software Tools – Word, Excel and Power-Point.
CO4: Design an algorithm and draw flowchart for simple problems.

UNIT-I

Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script. XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Review of Applets, Class, Event Handling, AWT Programming.

UNIT-II

Introduction to Swing, Differences between AWT Controls & Swing Controls, JApplet, Swing Button: JButton, JToggleButton, CheckBoxes, Radio Button, JComboBox, Text Boxes etc., Icons, Labels, JTabbed Pains, JScroll Pains, JList, JTrees, JTables Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Developing a Home page using Applet & Swing.

UNIT-III

Introduction to Servlets: Lifecycle of a Servlet, The Servlet API, The javax. Servlet Package, Reading Servelet parameters, Reading Initialization parameters; The javax.servlet HTTP package, Handling Http Request & Responses, Security Issues Introduction to JSP, Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat.

UNIT-IV

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an

Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations Introduction to struts framework, RMI, CGI programming.

Suggested Readings:

1. Dietel and Nieto: Internet and World Wide Web – How to program?, PHI/Pearson Education Asia.
2. Patrick Naughton and Herbert Schildt: The Complete Reference Java, Tata McGraw-Hill.
3. Hans Bergstan: Java Server Pages.
4. Bill Siggelkow, S P D O'Reilly: Jakarta Struts, Cookbook.
5. Murach: Murach's beginning JAVA JDK 5, SPD.
6. Wang-Thomson: An Introduction to Web Design and Programming.
7. Knuckles: Web Applications Technologies Concepts- John Wiley.
8. Sebesta: Programming world wide web, Pearson.
9. Building Web Applications-NIIT,PHI.
10. Bai/Ekedaw-Thomas: Web Warrior Guide to Web Programmming.
11. Jon Duckett: Beginning Web Programming, WROX.
12. Pekowsky, Java Server Pages, Pearson.

MCA-22113. ELECTIVE – 1

(i) HYPERTEXT PREPROCESSOR (PHP) & WEB DESIGNING.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand regular expressions including modifiers, operators, and meta characters.
CO2: Create PHP programs that use various PHP library functions, and that manipulate files and directories.
CO3: Analyze and solve various database tasks using the PHP language.
CO4: Analyze and solve common Web application tasks by writing PHP programs.
CO5: Formulate, design and create PHP control structures, including selection and iterative structures.

UNIT-I

Introduction to PHP: Evolution of PHP & its comparison with other web programming languages, Interfaces to External systems, Hardware and Software requirements.

Basic PHP Development: PHP Scripting, Working of PHP scripts, Basic PHP syntax, PHP data types, Operators, Variable manipulation, Dynamic variables, Variable scope, and Accessing variable with the global statement Static vs. Dynamic Optimization, Google Caffeine.

Control Statements: if( ) and else if( ) condition Statement, The switch statement, Using while ( ) Loop, The do while statement, Using the for ( ) Loop, Breaking out of loops, Nesting loops.

UNIT-II

String & Arrays: Formatting String for Presentation, Formatting String for Storage, Joining and Splitting String, Comparing String, Matching and replace Substring. Arrays: Anatomy of an Array, Creating index based and Associative array, Accessing array Elements, Looping with Index based array, Looping with associative array using each( ) and foreach( ) loops, Library functions.

Functions: Function definition, Creation, Returning values, User-defined functions, Dynamic function, Function calls with the static statement, default arguments, passing arguments to a function by value.

UNIT-III

Forms: Working with Forms, Super global variables, Super global array, Importing user input, Accessing user input, Handling Html Form With PHP, Using hidden fields, Redirecting the user.
Working with File and Directories: Understanding file & directory, Opening and closing a file, Copying ; renaming and deleting a file, Working with directories, Building a text editor, File Uploading & Downloading.
Generating Images with PHP: Basics computer Graphics, Creating Image , Manipulating Image , Using text in Image.
Object Oriented concept using PHP: Classes, Objects, Polymorphism, Inheritance, Interface, Abstraction, Constructor, Destructor.

UNIT-IV

PHP with MySQL: Creating Connection, Selecting Database, Perform Database (query), Use returned data, close connections, file handling in PHP – reading and writing from and to FILE.
Advance PHP Techniques: Introduction about FTP/SMTP server, Math functions, File upload, File Download, E-mail with PHP, PHP configuration file, Error tackling and debugging.
PHP Project Development: Exposure of Requirements analysis of a Project and its development.

Suggested Readings:

1. Matt Doyle: Beginning PHP 5.3, Willey Publishing.
2. Steve Suehring, JavaScript Step by Step, Microsoft Press, PHI.
3. Harwani: Developing Web Applications in PHP and AJAX, McGraw Hill
4. P.J. Deitel & H.M. Deitel: Internet and World Wide Web- How to Program, Pearson.
5. Web Technologies, Black Book, Dreamtech Press.
6. Steven Holzner: PHP- The Complete Reference, Tata McGraw Hill.
7. Kevin Tetroi: Programming PHP, O' Reilly
8. Any other book(s) covering the contents of the paper in more depth.

MCA-22113. ELECTIVE – 1
(ii) MIXED REALITY & WEARABLE COMPUTING.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Knowledge of wearable computing
CO2: Understanding of various devices used in wearable computing
CO3: Understand the hardware and software requirements of wearable computing
CO4: Understand the cybernetics and humanistic intelligence
CO5: Knowledge of Internet of Everything

UNIT-I

Introduction: History, Creative Coding Platforms, Open Source Platforms, PIC, Arduino, Sketch, Raspberry Pi, Iterative coding methodology. Python Programming - Mobile phones and similar devices, Arm Devices, Basic Electronics (circuit theory, measurements, parts identification)

Sensors and Software: Understanding Processing Code Structure, variables and flow control, Interfacing to the Real World.

UNIT-II

Software &Hardware Frameworks: Software-Open Frameworks as our IDE (C/C++) - Arduino Language (C/C++), Hardware- Desktop / Laptop / Raspberry Pi - How to approach a programming problem? Representing "reality" with computers. Digital vs. Analog circuits, audio, communication, etc. Analog to Digital Conversion (ADC) - Digital to Analog Conversion (DAC)– Microcontrollers - Communication – Serial & Parallel - Hardware to Hardware Communication - I2C/IIC (Inter-Integrated Circuit) - SPI (Serial Peripheral Interface) – Serial UART Communication.

UNIT-III

Cybernetics and Humanistic Intelligence Wearables: Augmented Reality – Mixed Reality. AR versus VR - IoT and Wearables: Smart Cites and Wearable Computing as a form of urban design - Advanced I/O – open Frameworks: Live Network feeds (push and pull) - Data persistence (saving data and preferences) - Database interface (MySQL, SQLite, XML,

PHP/Web) - Arduino: Wired/Wireless Networking (hardware vs. USB proxy) - Software serial (RS-232).

UNIT-IV

Internet of Everything: Humanistic Intelligence; Wearable Computing and IoT (Internet of Things), Overview of Mobile and Wearable Computing, Augmented Reality, and Internet of Things. The fundamental axes of the Wearables + IoT + AR space - Free-roaming AR: Wearable Computing, Wireless, Sensing, and Meta sensing with light bulbs Phenomenal Augmented Reality: Real world physical phenomena as the fundamental basis of mobile and wearable AR.

Suggested Readings :

1. Woodrow Barfield : Fundamentals of Wearable Computers and Augmented Reality, 2nd.Ed.
2. Omesh Tickoo, Ravi Iyer : Making Sense of Sensors: End-to-End Algorithms and Infrastructure Design.
3. Josha Noble : Programming Interactivity, Second Edition.
4. Raspberry Pi: Getting Started with Python, second edition, 2016
5. Any other book(s) covering the contents of the paper in more depth.

MCA-22113. ELECTIVE – 1

(iii) NATURAL LANGUAGE PROCESSING AND SPEECH RECOGNITION.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand Natural Language Processing, Probabilistic model of defining language and techniques.
CO2: Applying Hidden Markov model and Speech Recognition.
CO3: Application of context free grammar and language parsing.
CO4: Implement probabilistic and language parsing.
CO5: Differentiation of semantic and discourse in terms of NLP.

UNIT - I

Introduction to Natural Language Processing: NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity.

Regular Expressions: Regular Expressions, Automata, Similarity Computation: Regular Expressions, patterns, FA, Formal Language, NFSA, Regular Language and FSAs, Raw Text Extraction and Tokenization, Extracting Terms from Tokens, Vector Space Representation and Normalization, Similarity Computation in Text.

Morphology and Finite-State Transducers: Inflection, Derivational Morphology, Finite-State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Combining FST Lexicon and Rules, Lexicon-free FSTs: The Porter Stemmer, Human Morphological Processing.

UNIT - II

Matrix Factorization and Topic Modeling: Introduction, Singular Value Decomposition, Nonnegative Matrix Factorization, Probabilistic Latent Semantic Analysis, Latent Dirichlet Allocation

Computational Phonology and Text-to-Speech: Speech Sounds and Phonetic Transcription, The Phoneme and Phonological Rules, Phonological Rules and Transducers, Advanced Issues in Computational Phonology, Machine Learning of Phonological Rules, Mapping Text to Phones for TTS, Prosody in TTS .

Probabilistic Models of Pronunciation and Spelling: Dealing with Spelling Errors, Spelling Error Patterns, Detecting NonWord Errors, Probabilistic Models, Applying the Bayesian method to spelling, Minimum Edit Distance, English Pronunciation Variation, The Bayesian method, Pronunciation in Humans.

N-gram Language Models: The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Smoothing, Backoff, Deleted Interpolation, N-grams for Spelling and Pronunciation, Entropy.

UNIT - III

HMMs and Speech Recognition: Speech Recognition Architecture, Overview of Hidden Markov Models, The Viterbi Algorithm Revisited, Advanced Methods for Decoding, Acoustic Processing of Speech, Computing Acoustic Probabilities, Training a Speech Recognizer, Waveform Generation for Speech Synthesis, Human Speech Recognition.

Word Classes and Part-of-Speech Tagging: Tagsets for English, Part of Speech Tagging, Rule-based Part-of-speech Tagging, Stochastic Part-of-speech Tagging, Transformation-Based Taggin.

Context-Free Grammars for English: Context-Free Rules and Trees, Sentence-Level Constructions, The Noun Phrase, Coordination, Agreement and The Verb Phrase and Sub-categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence & Normal Form, Finite State & Context-Free Grammars, Grammars & Human Processing.

UNIT - IV

Parsing with Context-Free Grammars and Features and Unification: Parsing as Search, A Basic Top-down Parser, The Earley Algorithm, Finite-State Parsing Methods, Feature Structures, Unification of Feature Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints, Types and Inheritance

Lexicalized and Probabilistic Parsing: Probabilistic Context-Free Grammars, Problems with PCFGs, Probabilistic Lexicalized CFGs, Dependency Grammars, Human Parsing, The Chomsky Hierarchy, How to tell if a language isn't regular, Natural Language Context-Free or not, Complexity and Human Processing.

Representing Meaning and Semantic Analysis: Computational Desiderata for Representations, Meaning Structure of Language, First Order Predicate Calculus, Some Linguistically Relevant Concepts, Alternative Approaches to Meaning, Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Earley Parser, Idioms and Compositionality, Robust Semantic Analysis

Text Sequence Modeling and Deep Learning: Statistical Language Models, Kernel Methods, Word-Context Matrix Factorization Models, Neural Language Models, Recurrent Neural Networks.

Suggested Readings:

1. Daniel Jurafsky and James H.Martin: Speech and Language Processing(2nd Edition),PHI,
2. Charu C.Aggarwal: Machine Learning for Text Springer,2018 edition
3. Christopher D.Manning and Hinrich Schuetze: Foundations of Statistical Natural Language Processing MIT press.
4. Steven Bird,Ewan Klein and Edward Loper: Natural Language Processing with Python,O'Reilly Media.

5. Roland R.Hausser: Foundations of Computational Linguistics:HumanComputer Communication in Natural Language,Paperback,MIT press..

MCA-22114. ELECTIVE – 2

(i)ADVANCED DATABASE MANAGEMENT SYSTEM.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Understand the difference between ER and EER model.
CO2: Understand the concepts of OODBMS and ORDBMS.
CO3: Know about parallel and distributed database and Client-Server architecture.
CO4: Understand Emerging database based on the types of data.
CO5: Know about the concepts of data warehouse, its types, architecture and schema.

UNIT – I

The Enhanced Entity-Relationship Model and Object-Oriented Database:

EER Model: The ER model revisited, EER model: Super classes, Subclasses, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Category.

Object Model: Overview of Object-Oriented concepts, Object identity, Object structure, Type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Complex objects, Schema design for OODBMS, OQL, Persistent Programming language, OODBMS architectures and storage issues, Transaction and concurrency control.

UNIT II

Object Relational and Extended Relational databases: Database design for an ORDBMS – Nested relations and collections; Storage and access methods, Query processing and Optimization, Advance Querying: User define data types, manipulating objects table, object views. Information Retrieval, Decision Support Systems, Data Warehousing: fundamental Concepts, architecture, data flow, tools and techniques, data warehouse design, OOLP. Data Mining: KDD
process, primitives, types of data mining, association, classification and clustering.

UNIT-III

Parallel and Distributed Databases and Client-Server Architecture:

Parallel Database: Architectures for parallel databases, Inter and Intra Query parallelism, Inter and Intra Query operations, Parallelizing individual operations, Sorting, Joins, Pipelining;
Distributed database: architectures for distributed database, Data fragmentation, Replication, and allocation techniques for distributed database design, Query processing in distributed databases; Concurrency control and Recovery in distributed databases
Overview of Client Server Architectures: Centralized and Client-Server architectures, Server architectures

UNIT – IV

Enhanced Data Models for Advanced Applications & Emerging Technologies: Active database: syntax and semantics (DB2, Oracle), applications, design principles for active rules, Temporal database concepts, Spatial databases, Deductive databases;
Emerging Database Technologies: Mobile databases, Multimedia Databases, Geographic information systems (GIS); XML and Internet Databases: Structured, Semi-structured and Unstructured Data, Introduction to web databases and XML, Structure of XML data,
Cloud based databases: data storage systems on cloud, cloud storage architectures, cloud data models**; Big data:** storage and analysis of Big data.

Suggested Readings:

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education.
2. Korth, Silberchatz, Sudarshan, Database System Concepts, McGraw-Hill.
3. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill
4. Peter Rob and Coronel, Database Systems, Design, Implementation and Management, Thomson Learning.
5. C.J.Date, Longman, Introduction to Database Systems, Pearson Education
6. Thomas Connolly, Carolyn Begg, Database Systems, Pearson Education

MCA-22114. ELECTIVE – 2

(ii)BIOINFORMATICS COMPUTING.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand bioinformatics computing and the need for Bioinformatics technologies.
CO2: Exposed to biomedical data analysis.
CO3: Be familiar with the modelling techniques.
CO4: Exposed to Pattern Matching and Visualization.
CO5: Learn microarray analysis.

UNIT – I

Introduction: Bioinformatics computing, Bioinformatics technologies, Structural bioinformatics, Data format and processing, Secondary resources and applications, Role of Structural bioinformatics, Biological Data Integration System.

Data Warehousing and Mining in Bioinformatics: Bioinformatics data, Data warehousing architecture, data quality, Biomedical data analysis, DNA data analysis, Protein data analysis, Machine learning, Neural network architecture and applications in bioinformatics.

UNIT – II

Modelling for Bioinformatics: Hidden Markov modelling for biological data analysis, Sequence identification, Sequence classification, Multiple alignment generation, Comparative modelling, Protein modelling, Genomic modelling, Probabilistic modelling, Bayesian networks, Boolean networks, Molecular modelling, Computer programs for molecular modelling.

UNIT – III

Pattern Matching and Visualization: Gene regulation, motif recognition, motif detection, strategies for motif detection; Visualization – Fractal analysis, DNA walk models – one dimension, two dimension, higher dimension; Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

UNIT – IV

Microarray Analysis: Microarray technology for genome expression study, image analysis for data extraction, pre-processing, segmentation, gridding, spot extraction, normalization, filtering, cluster analysis, gene network analysis; Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

Suggested Readings:

1. Yi-Ping Phoebe Chen (Ed): BioInformatics Technologies, Springer Verlag.
2. Bryan Bergeron: Bio Informatics Computing, Pearson Education.
3. Arthur M Lesk: Introduction to Bioinformatics, Oxford University Press
4. Stanley I. Letovsky: Bioinformatics: Databases and Systems.
5. SorinDraghici: Bioinformatics Databases- Design, Implementation, and Usage, Chapman & Hall/ CRC Mathematical Biology & Medicine.
6. Arthur M.Lesk: Database Annotation in Molecular Biology- Principles and Practices.

MCA-22114. ELECTIVE – 2

(iii)INTERNET OF THINGS & SENSOR NETWORKS.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:
CO1: To understand the concepts of IoT and its applications.
CO2: Describe the OSI Model for the IoT/M2M Systems.
CO3: Understand the architecture and design principles for IoT.
CO4: Learn the programming for IoT Applications.
CO5: Identify the communication protocols which best suits the WSNs.

UNIT-I

IoT Overview: Introduction to Internet of Things, IoT Applications, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway, web communication protocols used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAPMQ, MQTT,XMPP) for IoT/M2M devices.

Architecture and Design Principles for IoT: Internet connectivity, Internet-based communication,IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports.

UNIT-II

Data Collection, Storage and Computing using a Cloud Platform: Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing services using Nimbits.

Prototyping and Designing Software for IoT Applications: Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development.

Programming MQTT clients and MQTT server.

IoT Security: Introduction to IoT privacy and security, Vulnerabilities, Security requirements and threat analysis, IoT Security Tomography and layered attacker model.

UNIT-III

Wireless Sensor Networks: Overview of WSNs, Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

Architectures: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs, Gateway Concepts.

UNIT-IV

Communication Protocols: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols (CSMA,PAMAS), Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical Networks by Clustering.

Suggested Readings:

1. Raj Kamal: Internet of Things-Architecture and design principles, McGraw Hill Education.
2. Holger Karl & Andreas Willig: Protocols And Architectures for Wireless Sensor Networks , John Wiley.
3. Feng Zhao & Leonidas J. Guibas: Wireless Sensor Networks- An Information Processing Approach, Elsevier.
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati: Wireless Sensor NetworksTechnology, Protocols, And Applications, John Wiley.
5. Anna Hac, Wireless Sensor Network Designs, John Wiley.
6. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle: From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Academic Press.
7. Peter Waher, Learning Internet of Things, PACKT publishing, BIRMINGHAM – MUMBAI
8. Bernd Scholz-Reiter, Florian Michahelles: Architecting the Internet of Things, Springer.
9. Daniel Minoli: Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, Willy Publications
10. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati: Wireless Sensor Networks, Springer Science.

MCA-22115. LAB ON JAVA

Will be conducted by the concerned faculty member.

MCA-22116. LAB ON WEB DESIGNING

Will be conducted by the concerned faculty member.

MCA-2217. LAB ON DATABASE

Will be conducted by the concerned faculty member.

SEMESTER - II

MCA-22120.MACHINE LEARNING AND PYTHON PROGRAMMING(CORE-5)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand the basic concept of Machine learning.

CO2: Understand supervised, unsupervised and reinforcement learning.

CO3: Familiar with Python environment, data types, operators used in Python.

CO4: Compare and contrast Python with other programming languages and Learn the use of control structures and functions in Python.

CO5: To understand the concepts of modules, packages, 2D & 3D visualization, database and concepts relating machine learning using Python.

UNIT-I

Machine Learning: Introduction, various learning paradigms, perspective and issues, Version spaces, finite and infinite hypothesis spaces, PAC learning, Learning versus Designing, Training versus Testing, Predictive and descriptive tasks.

Supervised Learning: Decision trees- ID3, classification and regression trees; Regression-linear regression, Multiple linear regression, logistic Regression; Support Vector Machines-linear and non-linear, kernel functions, K-nearest neighbors.

UNIT - II

Ensemble Learning: Model combination Schemes, Voting, Error-correcting output codes; Bagging: Random Forest Trees; Boosting: Adaboost, Stacking.

Unsupervised Learning: Introduction to Clustering, Hierarchical: AGNES, DIANA; Partitional: K-means clustering, K-mode clustering, Expectation Maximization, Dimensionality Reduction, Feature Selection, PCA, factor analysis, manifold learning.

Reinforcement Learning: Value iteration; policy iteration; TD learning; Q learning; actor-critic

UNIT-III

Introduction to Python: History and Origin of Python Language, Features, Python, Two modes of using Python interpreter, variable and data types, operator and their precedence, Python string

& slicing, Python lists, mutable and immutable types, Input from keyboard. Loops and Iterations, Functions, Strings & Lists.

Modules and Packages: Python Modules and Packages, Different ways to import Packages, File Input/Output ,The pickle module, Formatted Printing, Exception Handling.

Arrays and Matrices: The NumPy Module, Creating Arrays and Matrices, Copying, Arithmetic Operations, Cross product & Dot product , Saving and Restoring, Matrix inversion, Vectorized Functions.

UNIT-IV

2D & 3D Data Visualization: The Matplotlib Module, Multiple plots, Polar plots, Pie Charts, Plotting mathematical functions, Sine function and friends, Parametric plots, Astroid, Ellipse, Spirals of Archimedes and Fermat, Polar Rose, Power Series & Fourier Series, 2D plot using colors, Fractals, Meshgrids, 3D Plots, Surface Plots & Line Plots, Wire-frame Plots, Mayavi, 3D visualization; Files and Streams:File modes and permissions, Reading & Writing data from a file, Redirecting output streams to files, Working with directories, CSV files and Data Files.

Python and Databases: ODBC and Python, Working with database in MySQL.

Machine Learning: Getting started, Mean, median, Mode, Deviation, percentile, Data distribution, Scatter plot, Regression

Suggested Readings:

1. Ethem Alpaydin: Introduction to Machine Learning, MIT Press, PHI, 3rd Edition 2014.
2. M. Gopal: Applied Machine Learning, TMH.
3. Tom Mitchell: Machine Learning, McGraw Hill.
4. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar: Foundations of Machine Learning, MIT Press, 2012.
5. Vinod Chandra and Anand Harindra: Artificial Intelligence and Machine Learning, PHI.
6. E. Alpaydin: Introduction to Machine Learning, Prentice Hall of India.
7. Ethem Alpaydin: Introduction to Machine Learning, PHI learning.
8. Pooja Sharma: Programming in Python", BPB Publications, 2017.
9. R. Nageswara Rao: Core Python Programming, Dreamtech.
10. Langley: Elements of Machine Learning, Morgan Kaufmann.
11. Hans Fangohr: Introduction to Python for Computational Science and Engineering(A beginner's guide).
12. Timothy A. Budd: Exploring Python, McGraw Hill Education
13. Mark Lutz: Learning Python 4th Edition, O'Reilly Publication
14. Jason Bell: Machine Learning: Hands-On for developers and Technical Professionals Wiley Publication, 2015

MCA-22121. (ELECTIVE FOUNDATION COURSE-3)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: understand basics of marketing and digital marketing;

CO2: analyse the role of search engine in improving digital marketing and understand about the basics and importance of email marketing;

CO3: analyse role of social media marketing for the given problem;

CO4: understand about the basics and importance of web marketing and mobile marketing;

UNIT–I

Introduction to Marketing, Importance and Scope of Marketing, Elements of Marketing - Needs, Wants, Demands, Consumer, Markets and Marketers; Marketing vs Sales. Introduction to Digital Marketing, Benefits & Opportunity of Digital Marketing, Inbound and Outbound Marketing, Content Marketing, Understanding Traffic, Understanding Leads, Digital Marketing use in 'Business to Business' (B2B), 'Business to Consumer' (B2C) and 'Not-for Profit' marketing.

UNIT-II

Search Marketing (SEO): Introduction to Search Engine, Search Engine Optimization (SEO), importance of SEO for business websites, Search Results & Positioning, Benefits of Search Positioning, Role of Keywords in SEO, Meta Tags and Meta Description, On-page & Off-page optimization, Back Link, Internal & External Links, Ranking, SEO Site Map, Steps for B2B SEO and B2C SEO, Advantages & Disadvantages of SEO.

Email Marketing: Introduction to Email Marketing, Elements of Email, Email List Generation, Email Structure, Email Delivery, Online Data Capture, Off Line data Capture, Creating an Email campaign, Campaign Measurement, Concept of A/B testing &its use in email marketing.

UNIT-III

Digital Display Advertising: Concepts, Benefits, Challenges, Ad Formats, Ad Features, Ad Display Frequency. Overview of Google AdWords.

Social Media Marketing: Key Concepts, Different Social Media Channels – Facebook, YouTube, Twitter, Instagram, Business Page- Setup and Profile, Social Media Content, Impact of Social

Media on SEO, Basic concepts – CPC, PPC, CPM, CTR, CR. Importance of Landing Page. How to create & test landing Pages. User Generated Content (Wikipedia etc.), Multi-media - Video (Video Streaming, YouTube etc), Multi-media - Audio & Podcasting (iTunes etc), Multimedia - Photos/Images (Flickr etc).

UNIT-IV

Introduction to Mobile Marketing, Overview of the B2B and B2C Mobile Marketing, Use of Mobile Sites, Apps (Applications) and Widgets, Overview of Blogging Web Analytics: Introduction to Web Analytics, Web Analytics – Types & Levels, Introduction of Analytics Tools and it's use case (Google Analytics and others), Analytics Reporting, Traffic and Behaviour Report, Evaluate Conversion.

Suggested Readings:

1. Stanton William J., Fundamentals of Marketing, McGraw Hill.
2. VandanaAhuja, Digital Marketing, Oxford Higher Education.
3. Seema Gupta, Digital Marketing, McGrawHill.
4. Kotler Philip & Armstrong Graw, Principles of Marketing, Pearson Education.
5. Neelamegham S., Indian Cases in Marketing, Vikas Publication.
6. Ian Dodson,The Art of Digital Marketing, Wiley.
7. Puneet Singh Bhatia, Fundamentals of Digital Marketing, Pearson Education.

MCA-22121. (ELECTIVE FOUNDATION COURSE-3)

(ii)STRESS MANAGEMENT.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

At the end of this course, the student will be able to:

CO1: understand about stress and causes of stress.

CO2: understand the stages of stress and strategies to cope up by the stress.

C03: learn the causes of stress at work place and duties of an employer/ management to manage it.

CO4: know the civil implication and HSE management standards.

UNIT-I

Introduction to Stress: Definition, Evidence, Stress and Pressure, Physiology of stress, Model of human performance and stress, The effects of stress, Classification of the causes of stress, Factors contributing to stress, Sources of work stress, The home–work interface, Reducing stress at organizational level, bullying and harassment, Violence management.

UNIT-II

Responses to Stress: Stages of the stress response, Stress indicators, Anxiety and depression, Personality and stress, Submission, Assertion and Aggression.

Evaluation of stress: Measurement and evaluation of stress, Stress levels in occupations. Coping with stress strategies, Better time management, Relaxation therapy, Ideas for managing stress.

UNIT-III

Stress in the workplace: Recognizing stress in the workplace, Strategies for reducing stress, Human behavior and stress, Workplace indicators of stress, Stress and the potential for human.

Managing stress at work: Employers' responsibilities and duties in relation to stress, Duties of senior management: The human factors-related approach, Strategies for managing stress, Remedies for employers.

UNIT-IV

The civil implications: Principal areas of consideration, Court of Appeal guidelines: Employers' obligations, Violence, harassment and bullying at work, Court of Appeal general guidelines, The remedies for employers, HSE management standards.

Suggested Readings:

1. Jeremy Stranks, Stress at Work Management and Prevention, Elsevier.
2. Dutta, P.K., Stress Management, Himalaya Publication.
3. D.M. Pestonjee, Stress And Coping : An Indian Experience, Sage Publication.
4. Udai Pareek, Handbook of HRD Tools.

MCA-22121. (ELECTIVE FOUNDATION COURSE-3)

(iii)DTP PACKAGES.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

At the end of this course, the student will be able to:

CO1: edit different types of photos and also create own photo album with different effects.

CO2: create the index of their books, create their I-cards and Magazines, etc.

CO3: develop different types of animations as well as animated multimedia presentations.

CO4: interact with the idea of flash movies.

Unit- I

Desktop Publishing (DTP): Introduction to DTP, Need and Features.
Adobe PhotoShop: Opening and Saving, Selection Modes, Color Modes, Color Models, Paintbrushes and Art Tools, Layers, Masks, Filters.

Unit- II

PageMaker: Basics, Publication, Drawing Tools, Text Tool, Transformations, Master Pages.
Corel Draw: Basics, Artistic Media tool, Advanced Drawing, Outline and Fill Tool, Interactive Tools.
Multimedia: Introduction to Multimedia, Multimedia application goals and objectives, Multimedia and the internet.

Unit- III

Macromedia Flash: Flash Concepts, Introducing Flash drawing tools, Panels, creating a new flash document, Movie properties, Scenes in flash, layers in flash, concept of frame, Saving a flash document, testing a flash movie, publishing a flash movie.
Advances Animation: Using Motion Tweening to create Animations, Using Shape Tweening to create Animations, Using the Onion Skin Feature, Creating a Masking effects: Masking a text using Motion Tweening, masking an image using shape tweening, Frame-by-Frame Animation.

Unit- IV

Interactivity to Flash Movie: Programming concepts in ActionScript, Object Oriented features in actionscript, Creation of an animated button, Assign actions to buttons, Play buttons, Rollover

Menu, Test buttons and menus, Working with the movieclip class, date class and Timeline Control Actions, controlling movie clips with actions, Constructing a Hierarchical Menu.

Suggested Readings:

1. Kevin Proot, Adobe Pagemaker 7.0, India Addition.
2. Satish Jain & Shashank Jain, Coreldraw 12 Training Guide, BPB Publication.
3. Shalini Gupta &Adity Gupta, Flash 8 in Simple Steps.
4. Lauri Ulrich Fuller and Robert C. Fuller, PHOTOSHOP CS3 Bible, Wiley-India Addition.
5. John Villamil and Louis Molina, Multimedia – An Introduction, PHI Publication.
6. Denise Tyler, How to use Macromedia Flash Mx and ActionScript.

MCA-22122. ELECTIVE – 4

(i)ADVANCED DATA STRUCTURES & ALGORITHMS.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: To learn about analyzing and designing algorithms to solve a problem and learn to find the asymptotic efficiency of an algorithm.

CO2: To study about binary tree and its applications.

CO3: To learn advanced data structures such as balanced search trees and heap hash operations.

CO4: To learn about graphs & its algorithms such as

CO5: To study various graph processing algorithms and Algorithm Design techniques

Unit-1

The Role of Algorithms in computing: Analyzing Algorithms, Time and Space Analysis of Algorithms, Big-Oh and Theta Notations, Average, Best and Worst case analysis. Designing Algorithms, Growth of functions. Asymptotic Notations, Divide and Conquer, Recurrences, Maximum sub-array problem, Stressan's Method, Substitution method, Recurrence tree method, The Master method, Floors and Ceilings.

Unit-II

Trees : Binary tree traversal methods: Pre-order, In-order, Post-ordered traversal. Recursive Algorithms. Traversal methods. Representation of trees and its applications: Binary tree representation of a general tree. Conversion of forest into tree. Threaded binary trees. Binary search tree: Height balanced (AVL) tree, B-trees, Splay tree. Heap: Heap operations, Binomial heaps, Fibonacci heaps, Skew heaps, heap set.

Unit-III

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, , Depth-and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Maxflow: Ford-Fulkerson algorithm, max flow –min cut.

Unit-IV

Dynamic Programming: Backtracking Algorithms, Design Methodologies, Travelling salesperson problem, 0/1 Knapsack problem, multistage graphs, All Pair Shortest Path, 8-Queens problem Advanced String Matching Algorithms: Naïve string matching algorithm, Robin-Karp algorithm, string matching with finite automata, Knuth-Morris-Pratt algorithm.

P, NP and Approximation Algorithms: Basic Concepts, Non Deterministic algorithms, NP Complete and NP-hard classes, NP complete Problems.

Implementation of above mentioned data structures & algorithms through C++/Java programming.

Suggested Readings

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest: Introduction to Algorithms, PHI Learning Pvt. Ltd.
2. Gilles Brassard, Paul Bratley: Fundamentals of Algorithms, PHI Learning Pvt. Ltd, 2011.
3. Hubbard JR: Schaum's Outline of Data Structures with C++, Tata McGraw Hills, New Delhi.
4. R. Sedgewick: Algorithms in C++, Pearson Education Asia.
5. Y.Langsam, M.J.Augenstein and A.M.Tanenbaum: Data Structures Using C and C++, Prentice Hall of India.
6. R.Kruse, C.L.Tonodo and B.Leung: Data Structures and Program Design in C, Pearson Education. New Delhi
7. G.L. Heileman: Data Structutes: Algorithms and Object Oriented Programming,Tata McGraw Hill, New Delhi
8. E. Horowitz, Sahni and D. Mehta: Fundamentals of Data Structures in C++, Galgotia Publication, New Delhi.
9. Any other book(s) covering the contents of the paper in more depth.

MCA-22122. ELECTIVE – 4

(ii) CYBER SECURITY AND BLOCKCHAIN TECHNOLOGY.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Become familiar with the concepts of cyber threats, cyber crime, cyber security and understand the vulnerability scanning.
CO2: Understand network defence tools and web application tools.
CO3: To learn about cyber crime, hacking attacks and cyber laws.
CO4: Understand the concepts of blockchain technology & its need and cryptocurrency.
CO5: Comprehend the applications of blockchain technology.

Unit - I

Introduction to Cyber Security: Overview of Cyber Security, Internet Governance – Challenges and Constraints; Cyber Threats: Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage; Need for a Comprehensive Cyber Security Policy.

Introduction to Vulnerability Scanning: Overview of vulnerability scanning, Open Port/Service Identification, Banner/Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit.

Network Vulnerability Scanning: Netcat, Socat; understanding Port and Services tools - Datapipe, Fpipe, WinRelay; Network Reconnaissance – Nmap, THC-Amap and System tools, Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping, Kismet.

Unit - II

Network Defense Tools: Firewalls and Packet Filters - Firewall Basics, Packet Filter Vs Firewall; Network Address Translation (NAT) and Port Forwarding; Basics of Virtual Private Networks, Linux Firewall, Windows Firewall.

Web Application Tools: Scanning for web vulnerabilities tools- Nikto, W3af; HTTP utilities - Curl, OpenSSL; and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat; Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTCHydra.

Unit - III

Cyber Crimes and Law: Introduction to Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Digital Forensics, Realms of the Cyber world, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.

Cyber Crime Investigation: Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.

Unit - IV

Blockchain Technology: Cryptography - Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof; **Blockchain Overview:** Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

Blockchain Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Suggested Readings:

1. Mike Shema: Anti-Hacker Tool Kit, McGraw Hill
2. Nina Godbole and Sunit Belpure: Cyber Security Understanding Cyber Crimes, ComputerForensics and Legal Perspectives, Wiley.
3. Achyut S.Godbole: Data Communication and Networking, McGraw –Hill Education New Delhi.
4. Forouzan: Data Communication and Networking (Global Edition) 5/e, McGraw Hill Education India.
5. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder: Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press.
6. Wattenhofer: The Science of the Blockchain.
7. Antonopoulos: Mastering Bitcoin - Unlocking Digital Cryptocurrencies.
8. Satoshi Nakamoto: Bitcoin: A Peer-to-Peer Electronic Cash System
9. Forouzan, B.A.: Cryptography & Network Security. Tata McGraw-Hill Education.
10. Kahate, A. Cryptography and Network Security. McGraw-Hill Higher Ed.
11. Peter Szor , The Art of Computer Virus Research and Defense, Symantec Press.
12. Markus Jakobsson and Zulfikar Ramzan, Crimeware, Understanding New Attacks and Defenses, Symantec Press, 2008, ISBN: 978-0-321-50195-0.
13. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
14. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', CSI Publishing Platform, 2017.

MCA-22122. ELECTIVE – 4

(iii)EDGE & FOG COMPUTING.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Become familiar with the concepts of Fog Computing and its characteristics.
CO2: Understand Fog computing services, its components and Fog protocols.
CO3: Understand privacy-preserving computation in Fog computing.
CO4: Comprehend self-aware fog computing and cyber physical systems.
CO5: Understand leveraging fog computing in Healthcare IoT and other important Case Studies.

Unit - I

Evolution of Edge and Fog Computing: Introduction to Edge Computing, Cloud Computing analytics pipeline, Cloud databases, Coordination of Cloud Services, Geo-Distributed Computing, Edge Architectures, Edge Computing Applications. Concept of Fog Computing, Background and Motivation, Definition, Pros and Cons, Myths of Fog Computing, Characteristics, Issues, Application Scenarios, Fog Computing Services, Fog Computing Components; Fog Computing vs Edge Computing vs Cloud Computing, Fog Resource Estimation and its challenges, Software architecture.

Unit - II

Fog Protocols: Fog Protocol, Fog Kit, Proximity Detection Protocols- DDS/RTPS computing protocols

Fog Computing in Support of Hierarchical Emergent Behaviors: Introduction – Fog Computing – Hierarchical Emergent Behaviors, A Fresh Approach for ULSS - Two Autonomous Vehicles Primitives Case Study.

Privacy-Preserving Computation in Fog Computing: Introduction, Block Chain, Multi-Party Computation, Multi-Party Computation and Block Chain.

Unit - III

Self-aware Fog Computing in Private and Secure Sphere: Cloud, Fog and Mist Computing Networks, Self-aware Data Processing.

Urban IoT Edge Analytics: Design challenges, Edge-assisted Architecture, Information Acquisition and Compression, Content-aware wireless networking, Information availability.

Cyber-Physical Energy Systems over Fog Computing: Power Grid and Energy Management, Energy Management Methodologies, Cyber-Physical Energy Systems, Internet-of-Things and Fog Computing, Control-as-a-Service, Residential Cyber-Physical Energy System.

Unit - IV

Leveraging Fog Computing for Healthcare IoT: Introduction: Healthcare Services in the Fog Layer, Data management, Event Management, Resource Efficiency, Device management, Personalization, Privacy and Security, System Architecture of Healthcare IoT.

Case Studies: Wind Farm - Smart Traffic Light System, Wearable Sensing Devices, Wearable Event Device, Wearable System, Demonstrations, Post Application Example, Event Applications Example, Health monitoring – Patient Safety monitoring and training support – Smart house.

Suggested Readings:

1. Amir M. Rahmani ,PasiLiljeberg, Preden, Axel Jantsch: Fog Computing in the Internet of Things - Intelligence at the Edge‖, Springer International Publishing, 2018.

2. Amir Vahid Dastjerdi and Rajkumar Buyya: Fog Computing: Helping the Internet of Things Realize its Potential‖, University of Melbourne.

3. Zaigham Mahmood*:* Fog Computing: Concepts, Frameworks and Technologies, Kindle Edition.

4. Rahmani, A., Liljeberg, P., Preden, J.-S., Jantsch, A. (Eds.): Fog Computing in the Internet of Things - Intelligence at the Edge.

5. Assad Abbas, Samee U. Khan, Albert Y. Zomaya: Fog Computing – Theory and Practice, John Wiley & Sons, 2020.

MCA-22123. COMPUTER SYSTEM ARCHITECTURE(CORE-6)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand the principles of computer architecture, parallel computers and performance aspects.

CO2: Understand the program flow mechanisms, interconnect architectures and memory hierarchy design.

CO3: Understand multiprocessor and multicomputer architectures.

CO4: Comprehend concept of quantum computing and its essence.

Unit - I

Evolution of Computer Architecture: Introduction of computer architecture, Elements of Modern Computers, Evolution of Computer Architectures, Classification of parallel computers, System attributes to performance.

Program and Network Properties: Conditions of Parallelism - data and resource dependences, Bernstein's conditions, hardware and software parallelism. Program Flow Mechanisms - control flow versus data flow, data flow architecture, demand driven mechanisms, comparison of flow mechanisms.

Unit – II

System Interconnect Architectures: Network properties and routing, Static connection Networks –Linear Array, Ring & Chordal Ring, Barrel Shifter, Fat Tree, Mesh & Torus, Systolic Arrays, Hypercubes; Dynamic connection Networks – Digital Buses, Switch modules, MINs, Omega-, Baseline-, Crossbar-Network.

Unit – III

Memory Hierarchy Design: Memory hierarchy, Inclusion, coherence & locality; memory capacity planning; Virtual Memory technology – Models, TLB, Paging and Segmentation; Cache Memory Organization - Cache basics & cache performance, cache addressing models & mapping, multilevel cache hierarchies, interleaved memory.

Unit – IV

Multiprocessor and Multicomputer Architectures: Multiprocessor System Interconnects – Hierarchical bus systems, Crossbar Switch and Multiport memory, Multistage and Combining networks; Symmetric shared memory architectures, distributed shared memory architectures,

Cache coherence problem, Snoopy cache coherence protocol, directory-based protocols; Multicomputer Generations, Message passing mechanisms – message routing schemes, deadlock and virtual channels, flow control strategies, multicast routing algorithms.

Suggested Readings:

1. Kai Hwang & Naresh Jotwani: Advanced Computer Architecture; McGraw-Hill.
2. Kai Hwang: Advanced computer architecture; TMH.
3. D.Sima, T.Fountain, P.Kasuk: Advanced Computer Architecture-A Design space Approach, Addison Wesley.
4. M.J Flynn: Computer Architecture, Pipelined and Parallel Processor Design; Narosa Publishing.
5. D. A. Patterson and J. L. Hennessey: Computer organization and design, Morgan Kaufmann
6. J.P.Hayes: Computer Architecture and Organization, MGH.
7. Harvey G. Cragon: Memory System and Pipelined processors, Narosa Publication.
8. V.Rajaraman & C.S.R.Murthy: Parallel computer: Architecture & Programming, PHI.
9. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, MGH.
10. Kai Hwang and Zu: Scalable Parallel computing, MGH.

MCA-22124. ELECTIVE – 5

(i)ARTIFICIAL INTELLIGENCE.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Learn the concept of Artificial intelligence, problem solving and searching process.
CO2: Understand the concept of Expert system with its architecture and life cycle.
CO3: Understand the concepts of knowledge, Knowledge acquisition and various levels and schemes for knowledge representation.
CO4: Learn the concepts of computational intelligence evolutionary computation and neural networks.
CO5: Handle the uncertainty in knowledge using fuzzy logic and understand concepts of fuzzy logic.

Unit-I

Introduction to Artificial Intelligence: Definition, history and applications of AI; Problem solving: Definingthe problem as state space search, Production System, Problem characteristics; Search techniques: Brute Force and Heuristic Search.

Expert System: Definition, role of knowledge, architecture and life cycle of Expert System.

Unit -II

Knowledge &Its Representation: Types of knowledge, Knowledge acquisition and its techniques, Knowledge engineering, Cognitive behavior; Knowledge representation: Level of representation; Knowledge representation schemes: Formal logic, Inference Engine, Semantic net, Frame, Scripts.

Perception: Sensing, Speech recognition, Vision, Action.

Unit -III

Computational Intelligence: Introduction to Computational Intelligence, Biological and Artificial Neural **N**etwork (ANN), artificial neural network models; learning in artificial neural networks; neural network and its applications.

Evolutionary Computation: Fundamentals of evolutionary computation, Design and Analysis of Genetic Algorithms, Evolutionary Strategies, comparison of GA and traditional search methods. Genetic Operators and Parameters, Genetic Algorithms in Problem Solving; Optimization: Particle Swarm Optimization, Ant Colony Optimization, Artificial Immune

Systems; Other Algorithms: Harmony Search, Honey-Bee Optimization, Memetic Algorithms, Co-Evolution, Multi-Objective Optimization, Tabu Search,Constraint Handling.

Unit-IV

Fuzzy Systems: Crisp sets, Fuzzy sets: Basic types and concepts, characteristics and significance of paradigm shift, Representation of fuzzy sets, Operations, membership functions, Classical relations and fuzzy relations, fuzzyfication, defuzzyfication, fuzzy reasoning, fuzzy inference systems, fuzzy control system, fuzzy clustering, applications of fuzzy systems.Neuro-fuzzy systems, neuro-fuzzy modeling; neuro-fuzzy control.

Applications: Pattern Recognition, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Natural Language Processing.

Suggested Readings:

1. Rich Elaine and Knight Kevin : Artificial Intelligence, Tata McGraw Hill .
2. M. Mitchell: An Introduction to Genetic Algorithms, Prentice-Hall.
3. J.S.R.Jang, C.T.Sun and E.Mizutani: Neuro-Fuzzy and Soft Computing, PHI, Pearson Education.
4. Timothy J.Ross: Fuzzy Logic with Engineering Applications, McGraw-Hill.
5. Davis E.Goldberg: Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley.
6. Any other book(s) covering the contents of the paper in more depth.

MCA-22124. ELECTIVE – 5

(ii)LINUX & SHELL PROGRAMMING.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

At the end of this course, the student will be able to:

C01: understand the concepts and commands of Linux;

C02: understand the file management and process manipulation in Linux;

C03: understand the C environment under Linux and do the system administration andcommunication in Linux;

CO4: develop shell programs in Linux.

Unit – I

Introduction: History, Basic features, architecture, distributions. Installing Linux, Logging in / Logging out.

File System: Introduction to files, Organization, Assessing File systems, Structure - boot block, super block, inode block, data block.

Basic and Advanced Commands: Directory oriented commands, File oriented commands, File access permissions: chmod, umask, chgrp, groups. General purpose commands.

Unit – II

File management and Compression: Computer devices, Disk related commands: dd, du, df, dfspace, fdisk, compressing and uncompressing files.

Manipulating Processes and Signals:Basics, process states and transitions, zombie and orphan processes, process oriented commands. Handling foreground and background jobs. Process scheduling using cron, crontab, at, batch. Changing priority. Signal generation and Handling.

System calls: Files related system calls for opening, creating, reading, writing, relocating file descriptors, closing, duplicating file descriptors, linking, unlinking, accessing file status information, checking permissions, changing ownership, groups and permissions of files. Process related system calls: exec, fork, wait, exit.

Unit – III

System Administration: Booting and shutting down process. Creating, mounting and unmounting file systems. Managing User accounts**:** creating, modifying & deleting user accounts and groups. Networking Tools: Communication oriented commands. ping, nslookup, telnet, arp, netstat, route, ftp, trivial file transfer protocol, finger, rlogin.

C language compiler, the make command and makefiles, general debugging techniques, debugging with gdb.

Unit – IV

Pipes and filters: Connecting processes with pipes, redirecting input and output. Filters: sort, grep, egrep, fgrep, uniq, more, pr, cut, paste, tr.

Shell Programming: Shell meaning & types; Introduction to shell scripting, shell variables, exporting shell variables, Escape mechanisms, Shell meta characters, read command, conditional statements, looping and case statements, expr statement, command line arguments, sleep and base name commands, Bourne Shell Commands, string handling, arrays, shell functions, shell programs to automate system tasks.

Suggested Readings:

1. Harwani B.M., Unix and Shell Programming, Oxford University Press.
2. Goerzen John, Linux Programming Bible, IDG Books, New Delhi. Matthew Neil, Stones Richard, Beginning Linux Programming, Wiley India Pvt. Ltd.
3. Christopher Negus, Linux Bible, Wiley India Pvt. Ltd.
4. Das Sumitabha, You UNIX – The Ultimate Guide, Tata McGraw Hill
5. Richard Peterson, Linux – The Complete Reference, Tata McGraw Hill.

MCA-22124. ELECTIVE – 5

(iii)COMPILER DESIGN.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

At the end of this course, the student will be able to:

CO1: understand overall process of compilation;

CO2: understand the process of parsing in compilers;

CO3: analyze semantic analysis, building a symbol table, handling storage management and error-detection in the process of compiler designing;

CO4: design a compiler and understand the concept of code generation and optimization.

Unit – I

Compilers and Translators, Need of Translators, Tools used for compilation, Structure of Compiler, Single-Pass and Multi-Pass Compilers, Bootstrapping, Compiler Construction Tools, Phases of Compilation process, Classification of grammars.

Lexical Analysis: Design, Finite Automata and Regular Expressions, Process of Lexical Analysis, Lexical Analyzer generators, Derivations and parse trees.

Unit – II

Parsing Techniques: Top down Parsing- Predictive Parsers, Left Recursion and its removal, Recursive Descent Parsers, LL Grammars.

Bottom-up parsing: Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers, LR grammars, Comparison of parsing methods, Parser Generators.

Unit – III

Semantic Analysis: Syntax-Directed Translation Schemes.

Building Symbol Table, Data Structures for symbol table, representing scope information.

An overview of Run-time Storage Administration.

Error Detection and Recovery: Errors, Lexical-Phase Errors, Syntactic Phase Errors, Semantic Errors.

Unit – IV

Intermediate Source Forms: Postfix Notation, Syntax Trees, Triples & Quadruples.

Code Optimization: Potential cases of Code Optimization, Optimization of basic blocks, Local and Global optimizations, Code Improving Transformation.

Code Generator: Issues in the design of a code generator.

Suggested Readings:

1. Alfred V Aho, Principles of Compiler Design, Narosa Publishing House.
2. Jean Paul Tremblay and Sorenson, The Theory and Practice of Compiler Writing, McGraw Hill.
3. Dhamdhere D.M, System programming and operating system, McGraw Hill.
4. 2. Beck L. Leland, System Software, Pearson Education.
5. 3. Aho, Sethi, & Ullman, Compilers Principles, Techniques and Tools, Pearson Education.
5. Fischer, Crafting a compiler in C, Pearson Education.

MCA-22125. LAB ON PYTHON

Will be conducted by the concerned faculty member.

MCA-22126. LAB ON DATA STRUCTURES

Will be conducted by the concerned faculty member.

MCA-22127. LAB ON ARTIFICIAL INTELLIGENCE

Will be conducted by the concerned faculty member.

SEMESTER – III

MCA-22210. ADVANCEMENT IN CYBER SECURITY(CORE-7)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

At the end of this course, the student will be able to:

CO1: learn various challenges and constraints in cyber security;

CO2: learn IT ACT (Cyber law) to the given case/problem and analyse it;

CO3: understand the need for Computer Cyber forensics;

CO4: demonstrate the network defence tools to provide security of information.

Unit- I

Introduction to Cyber Security: Overview of Cyber Security, Internet Governance: Challenges and Constraints, Cyber Threats, Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, International convention on Cyberspace.

Unit – II

Introduction to Cybercrime and Laws: Origins of Cybercrime, Classifications of Cybercrimes, information Security, Cybercriminals, Criminals Plan for Attacks, Cybercafe, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.

Tools and Methods used in Cybercrime: Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, DOS and DDOS attack, SQLinjection.

Unit – III

Phishing and Identity Theft: Introduction to Phishing, Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft: PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para - Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law –types of intellectual property rights.

Unit – IV

Network Defence tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs. Firewall, Packet Characteristic to Filter, Stateless Vs. Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, Virtual Private Networks, Linux Firewall, Windows Firewall, Snort Detection System, Introduction to block chain technology and its applications.

Suggested Readings:

1. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), McGraw Hill.
2. Nina Godbole and SunitBelpure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
3. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson Education
4. Chwan-Hwa (John) Wu,J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press
5. Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, Cengage Learning
6. DebiragE.Bouchoux, Intellectual Property,CengageLearning.

MCA-22211. ADVANCE OPERATING SYSTEMS(CORE-8)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand basic concepts of Operating Systems and their structure.
CO2: Learn about concept of processes and process scheduling.
CO3 Understand about interprocess communication and role of semaphores.
CO4: Learn in detail about Deadlock, memory management and I/O management.
CO5: Understand Linux basics and Shell programming.

Unit-I

Operating System Basics: Evolution, Objectives & Functions, Characteristics; Classification of Operating Systems, OS Services, System Calls, OS Structures, Concept of Virtual Machine.

Process Concepts: Definition, Process Relationship, Process states, Process State transitions, Process Control Block ,Context switching – Threads – Concept of multithreads , Benefits of threads – Types of threads.

Process Scheduling: Definition, Scheduling objectives, Types of Schedulers, Scheduling criteria. **Scheduling Algorithms:** Preemptive and Non-preemptive, FCFS–SJF–RR, **Multiprocessor scheduling:** Types, Performance evaluation of the scheduling.

Unit-II

Interprocess Communication: Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem.

Deadlocks - System Model, Deadlock Principles, Deadlock Characterization, Methods for Handling Deadlocks Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

Unit -III

Memory Management: Basic Memory Management, Logical and Physical address map, Memory allocation, Fragmentation and Compaction, Paging and its disadvantages, Virtual Memory, Locality of reference, Page Fault, Working Set , Demand paging concept, Page Replacement policies.

Input/Output Management: I/O devices, Device controllers , Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms.
File Management: File concept, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods.

Unit -IV

Linux Basics: Genesis of Linux, Architecture of Linux, Features of Linux, Introduction to vi editor, Linux commands. Linux Shells: Role, Types- Bourne Shell (sh), C Shell (csh), Korn Shell (ksh), Bourne Again Shell (bash).
Linux Utilities: File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text Processing utilities and backup utilities.
Shell programming (With bash): Introduction, shell responsibilities, pipes and Redirection, Running a shell scripts, The shell as a programming language, Shell meta characters, File name substitution, Shell variables, Command substitution, Shell commands, The environment, Quoting, Test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

Suggested Readings:

1. Silberschatz & Galvin: Operating System Concept, Wiley.
2. Milan Milenkovic: Operating Systems, Tata McGraw – Hill.
3. William Stallings: Operating Systems, PHI.
4. Yashawant Kanetkar: Unix Shell Programming, BPB.
5. Behrouz A. Forouzan, Richard F. Gilberg: Unix and shell Programming, Thomson
6. A.S. Tanenbaum: Modern Operating Systems, Pearson/PHI.
7. Dhamdhere: Operating Systems, Tata McGraw Hill.
8. Robert Love: Linux System Programming, O'Reilly, SPD.
9. Jason Cannon: Linux For Beginners,
10. William Shotts: T he Linux Command Line : A Complete Introduction.
11. Daniel J. Barrett: Linux Pocket Guide : Essential Commands

MCA-22212. PROFESSIONAL COMMUNICATION
(COMPULSORY FOUNDATION COURSE)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO 1 Develop vocabulary and language skills relevant to engineering as a profession
CO 2 Analyze, interpret and effectively summarize a variety of textual content
CO 3 Create effective technical presentations
CO 4 Discuss a given technical/non-technical topic in a group setting and arrive at generalizations/consensus
CO 5 Identify drawbacks in listening patterns and apply listening techniques for specific needs
CO 6 Create professional and technical documents that are clear and adhering to all the necessary conventions

Unit-I

Use of language in communication: Significance of technical communication Vocabulary Development: technical vocabulary, vocabulary used in formal letters/emails and reports, sequence words, misspelled words, compound words, finding suitable synonyms, paraphrasing, verbal analogies. Language Development: subject-verb agreement, personal passive voice, numerical adjectives, embedded sentences, clauses, conditionals, reported speech, active/passive voice. Technology-based communication: Effective email messages, slide presentations, editing skills using software. Modern day research and study skills: search engines, repositories, forums such as Git Hub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora; Plagiarism

Unit-II

Reading, Comprehension, and Summarizing: Reading styles, speed, valuation, critical reading, reading and comprehending shorter and longer technical articles from journals, newspapers, identifying the various transitions in a text, SQ3R method, PQRST method, speed reading. Comprehension: techniques, understanding textbooks, marking and underlining, Note-taking: recognizing non-verbal cues.

Unit-III

Oral Presentation: Voice modulation, tone, describing a process, Presentation Skills: Oral presentation and public speaking skills, business presentations, Preparation: organizing the material, self-Introduction, introducing the topic, answering questions, individual presentation practice, presenting visuals effectively.
Debate and Group Discussions: introduction to Group Discussion (GD), differences between GD and debate; participating GD, understanding GD, brainstorming the topic, questioning and clarifying, GD strategies, activities to improve GD skills.

Unit-IV

Listening and Interview Skills Listening: Active and Passive listening, listening: for general content, to fill up information, intensive listening, for specific information, to answer, and to understand. Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks.
Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews

Suggested Readings:

1. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan 2010.
2. Meenakshi Raman and Sangeetha Sharma,"Technical Communication: Principles and Practice", 2nd Edition, Oxford University Press, 2011
3. Stephen E. Lucas, "The Art of Public Speaking", 10th Edition; McGraw Hill Education, 2012.
4. Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw Hill Education, 2017.
5. William Strunk Jr. & E.B. White, "The Elements of Style", 4th Edition, Pearson, 1999.
6. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
7. Goodheart-Willcox, "Professional Communication", First Edition , 2017.
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 edition, 2015.
9. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.
10. Anand Ganguly, "Success in Interview", RPH, 5th Edition, 2016.
11. Raman Sharma, "Technical Communications", Oxford Publication, London, 2004.

MCA-22213. COMPUTER GRAPHICS(CORE-9)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand basic of computer graphics, display devices and graphics standards.
CO2: Learn about graphics primitives and their importance.
CO3: Understand 2D transformations and representation of 3D objects.
CO4: Learn about 3D transformations, hidden surfaces and color models.
CO5: Understand about multimedia authoring and create a multimedia project using Flash/Blender multimedia software.

Unit-I

Basics of Computer Graphics: Computer Graphics, Classification, Applications of computer graphics, Display devices, Random and Raster scan systems, Graphics input devices, Graphics software and standards.

Graphics Primitives: Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributers.

Unit-II

2D Transformation and Viewing: Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (cohen-sutherland, liang- bersky, NLN), polygon clipping.

3D Concepts and Object Representation: 3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods, Bazier curves and surfaces, B-spline curves and surfaces.

Unit-III

3D Transformation and Viewing: 3D scaling, rotation and translation, composite transformation, viewing pipeline and coordinates, parallel and perspective transformation, view

volume and general (parallel and perspective) projection transformations. **Modelling:** Wireframe and Solid.

Hidden Surfaces: Visible surface detection concepts, Back-face detection, Depth Buffer method, Illumination, Light sources, Illumination methods (ambient, diffuse reflection, specular reflection). **Color models:** properties of light, XYZ, RGB, YIQ and CMY color models. **Shading:** Flat, Gouraud and Phong.

Unit-IV

Multimedia Basics: Concepts of Multimedia, Multimedia applications, Multimedia system architecture, Evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia databases. **Compression and decompression:** Data and file format standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies.

Multimedia Authoring: Concept of Multimedia Authoring, Hypermedia messaging, Mobile messaging, Hypermedia message component, Creating hypermedia message, Integrated multimedia message standards, Integrated document management, Distributed multimedia systems.

Suggested Readings:

1. Donald Hearn and M.Pauline Baker: Computer Graphics, PHI Publications
2. Plastock : Theory & Problem of Computer Graphics, Schaum Series.
3. Foley & Van Dam: Fundamentals of Interactive Computer Graphics, Addison-Wesley.
4. Newman : Principles of Interactive Computer Graphics, McGraw Hill.
5. Tosijasu, L.K. : Computer Graphics, Springer-Verlag.
6. S Gokul: Multimedia Magic, BPB Publication.
7. Bufford: Multimedia Systems, Addison Wesley.
8. Jeffcoate : Multimedia in Practice, Prentice-Hall.

MCA-22214. ELECTIVE – 6

(i)SOFTWARE TESTING & QUALITY ASSURANCE.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Knowledge of various Software Testing techniques.
CO2: Apply Software Testing Strategies and Metrics for Software testing.
CO3: Implement Object Oriented Testing strategies.
CO4: Use of Software Quality Assurance.
CO5: Implement Quality management standards and methods.

Unit-I

Testing Strategy and Environment: Minimizing Risks, Writing a Policy for Software Testing, Economics of Testing, Testing-an organizational issue, Management Support for Software Testing, Building a Structured Approach to Software Testing, Developing a Test Strategy Building Software Testing Process: Software Testing Guidelines, workbench concept, Customizing the Software Testing Process, Process Preparation checklist - Software Testing Techniques: Dynamic Testing – Black Box testing techniques, White Box testing techniques, Static testing, Validation Activities, Regression testing.

Unit-II

Software Testing Strategies: Approach, Issues; integration, incremental, System, alpha, Beta testing etc; Comparative evaluation of techniques: Testing tools; Dynamic analysis tools, test data generators, Debuggers, test drivers etc. Technical Metrics for Software: Quality Factors, framework; Metrics for analysis, design, testing source code.

Unit-III

Object Oriented Testing: Introduction to Object Oriented testing, Path Testing, State Based Testing, Class Testing, Testing Web Applications: Web testing, Functional Testing, User interface Testing, Usability Testing, Configuration and Compatibility Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing.

Rational Rose Software: Introduction, Features, Various types of software testing using Rational Rose.

Unit-IV

Software Quality Assurance and Standards: Software Quality, Software QualityChallenges, Software Quality factors. Software Quality Assurance: concept, components, importance and essence; FTR, structured walk through technique etc. Software Quality Management Standards, Management and its role in Software Quality Assurance, Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI.

Suggested Readings:

1. Meyers, G.: The art of Software Testing, Wiley-Inter-Science.
2. Deutsch, Willis: Software Quality Engineering: A Total Technical and Management Approach, Prentice Hall.
3. Pressman : Software Engineering, TMH.
4. Gill, Nasib Singh: Software Engineering : Reliability, Testing and Quality Assurance, Khanna Book Publishing Co.(P) Ltd, N. Delhi
5. Ghazzi, Carlo: Fundaments of Software Engineering, PHI.
6. Chhillar Rajender Singh: Software Engineering: Testing, Faults, Metrics, Excel Books, New Delhi.
7. Jalote, Pankaj: An Integrated Approach to Software Engineering, Narosa Publications.
8. Doug Bell, Ian Murrey, John Pugh: Software Engineering-A Programming Approach, Prentice Hall.

MCA-22214. ELECTIVE – 6

(ii)THEORY OF COMPUTATION.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Analyze and design finite automata, formal languages, and grammars.
CO2: Understand the basic concepts of DFA and NDFA.
CO3: Construct context free grammar for various languages.
CO4: Understand Turning Machine and recursive language.
CO5: Gain understanding about tractable and non-tractable problems.

Unit-I

Review of Mathematical Terms and Theory: Basic Mathematical Notations And Set Theory, Logic Functions And Relations, Language Definitions, Mathematical Inductions and Recursive Definitions.

Finite Automata: Introduction, Alphabets, Strings and Languages, Kleen-closure; Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA) -Formal definition, simpler notations (state transition diagram, transition table), Regular and Non-Regular Languages, Equivalence of NDFA & DFA, NDFA to DFA conversion, DFA minimization using Myhill-Nerode Theorem, Applications of Finite Automata, Finite automata with output (Moore and Mealy machines) and inter-conversion.

Unit-II

Context Free Grammar: Introduction to CFG, CFG and Known Languages, Unions Concatenations and *'S Notations and CFL, Derivations of Trees and Ambiguity, Unambiguous CFG and Algebraic Expressions, Normal Forms and Simplified Forms.

Formal Grammar: Definition, Chomsky hierarchy of grammars, Construction of Context free, derivation, parse tree, ambiguity in grammars, Removal of null and unit production, Normal forms- CNF & GNF.

Pushdown Automata: Introduction to PDA, Types of PDA, Designing of PDA, CFG Corresponding to PDA, Introduction to CFL, Intersections and Complements of CFL, Decisions Problems and CFL, Equivalence of Pushdown Automata and CFL, Pumping Lemma for CFL, Applications.

Unit-III

Turing Machines: Model of Computation and Church Turning Thesis, Definition of Turing Machine, Tm and Language Acceptors, Variations of Tm, Non- Deterministic Tm, Universal Tm, Tm & computers.

Recursive Language: Introduction, Enumerable and Language, Recursive and Non Recursive Enumerable, their properties.

PCP: Introduction to undecidability, undecidable problems about TMs, Post correspondence problem (PCP), Modified PCP.

Unit-IV

Computation Functions, Measuring, Classifications and Complexity: Primitive Recursive Functions, Halting Problem, Recursive Predicates and Some Bounded Operations, Unbounded Minimizations and μ-Recursive Functions, Godel Numbering, Computable Functions and μ-Recursive, Numerical Functions.

Tractable and Intractable Problems: Growth Rate and Functions, Time and Speed Complexity, Complexity Classes, Tractable and Possibly Intractable Problems, P And NP Completeness, Reduction Of Time, Cook's Theorem, NP-Complete Problems.

Suggested Readings:

1. John C. Martin: Introduction to Language and theory of Computation, Mcgraw Hill.
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman: Introduction to Automata Theory Languages and Computation, Pearson Education
3. K. L. P Mishra, N. Chandrashekaran: Theory of Computer Science-Automata Languages and Computation, Prentice Hall of India, India.
4. K.Krithivasan and R.Rama: Introduction to Formal Languages, Automata Theory and Computation; Pearson Education.
5. Harry R. Lewis and Christos H. Papadimitriou: Elements

MCA-22214. ELECTIVE – 6

(iii) CLOUD COMPUTING & INTERNET OF THINGS.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1:Understand core issues of cloud computing and enabling technologies;

CO2:Design services based on cloud computing platforms;

CO3:Understand concepts, architecture, applications and design principles for connected devices in IoT;

CO4:Explain, analyze and design IoT-oriented communication protocols and security concerns.

Unit – I

Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models.

Virtualization:benefits & drawbacks of virtualization, server virtualization, virtualization of - operating system, platform, CPU, network, application, memory and I/O devices etc.

Unit – II

Cloud Computing Service Platforms – Compute services, storage services,database services, applicationservices, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment& management services, identity& access management services and their case studies.

Security in cloud computing: issues, threats, data security and information security.

Unit – III

Internet of Thing (IoT): overview, conceptual framework, architecture, major components, common applications.Design principles for connected devices: Modified OSI Model for IoT/M2M systems, ETSI M2M Domains and High-level capabilities, wireless communication technologies - NFC, RFID, Bluetooth BR/EDR and Bluetooth low energy, ZigBee, WiFi, RF transceiver and RF modules. Data enrichment, data consolidation & device management at gateway.

Unit – IV

Design principles for web connectivity: web communication protocols for connected devices: constrained application protocol, CoAP Client web connectivity, client authentication, lightweight M2M communication protocol. Message communication protocols for connected devices - CoAP-SMS, CoAP-MQ, MQTT, XMPP. IoT privacy, security and vulnerabilities and their solutions.

Suggested Readings:

1. ArshdeepBahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press.
2. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd.
3. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hills.
4. Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier India Private Limited
5. Saurabh Kumar, Cloud Computing, Wiley India Pvt. Ltd.
6. Shailendra Singh, Cloud Computing, Oxford
7. Coulouris, Dollimore and Kindber, Distributed System: Concept and Design, Fifth Edition,Addison Wesley
8. Michael Miller, Cloud Computing, Dorling Kindersley India
9. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud computing: A practical Approach, McGraw Hill
10. DimitriosSerpnos, Marilyn Wolf, Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer
11. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-onApproach), VPT
12. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications.

MCA-22215. LAB ON OPERATING SYSTEMS (MCA-22211)

Will be conducted by the concerned faculty member.

MCA-22216. LAB ON PROFESSIONAL COMMUNICATIONS (MCA-22212)

Will be conducted by the concerned faculty member.

MCA-22217. LAB ON COMPUTER GRAPHICS (MCA-22213)

Will be conducted by the concerned faculty member.

MCA-22218. INDUSTRIAL TRAINING

Industrial training will be held immediately after 2nd Semester Examination and will be having a minimum duration of 45 days and maximum duration of 60 days. Students have to submit the Summer Training / Internship Report latest by 30th August. Evaluation of the Report and Viva- Voce shall be held during 3rd Semester. The Evaluation and Viva-Voce shall be held by one External and one Internal examiner.

SEMESTER – IV

MCA-22220. MOBILE APPLICATION DEVELOPMENT(CORE-10)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Understand concepts of android application development process
CO2: Analyze algorithms for use in MVC model of development
CO3: Handle databases in Android applications.
CO4: Synthesize location and mapping related user interfaces in android applications.
CO5: Understand Playing and Recording of Audio and Video in application.

Unit-I

Introduction: Mobile Applications, Characteristics and Benefits, Application Model, Infrastructure and Managing Resources, Mobile Software Engineering, Frameworks and Tools, Mobile devices Profiles.

Application Design: Memory Management, Design patterns for limited memory, Work flow for Application Development, Techniques for composing Applications, Dynamic Linking, Plug-ins and rules of thumb for using DLLs, Concurrency and Resource Management.

Unit-II

Google Android: Introduction, JDK & ADK, Android Application Architecture, Traditional Programming Model and Android, Activities, Intents, Tasks, Services.

Android Framework: GUI and MVC Architecture, Fragments and Multi-platform development, Creating Widgets: Layouts, Shadows, Gradients; Applications with multiple screens.

Development: Intents and Services, Storing and Retrieving data, Graphics and Multimedia, Telephony, Location based services, Packaging and Deployment.

Unit-III

Android Applications: Working with Android, Various life cycles for applications, Building an User Interface: Blank UI, Folding and Unfolding a scalable UI, Making Activity, Fragment,

Multiple layouts; Content Provider, Location and Mapping: location based services, Mapping, Google Maps activity, Working with Map View and Map Activity; Sensors and Near Field Communication; Native libraries and headers, Building client server applications.

Unit-IV

Using Google Maps, GPS and Wi-Fi Integration, Android Notification, Audio manager, Bluetooth; Camera and Sensor integration, Sending SMS, Phone Calls. Runtime Environment for Applications, Callbacks and Override in application, Concurrency, Serialization, Application Signing, API keys for Google Maps, Publishing Android Application; Introduction to Flutter, Android features, UI, implementation.

Suggested Readings:

1. Zigurd Mednieks, Laird Dornin, G, BlakeMeike and Masumi Nakamura: Programming Android, O'Reilly Publications.
2. Wei-Meng Lee: Beginning iPhone SDK Programming with Objective-C, Wiley India Ltd.
3. James C.S: Android Application development, CENGAGE Learning.
4. Gargenta M., Nakamura M.: Learning Android, O'Reilly Publications.
5. Reto Meier: Professional Android 2 Application Development, WROX Publication- Wiley-India.
6. James Edward: J2ME: The Complete Reference, James Edward – Publication.
7. Chris Haseman: Android Essentials, Apress Publication.
8. Mark L Murphy: Beginning Android - Wiley India Pvt Ltd.
9. Sayed Y Hashimi and Satya Komatineni: Pro Android – Wiley India Pvt Ltd.

MCA-22221. DATA WAREHOUSING & DATA MINING (CORE-11)

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Understand Data Mining Systems and Pattern Analysis.
CO2: Understand Classification and Clustering techniques.
CO3: Identify Big Data and relevance of Big Data Analytics.
CO4: Understand Map Reduce and its features.
CO5: Understand Hadoop and Hadoop Eco-System.

Unit-I

Data Mining Concepts: Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues, Applications, Data Objects and Attribute types, Statistical description of data; Data Pre-processing – Cleaning, Integration, Reduction, Transformation and Discretization; Data Visualization, Data similarity and dissimilarity measures.
Frequent Pattern Analysis: Mining Frequent Patterns, Associations and Correlations; Mining Methods- Pattern Evaluation Method, Pattern Mining in Multilevel; Multi-Dimensional Space – Constraint Based Frequent Pattern Mining; Classification using Frequent Patterns.

Unit-II

Classification and Clustering: Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Model Evaluation and Selection, Techniques to improve Classification Accuracy. Clustering Techniques: Cluster analysis, Partitioning Methods - Hierarchical Methods, Density Based Methods, Grid Based Methods; Evaluation of clustering, Clustering high dimensional data, Clustering with constraints, Outlier analysis-outlier detection methods.
WEKA Tool: Introduction to Datasets, WEKA sample Datasets, Data Mining Using WEKA tool.

Unit-III

Overview of Big Data and Hadoop: Types of Digital Data, Overview of Big Data, Challenges of Big Data,Modern Data Analytic Tools, Big Data Analytics and Applications;Overview and History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Environment.

HDFS: Concepts of Hadoop Data File System, Design of HDFS, Command Line Interface, Hadoop file system interfaces, Data flow; Hadoop I/O: Compression and Serialization.

Unit-IV

Map Reduce: Introduction, Map Reduce Features, How Map Reduce Works, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats.

Hadoop Eco System: Pig - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL: Introduction.

Data Analytics with R: Introduction of R and Big R, Collaborative Filtering, Big Data Analytics with Big R.

Suggested Readings:

1. Jiawei Han & Micheline Kamber: Data Mining - Concepts & Techniques, Harcourt India PVT Ltd. (Morgan Kaufmann Publishers).
2. I.H. Whiffen: Data Mining, Practical Machine Learning tools & techniques with Java (Morgan Kanffmen)
3. A.K. Pujari: Data Mining Techniques, University Press.
4. Pieter Adriaans Dolf Zant inge: Data Mining, Addition Wesley.
5. David Hand, Heikki Mannila, and Padhraic Smyth: Principles of Data Mining, PHI Publication.
6. Michael Berthold, David J. Hand: Intelligent Data Analysis, Springer.
7. Tom White: Hadoop- The Definitive Guide, Third Edition, O'reilly Media.
8. Seema Acharya, Subhasini Chellappan: Big Data Analytics, Wiley.
9. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos: Understanding BigData: Analytics for Enterprise Class Hadoop and Streaming Data, Mc Graw Hill publishing.
10. Anand Rajaraman and Jeffrey David Ullman: Mining of Massive Datasets, Cambridge University Press.
11. Bill Franks: Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streamswith Advanced Analytics, John Wiley &Sons.
12. Glenn J. Myatt: Making Sense of Data, John Wiley & Sons.
13. Pete Warden: Big Data Glossary, O'Reilly.
14. Zikopoulos, Paul, Chris Eaton: Understanding Big Data- Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications.

MCA-22222. ELECTIVE – 7

(i)SOFTWARE PROJECT MANAGEMENT.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand the basic concepts related to stepwise project planning..
CO2: Understand the knowledge about Quality Control, Standard and Risk Management.
CO3: Understand the activity-Planning & Resource Allocation Process.
CO4: Apply the concept of team structure & organization structure.
CO5: To compare various Project Evaluation & Estimation Techniques.

Unit-I

Introduction and Software Project Planning: Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.

Unit-II

Project Organization and Scheduling Project Elements: Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts. (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.

Unit-III

Project Monitoring and Control: Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.

Unit-IV

Project Management and Project Management Tools Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

Suggested Readings:

1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
2. Royce, Software Project Management, Pearson Education
3. Kieron Conway, Software Project Management, Dreamtech Press
4. S. A. Kelkar, Software Project Management, PHI Publication.
5. Harold R. Kerzner, Project Mangment "A Systems Approach to Planning, Scheduling, and Controlling" Wiley.
6. Mohapatra, Software Project Management, Cengage Learning.
7. P.K. Agarwal, SAM R., Software Project Management, Khanna Publishing House

MCA-22222. ELECTIVE – 7

(ii) BIG DATA & PATTERN RECOGNITION.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Understand Big Data strategies in Big Data Environment;
CO2: Learn Basics of HDFS and Learn map-reduce analytics using Hadoop;
CO3: Acquire knowledge of pattern recognition approaches and methods;
CO4: To develop solutions in NoSQL to meet the current job requirements.

Unit-I

Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data, Identifying Data Characteristics, Business Motivations and Drivers for Big Data Adoption: Business Architecture, Business Process Management, Information and Communication Technology, Big Data Analytics Lifecycle, Enterprise Technologies and Big Data Business Intelligence, Industry examples of big data.

Unit-II

Data Governance for Big Data Analytics: Evolution of Data Governance, Big Data and Data Governance, Big Datasets, Big Data Oversight, Big Data Tools and Techniques: HDFS, Map Reduce, YARN, Zookeeper, HBase, HIVE, Pig, Mahout, Developing Big Data Applications, Stepwise Approach to Big Data Analysis, Big Data Failure: Failure is common, Failed Standards, Legalities.

Unit-III

Data Analysis and Pattern Recognition: Quantitative and Qualitative Analysis, Pattern Recognition Systems, Fundamental Problems in Pattern Recognition, Feature Extraction and Reduction, Paradigms, Pattern Recognition Approaches, Importance and Applications. Data Domain for Pattern Recognition. Pattern Recognition using Nearest Neighbour Classifier and Modeling an AND Gate Neural Nets.

Unit-IV

An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types, Introduction of NoSQL Products, NoSQL Data Management for Big Data: Schema Less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph databases, NoSQL Misconceptions, NoSQL over RDBMS.

Suggested Readings:

1. Thomas Erl, WajidKhattak and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques Prentice Hall.
2. David Loshin, Big Data Analytics from Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph Morgan Kaufmann.
3. Jules J. Berman, Principles of Big Data Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann.
4. GauravVaish, Getting Started with NoSQL, Packt Publishing.
5. RajjanShinghal, Pattern Recognition Techniques and Applications, Oxford Higher Education.
6. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
7. Jay Liebowitz, Big Data and Business Analytics, Auerbach Publications, CRC press.
8. Pete Warden, Big Data Glossary, O'Reily.
9. Michael Mineli, Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications.

MCA-22222. ELECTIVE – 7
(iii)DIGITAL IMAGE PROCESSING.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: get acquainted with digital image fundamentals and its applications and get acquainted with the image representation and description methods;

CO2: Learn and perform image pre-processing and enhancement to improve the image for further processing;

CO3: reconstruct photometric properties degraded by the imaging process and partition a digital image into multiple segments;

CO4: represent and analyse images at different resolutions , process images according to their shapes, and apply compression techniques to reduce the storage space of images

Unit-I

Digital Image Fundamentals: Introduction to Digital Image Processing and its applications; Components of an Image Processing System.

Image Representation and Description: Image Representation; Digital Image Properties; Boundary descriptors; Regional descriptors; Steps in Digital Image Processing; Elements of Visual perception; Image Sensing and Acquisition; Image Sampling and Quantization; Relationship between Pixels; Color Representation.

Data Structures for Image Analysis: Levels of Image Data Representation; Traditional Image Data Structures: Matrices, Chains, Topological Data Structures, Relational Structures; Hierarchical Data Structures: Pyramids, Quadtrees, Other Pyramidal Structures.

Unit-II

Image Pre-Processing: Pixel Brightness Transformations: Position-Dependent Brightness Correction, Gray-Scale Transformation; Geometric Transformations: Pixel Co-ordinate Transformations, Brightness Interpolation; Local Pre-Processing.

Image Enhancement: Spatial Domain: Gray level transformations; Histogram processing; enhancement using arithmetic and logic operators; Basics of Spatial Filtering; Smoothing and Sharpening Spatial Filtering.

Frequency Domain: Introduction to Fourier Transform; Filtering in the Frequency Domain; Smoothing and Sharpening frequency domain filters; Homomorphic Filtering.

Unit-III

Image Restoration and Segmentation: Noise models; Mean Filters; Order Statistics; Adaptivefilters; Noise Reduction by Frequency Domain Filtering; Inverse and Wiener filtering; Constrained Least Squares Filtering.

Segmentation: Point, line, and Edge Detection; Edge Linking and Boundary detection; Thresholding; Region based segmentation; Edge based Segmentation; Segmentation by Morphological Watersheds; Matching.

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.

Unit-IV

Wavelets and MultiresolutionProcessing: Background: Image Pyramids; Subband coding; Multiresolution expansions.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.

Compression – Fundamentals ; Image Compression models; Error-Free Compression; Variable Length Coding, LZW coding, Bit-Plane Coding, Lossless Predictive Coding; Lossy Compression: Lossy Predictive Coding, Transform Coding, wavelet Coding; Image Compression Standards.

Suggested Readings:

1. Rafael C. Gonzales, Richard E. Woods, Digital Image Processing, Pearson Education.
2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, Tata McGraw Hill.
3. Anil Jain K., Fundamentals of Digital Image Processing, PHI Learning.
4. Willliam K Pratt, Digital Image Processing, John Willey.
5. Malay K. Pakhira, Digital Image Processing and Pattern Recognition, PHI Learning.
6. S. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital *Image Processing*,McGraw Hill
7. B. Chanda ,D.DuttaMajumder, Digital Image Processing and Analysis, Prentice Hall of India.

MCA-22223. ELECTIVE – 8

(i)SOFT COMPUTING.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand the terminology and concepts of related to soft computing techniques.

CO2: Understand the soft computing techniques including genetic algorithms, fuzzy systems & neural networks

CO3: Solve the problems related Genetic Algorithms, Fuzzy Logic & Neural Networks.

CO4: Analyse the design of Genetic Algorithms, Fuzzy Logic & Neural Networks.

Unit-I

Introduction: Introduction to soft computing, introduction to biological and artificial neural network; introduction to fuzzy sets and fuzzy logic systems.

Introduction to Genetic Algorithm: Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues.

Unit-II

Artificial neural networks and applications: Different artificial neural network models; learning in artificial neural networks; neural network applications in control systems. Neural Nets and applications of Neural Network.

Unit-III

Fuzzy systems and applications: fuzzy sets; fuzzy reasoning; fuzzy inference systems; fuzzy control; fuzzy clustering; applications of fuzzy systems.

Neuro-fuzzy systems: neuro-fuzzy modeling; neuro-fuzzy control.

Unit-IV

Applications: Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Natural Language Processing.

Suggested Readings:

1. M. Mitchell: An Introduction to Genetic Algorithms, Prentice-Hall.
2. J.S.R.Jang, C.T.Sun and E.Mizutani: Neuro-Fuzzy and Soft Computing, PHI, Pearson Education.
3. Timothy J.Ross: Fuzzy Logic with Engineering Applications, McGraw-Hill.
4. Davis E.Goldberg: Genet ic Algorithms: Search, Optimization and Machine Learning, Addison Wesley.
5. S. Rajasekaran and G.A.V.Pai: Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI.
6. D. E. Goldberg: Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley.

MCA-22223. ELECTIVE – 8

(ii)OPTIMIZATION TECHNIQUES.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: Understand the role and principles of optimization techniques in business world;

CO2: Understand the techniques to solve and use LPP and IPP;

CO3: Analyse the optimization techniques in strategic planning for optimal gain;

CO4: Understand the techniques to solve networking and inventory issues.

Unit-I

Introduction: The Historical development, Nature, Meaning and Management Application of Operations research. Modelling, Its Principal and Approximation of O.R. Models, Main characteristic and phases, General Methods of solving models, Scientific Methods, Scope, Role on Decision Making and Development of Operation Research in India.

Linear Programming: Formulation, Graphical solution, standard and matrix form of linear programming problems, Simplex method and its flow chart, Two-phase Simplex method, Degeneracy.

Unit-II

Duality in LPP: Definition of Dual Problem, General Rules for converting any Primal into its Dual, Dual Simplex method and its flow chart.

Integer Programming: Importance, Applications and Classification, Gomory's all integer programming problem technique and its flow chart, Branch and Bound Method.

Unit-III

Transportation Models: Formulation of problem, Obtaining Initial Basic feasible solution, Optimality tests, Progressing towards optimal solution, Unbalanced Transportation Problems.

Assignment Models: Formulation of problem, Hungarian Method for Assignment Problems, Unbalanced Assignment Problems.

Unit-IV

Inventory theory Costs involved in inventory problems - single item deterministic models-economic lot size models without shortages and with shortages having production rate infinite and finite.

PERT and CPM: Basic steps in PERT/CPM, Techniques, Network Diagram Representation, Forward and Backward Pass-computation, Representation in Tabular form, Determination of Critical path, Critical activity, Floats and Slack Times, Implementation in any programming language.

Suggested Readings:

1. Sharma, S.D., Operations Research, KedarNath and Ram Nath, Meerut.
2. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.
3. KantiSwarup, Gupta P.K. & Man Mohan, Operation Research, Sultan Chand & sons, New Delhi.
4. Rao S.S., Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi.
5. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York.
6. Gillet, B.E., Introduction to Operations Research: A Computer Oriented Algorithmic Approach, Tata McGraw Hill, New York.

MCA-22223. ELECTIVE – 8

(iii)COMPUTER VISION.

Credit:4
External Marks: 80
Internal Marks: 20

Time: 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (short-answer type questions) covering the entire syllabus and will carry 16 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 16 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Outcomes:

By the end of the course the students will be able to:

CO1: implement fundamental image processing techniques required for computer vision.

CO2: understand Image formation process and perform shape analysis.

CO3: extract features from Images and do analysis of Images.

CO4: extract features from Images and do analysis of Images.

Unit-I

Introduction: Image Processing & Computer Vision, What is Computer Vision - Low-level, Mid-level, High-level.

Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

Unit-II

Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Depth from Defocus, Construction of 3D model from images.

Unit-III

Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete), Edge detection. Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Unit-IV

Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi resolution analysis.

Suggested Readings:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Addison Wesley Longman, Inc.
2. D. H. Ballard, C. M. Brown, Computer Vision, Prentice-Hall.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA), Springer.
4. Sonka, Hlavac, and Boyle. Thomson, Image Processing, Analysis, and Machine Vision.
5. D. Forsyth and J. Ponce, Computer Vision - A modern approach, Prentice Hall.
6. E. Trucco and A. Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall.

----------THE END----------