KANNUR UNIVERSITY

(Abstract)

Master of Computer Applications (M.C.A.) Two Year Programme - Regulations, Scheme and Syllabus - Implemented w.e.f 2020 Admission onwards in Department of Information Technology, Affiliated Colleges and IT Education Centres - Orders issued.

ACADEMIC C SECTION

Acad/C4/650/2016	Dated: 14.10.2020

Read:-1. AICTE Approval Process hand Book 2020-21

2. Letter from Principal Chinmaya Institute of Technology, Chala Dated 27.02.2020
3. Minutes of the meeting of Faculty of Department of I T & Principals of Institutions offering MCA Programme, held on 16.03.2020
4. Combined meeting of 2 year MCA curriculum restructuring committee and Board of Studies in Computer Science (PG) and Dean, Faculty of technology, held on 13.07.2020
5. U O No. Acad A2/8372/MCA/2020 Dated.08.08.2020
6. Letter from Dr. Thomas Monoth, dated 24.09.2020, forwarding the Minutes of the meeting of BoS in Computer Science(PG) held on 04.08.2020 and Final Scheme, Syllabus, Regulation of 2 year MCA Programme

ORDER

1.As per paper read (1) above, the AICTE, New Delhi issued norms for the duration, entry level Qualifications and Statutory Reservation of the Technical programmes, in which the duration of 3 (Three) year Master of Computer Applications (MCA) Programme has been restructured as *'2 (Two) years '.*

2.Vide paper red (2) above, the Principal Chinmaya Institute of Technology, Chala, Kannur requested to approve the reconstituted programme structure of 2 year MCA Programme and restructure the Scheme, Syllabus and Regulation for the Academic year 2020-21, in tune with AICTE Approval Process hand Book 2020-21.

3.Subsequently, as per paper read (3) above, a meeting of the Head, Associate Professors of Dept. of IT of the University and Principals of affiliated colleges offering M.C.A. programme was convened to consider the matter of approval of reconstituted 2 year MCA programme and to restructure the Scheme and Syllabus for the academic year 2020-21 and a Sub Committee was constituted to prepare the draft Regulations, Scheme & Syllabus.

4.The Chairman, BoS in Computer Science (PG), after the combined meeting of the 2 year M.C.A. curriculum restructuring committee and Board of Studies in Computer Science (PG) and Dean, Faculty of Technology, held through online on 13.07.2020 vide paper read (4), submitted the Eligibility conditions for admission to 2 year M.C.A. programme.

5.Meanwhile, vide paper read (5) above, the duration of M.C.A. programme was fixed as 2 (Two) years at the Department of Information Technology and affiliated Colleges,from the academic year 2020-21.

6.Vide paper read (6), the Chairman, BoS in Computer Science (PG) submitted the final Scheme, Syllabus and Regulation of 2 year M.C.A. programme to be implemented in Department

of Information Technology, Affiliated Colleges offering MCA Programme and I.T Education Centres of Kannur University.

7.The Vice Chancellor, after considering the matter in detail and in exercise of the powers of the Academic Council, as per Section 11(I) Chapter III of Kannur University Act, 1996 and all other enabling provisions read together with, accorded sanction to implement the Regulations, Scheme and Syllabus of Two year M.C.A. Programme in Department of Information technology of the University, IT Education Centres of the University and Affiliated Colleges, with effect from 2020 admission, subject to report to the Academic Council.

8.The Regulations, Scheme and Syllabus of the two year M.C.A. programme effective from 2020-21 admission to be implemented in the Department of I.T, IT Education Centres and Affiliated Colleges, are uploaded on the University website (www.kannuruniversity.ac.in).

Orders are therefore, issued accordingly.

Sd/-
BALACHANDRAN V K
DEPUTY REGISTRAR (ACAD)
For REGISTRAR

To:
1. Head, Department of IT, Mangattuparamba Campus
2. Asst. Directors of IT Education Centres
3. Principals of Affiliated Colleges offering M.C.A. Programme

Copy To:
1. Examination Branch (through PA to CE)
1. PS to VC/ PA to PVC/ PA to R
2. DR/ AR I/AR II (Academic)
3. The Chairman, BoS in Computer Science
4. SF/ DF/ FC
5. The Computer Programmer (to upload in web site)

KANNUR UNIVERSITY * CPRS STATION P.O. KANNUR Pin-670 002 * THAVAKKARA *

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY

MASTER OF COMPUTER APPLICATIONS

(Credit Based Semester System)

Syllabus and Scheme of Evaluation

(With Effect from 2020 admission)

REGULATIONS

1. Duration of the MCA programme shall be 2 years (4 semesters). The maximum period of completion is 4 years (8 semesters).

2. Eligibility for Admission:

2.1 A pass in BCA/ Bachelor Degree in Computer Science/Engineering or equivalent degree.

OR

A pass in B.Sc./ B.Com/B.A with Mathematics at 10 + 2 Level or at Graduation Level or any equivalent degree (with additional bridge course as per the norms of the Kannur University).

2.2 Obtained at least 50% marks/grade (45% marks/grade in case of candidates belonging to reserved category) in the qualifying examination.

3. Programme Structure:

3.1 Attendance:

As per Kannur University PG regulations.

3.2 Credits: The total minimum credits, required to complete MCA programme is 80 in which minimum credits required for core (including practical and project) courses is 68. The credits for elective courses shall be 12.

3.3 Theory and Practical courses: The evaluation scheme for each Theory/ Practical course shall contain two parts; (a) Continuous Assessment (CA) and (b) End Semester Evaluation (ESE).40% marks shall be given to CA and the remaining 60 % to ESE.

Continuous Assessment (CA)

Theory: The components of theory evaluation are as follows:

	COMPONENTS	% OF MARKS
i	Test paper	40 %

ii	Assignment	20%
iii	Case Study/Seminar/Viva	40%

i. **Test Papers:** There shall be a minimum of two test papers to be conducted for each course. If more than two test papers are conducted, then two best scores shall be taken for the award of Internal Assessment (IA) marks. The dates of test papers shall be announced well in advance and the marks should be displayed in the notice board within one week of the test paper. Online tests such as objective type and open text book test paper (online or offline mode) also may be opted for conducting the test papers.

ii. **Assignments:** Two or more assignments (including practical assignments) shall be given for each course. The mode of assessment of the assignments shall be decided by the faculty concerned with due approval from the department council and shall be declared at the beginning of the semester. (It is suggested that to the extent possible, give individual assignments and also conduct short viva based on the assignment submitted). Assignment shall include practical assignments also. All the assignment works can be conducted either offline/online mode. If a faculty wishes to conduct the internal assessment mode online, (S) he can be utilize any online learning platform (like ***MOOCs*** etc.) for the evaluation.

iii. **MOOC course**

(a) Each student shall successfully complete one MOOC course in the second semester courses (*Communicative English, Financial Accounting, Android programming, Windows programming, Environmental studies or any new topic/programming language/technology introduced recently etc.*) with a minimum period of eight (08) weeks offered by reputed organizations like NPTEL etc..

(b) The College/Department should arrange facilities to the student for the online course and should provide one faculty in the department as in-charge of the program for giving guidance for choosing an appropriate online course. The concerned faculty in-charge will be responsible for the internal evaluation of the above program.

(c) Each student shall opt at least one MOOC course(s) at the beginning of each semester, in consultation with the faculty in-charge. The list of MOOC course opted by the students shall be placed before the Department council. The council may approve or reject the proposals on valid grounds. Once the list of MOOC course is finalized, the same may be forwarded to the University. The department shall ensure that the list is finalized and forwarded to the University at the beginning of each semester.

(d) The MOOC course completion certificate shall be submitted to the faculty in-charge, who will verify it and forward the same along with the internal assessment marks to the Head of Department. After due verification, Principal / Head of Department shall forward the same to the University for awarding credit for the course.

(e) Seminar / viva: The faculty with due approval from the department council shall choose one or more topic from the list of subject specified by the department depending on the nature of subject and the mode of assessment is to be declared at the commencement of the semester. In the case Seminar and Viva online facility also may be utilized if possible.

iv. Practical: The Components of CA for practical courses except Case study as follows:

	COMPONENTS	**% OF MARKS**
i	Lab Test	40%
ii	Completion of the list of Lab assignments prescribed by the faculty	20%
iii	Periodical assessment of assignment in the Lab & viva	40%

v. Case Study:

	COMPONENTS	**% OF MARKS**
i	Periodical viva / short quizzes /short programming assignments to evaluate the basic knowledge/understanding of the topic/Tool.	30%
ii	Coding – Logic, Selection of appropriate constructs / features of the Tool, Style etc.	30%
iii	Execution of the case study - output	20%
iv	Viva based on case study	20%

vi. Mini Project:

	COMPONENTS	% OF MARKS
i	Understanding of the problem / concepts	25%
ii	Adhering to methodology	20%
iii	Quality of presentation and demonstration(Demonstration is optional)	15%
iv	Quantum of work / effort	30%
v	Organization and content of Project report	10%

Note: All the records in respect of Continuous Assessment (CA) must be kept in the department and must be made available for verification by the University. The results of the CA shall be displayed on the notice board within 5 working days from the last day of a semester. It should be get signed by the candidates. The marks awarded for various components of the CA shall not be rounded off, if it has a decimal part. The total marks of the CA shall be rounded off to the nearest whole number

3.4 End Semester Evaluation (ESE):

There shall be single valuation system of answer books by the Kannur University. However, there is a provision for revaluation, as per the Kannur University PG regulation.

Pattern of questions: Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge.

Question paper for end semester theory examination shall consist of:

i. Short answer type: 10 questions (all questions are compulsory and two questions from each module). 10 x 2 = 20 marks,

ii. Essay type: 5 questions (either –or question from each module) x 8 marks = 40 marks.

End Semester Evaluation in Practical courses shall be conducted and evaluated by two examiners one internal and one external. Details of-evaluation of ESE practical courses are given along with respective syllabus and the scheme of evaluation will be finalized by the Board of Examiners, from time to time.

3.5 Project: A project work has to be undertaken by all students. The project can be software development following all or some of the software development lifecycle or an R&D project. The hours allotted for project work may be clustered into a single slot so that students can do their work at a centre or location for a continuous period of time. The Major project work should be carried out in the Department /Institution or in an Industry / R & D organization of national repute. Project work shall be carried out under the supervision of a Teacher. If the project is carried out in an Industry / R & D organization outside the campus, then a co-guide shall be selected from the concerned organization. If the project work is of interdisciplinary nature, a co-guide shall be taken from the other department concerned. Every student should do the Project individually and no grouping is allowed. The candidates are required to get the synopsis and the guide approved by the department before the commencement of the project. A co-guide should be a postgraduate in CS/Application/IT or allied subject or a person of eminence in the area in which student has chosen the project. At the end of the semester the candidate shall submit the Project report (two bound copies and one soft copy) duly approved by the guide and co-guide for End Semester Evaluation. The project report shall be prepared according to the guidelines appended along with this regulations/Guidelines approved by the University.

Evaluation of Project:

i. A Departmental committee duly constituted by the Head of the Department will review the project periodically.

ii. **Continuous Assessment of project work:** There shall be three internal presentations before the committee (Minimum two members, including the guide). The assessment is based on presentation, interim report and viva voce. The total mark for CA shall be divided among the three presentations in the ratio **20% : 30% : 50%.** Each internal presentation shall be evaluated based on the following components:

	COMPONENTS	% OF MARKS
i	Understanding of the problem / concepts	25%
ii	Adhering to methodology	20%

iii	Quality of presentation and demonstration (Demonstration is optional)	15%
iv	Quantum of work / effort	30%
v	Organization and content of Project report	10%

iii. End Semester Assessment of Project: A board of two examiners appointed by the University shall conduct ESE evaluation. The evaluation shall be based on the report, presentation of the work, demonstration of the work and a detailed viva voce based on the work carried out. A candidate will not be permitted to attend the Project evaluation without duly certified project reports. Also, a project will be evaluated only if the candidate attends the ESE presentation and Viva voce on the scheduled date and time. A board shall evaluate a maximum of 10 candidates in a day. The End Semester evaluation shall consist of the following components:

	COMPONENTS	% OF MARKS
i	Understanding of the problem/requirements/ concepts related to the project	15
ii	Adhering to methodology (Software engineering phases or research methodology) and the candidates understanding of the components of methodology	15
iii	Quality of Modeling of the problem and solution/ database design / form design / reports / testing (For research projects - relevance /novelty of the work(s)/ use of data/ proposal of new models /analysis of algorithms/ comparison and analysis of results /findings)	20
iv	Quality of presentation / demonstration	15

v	Quantum of work / effort - assessed through the content of report, presentation and viva	25
vi	Organization and content of report	10

iv. A student shall pass in the Project course if she/he secures a separate minimum of 40 % for the external and 40% for ESE and CA put together.

v. If a candidate fails in the evaluation of Project, he/she has to repeat the project course along with the next batch and undergo both CA and ESE. Unlike theory/practical courses, the CA mark will not be retained.

vi. There shall be no improvement chance for the marks obtained in the Project course.

3.5 Guidelines for preparing project Report (Both Mini and Major Project)

i. Arrangement of contents:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page
2. Plagiarism Report
3. Bonafide Certificate
4. Abstract
5. Table of Contents
6. List of Tables
7. List of Figures
8. List of Symbols, Abbreviations and Nomenclature
9. Chapters
10. Appendices
11. References

The chapters may be broadly divided into 3 parts (i) Introductory chapter, (ii) Chapters developing the main theme of the project work (iii) implementation details (if any) and Conclusion. The main text will be divided in to several chapters and each chapter may be further divided into several divisions and sub-divisions. Each chapter should be given an appropriate title. Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited. Footnotes should be used sparingly. They should be typed 1.5 spaces and placed directly underneath in the very same page, which refers to the material they annotate. The tables and figures shall be introduced at appropriate places.

ii. **Page Dimension and binding specifications**:

The dimension of the project report should be in A4 size. The project report should be bound using flexible cover of the thick white art paper. The cover should be printed in black letters and the text for printing should be identical.

iii. All the project report submitted by the students should be plagiarism checked using Turnitin software and the plagiarism report generated by the software should be verified and signed by the Head of the Department or person-in charge of the Project Coordinator.

3.6 Seminar: Each student shall select a relevant topic, prepare a seminar report and give a presentation (30 to 45 minutes), under the guidance of a faculty member. The evaluation of seminar is 100% internal and components and mode of evaluation shall be formulated by the department council (May include components like content, Presentation, interaction and structure of report).

3.7 Viva Voce: A general Viva Voce covering all courses in the Programme shall be conducted in the fourth semester. The Viva voce shall be conducted by two external examiners. The Viva voce shall not be clubbed with the project evaluation. The details of the mode of conduct and evaluation of Viva Voce shall be decided by the BOE.

4. Grading system

As per Kannur University PG regulations.

Note:

New stream of elective courses can be suggested by the University department/colleges and it may be included in the syllabus subject to the approval of Board of Studies.

KANNUR UNIVERSITY

Master of Computer Applications

Credits Distribution

Semester	Core	Elective	Practical	Project	Total
I	17	0	4	0	21
II	14	3	6	0	23
III	15	3	2	2	22
IV	2	6	0	6	14
Total	48	12	12	8	80

Course Structure

Semester I

Course Code	Course Name	Instructional Hours/Week			Marks			Credits
		L	P	T	ESA	CA	Total	
MCA1C01	Digital Fundamentals and Computer Organization	3	0	0	60	40	100	3
MCA1C02	System software and Operating systems	3	0	0	60	40	100	3
MCA1C03	Python Programming	4	0	0	60	40	100	4
MCA1C04	Data Communication and Computer Network	3	0	0	60	40	100	3
MCA1C05	Linux Administration	3	0	0	60	40	100	3
MCA1P01	Lab -I:Python Programming	0	5	2	60	40	100	2
MCA1P02	Lab-II: Linux Administration	0	4	1	60	40	100	2
MCA1 C06	Seminar	0	0	2	0	50	50	1
Total		16	9	5	420	330	750	21

Semester II

Course Code	Course Name	Instructional Hours/Week			Marks			Credits
		L	P	T	ESA	CA	Total	
MCA2 C01	Algorithms and Data structure	4	0	0	60	40	100	4
MCA2 C02	Programming in Java	3	0	0	60	40	100	3
MCA2 C03	Database Management Systems	4	0	0	60	40	100	4
MCA2 C04	Web Technology	3	0	0	60	40	100	3
MCA2 E01	Elective-I	3	0	0	60	40	100	3
MCA2 P01	Lab -III: Data Structure/Java	0	4	0	60	40	100	2
MCA2 P02	Lab-IV: DBMS/WT	0	4	0	60	40	100	2
MCA2 P03	Lab- V: MOOC course	0	0	5	0	50	50	2
Total		17	8	5	420	330	750	23

Semester III

Course Code	Course Name	Instructional Hours/Week			Marks			Credits
		L	P	T	ESA	CA	Total	
MCA3 C01	Software Engineering	4	0	0	60	40	100	4
MCA3 C02	Theory of Computation	3	0	0	60	40	100	3
MCA3 C03	Computer Graphics with OpenGL	4	0	0	60	40	100	4
MCA3 C04	Principles of Intelligent Systems	4	0	0	60	40	100	4
MCA3 E02	Elective – II	3	0	0	60	40	100	3
MCA3 P01	Computer Graphics/ Principles of Intelligent Systems	0	3	3	60	40	100	2
MCA3 P02	Mini Project	0	4	2	60	40	100	2
Total		18	7	5	420	280	700	22

Semester IV

Course Code	Course Name	Instructional Hours/Week			Marks			Credits
		L	P	T	ESA	CA	Total	
MCA4 E03	Elective -III	3	0	0	60	40	100	3
MCA4 E04	Elective- IV#	1	2	1	60	40	100	3
MCA4 C01	Project	0	19	5	120	80	200	6
MCA4 C02	General Viva	0	0	0	100	0	100	2
Total		4	21	5	340	160	500	14

MCA4 E04- Those who selected Stream-4 and Stream-5 as electives have ESE will be practical.

ELECTIVES:

STREAM-1: COMPUTATIONAL BIOLOGY

Elective-I: MCA 2E01- INTRODUCTION TO BIOINFORMATICS AND BIOSCIENCE

II: MCA 3E02 - ALGORITHMS IN COMPUTATIONAL BIOLOGY

III: MCA 4E03 - BIOLOGICAL DATABASES AND SCRIPTING LANGUAGES

IV: MCA 4E04 –MOLECULAR MODELLING AND SIMULATION

STREAM-2: NATURAL LANGUAGE PROCESSING

Elective- I : MCA 2E01- ARTIFICIAL INTELLIGENCE

II: MCA 3E02 -ARTIFICIAL NEURAL NETWORKS & DEEP LEARNING

III: MCA 4E03- FOUNDATIONS OF NATURAL LANGUAGE PROCESSING

IV: MCA 4E04 - NATURAL LANGUAGE PROCESSING WITH PYTHON

STREAM- 3: DATA SCIENCE

Elective -I: MCA 2E01- STATISTICAL FOUNDATIONS FOR DATA SCIENCE

II: MCA 3E02- FOUNDATIONS OF DATA SCIENCE

III: MCA 4E03 -BIG DATA ANALYTICS

IV: MCA 4 E04 - PYTHON FOR DATA SCIENCE

STREAM-4: INTERNET OF THINGS

Elective – I : MCA 2E01- INTRODUCTION TO SENSORS

II: MCA 3E02 -INTRODUCTION TO CLOUD COMPUTING

III: MCA 4E03 -INTERNET OF THINGS

IV: MCA 4E04- IOT IMPLEMENTATION AND CASE STUDIES

STREAM 5: IMAGE PROCESSING AND COMPUTER VISION

Elective I: MCA 2E01- FOUNDATIONS OF DIGITAL IMAGE PROCESSING AND PATTERN RECOGNITION

II: MCA 3E02- ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

III: MCA 4E03 -ADVANCED CONCEPTS IN IMAGE PROCESSING AND COMPUTER VISION

IV: MCA 4E04 - IMPLEMENTATION OF IMAGE PROCESSING AND COMPUTER VISION

STREAM- 6: SOFTWARE ENGINEERING

Elective -I: MCA 2E01- OPERATION RESEARCH

II: MCA 3E02- SOFTWARE ARCHITECTURE

III: MCA 4E03- SOFTWARE PROJECT MANAGEMENT

IV: MCA 4E04- SOFTWARE TESTING AND QUALITY ASSURANCE

STREAM-7: CYBER FORENSIC

Elective -I : MCA 2E01- FUNDAMENTALS OF CYBER SECURITY

II: MCA 3E02- INFORMATION SECURITY

III: MCA 4E03- CYBER FORENSIC AND MALWARE DETECTION

IV: MCA 4E04-INTRUSION DETECTION AND INCIDENCE RESPONSE

SCHEME AND SYLLABUS FOR BRIDGE COURSE

1. Introduction

The bridge program comprises 80 hours teaching and learning activity. It consists of two theory courses and one laboratory courses. This course shall be conducted during the first semester of the MCA programme without affecting the actual work load of the semester. The course shall be offered in the department/college at which the candidates enrolled for the MCA program. The mode conduct of the course is completely under the strict control of the department/college at which the MCA program is offered. Total eighty (80) hours teaching and learning activities shall be completed before the notification of Ist semester examination by the University. The department/College has to complete the course by conducting classes and evaluation of the students before the commencement of the Ist semester MCA examination by the University. All those students who successfully complete the bridge course shall be given completion certificate by the department/College. The list of all successful candidates shall be forwarded to the University along with Continuous Assessment mark list of the Ist semester MCA program.

2. Conduct of classes

Department/College council shall schedule regular classes (may be online class – preferred MOOC) and completed eighty (80) hours programme before the Ist semester MCA end semester examination notification by the University. The classes shall be conducted either in the weekend mode or regular working day without affecting the actual regular teaching and learning activities of the Ist semester MCA curriculum.

3. Duration of the program

The bridge course shall comprise three (03) courses i.e. two (02) theory courses and one (01) practical course. Candidate has to appear examinations for all above courses at the end of the program conducted by the Department/College at which candidate has registered for the MCA program. The details of subjects and corresponding examination details are mentioned in the curriculum.

4. Conduct of examination

At the end of the course, department/ college has to conduct the examinations on each theory paper with two (02) hours duration and complete the evaluation process of all those papers within two (02) weeks. The pattern of question papers and evaluation criteria for passing examinations are specified in the regulation.

5. Pattern of question paper for theory papers

Sl.	Question Type	Number Of Questions	No. Of Questions to be answered	Marks/ question	Max. Marks
1	Single word/MCQ/Fill in the blank	10	10	$10 \times 1 = 10$	10

2	Short answer	05	05	05 × 2 = 10	10
3.	Short essay	05	03	03 × 4 = 12	12
5	Essay	04	02	02 × 9 = 18	18

6. Question Paper preparation

The faculty in-charge of each course shall prepare three (03) unique set of question papers on the subject he/she taught. Faculty should give utmost care in preparing the question paper. The question paper should contain four (04) different sections titled as Part A, Part B, Part C and Part D. In part A out of ten (10) questions, two (02) questions from each unit, for part B and Part C, out of five (05) questions, single (01) question from each unit and finally Part D comprises any four (04) questions from all the five (05) units. After preparing the question paper, faculty in-charge shall submit these question papers to the Head of the department in sealed cover. The Head of the department shall then constitute question paper scrutiny committee comprising the Head of the department and two more senior faculties other than faculty in-charge of any course in Bridge program for scrutinizing the question papers submitted by the faculty in-charge and finalize the question papers for the examinations.

7. Conduct of practical examination

At the end of the course, department/college shall conduct a practical examination for the course BR03 Lab- C programming Language by appointing two faculties in the department and provide a printed question paper which comprises of list ten questions and out of which faculties have to assign one questions on checking the skill of C programming construct and another one related to the numerical methods taught in Module IV and V of the BR02 Course. The evaluation of the practical examination shall be done as follows for each two questions given to the students:

Sl.	Components	Marks
1	Writing Algorithm/Flow Chart	10
2	Program writing and compilation using system	10
3	Correct output	05

8. Theory paper evaluation

The Head of the department shall constitute a Board of Examiners (BoE) by including all the faculties in the department (minimum three faculties) with the Head of the department as the chairman. The BoE prepare the scheme and criteria for the evaluation of the answer books of the students in the Bridge course and the evaluation shall be completed within two weeks after the examinations of the Bridge Program. Only single valuation is enough.

9. Finalizing the results of Bridge program

The BoE shall conduct a pass board meeting soon after completing the evaluation of the answer books and related tabulation works. The students who receive (40%) marks in each subject including the practical examination in total (50 %) shall be placed as successful completion of the program. All the documents including the tabulation registers regarding the conduct of the examinations shall be kept in the department and the same shall be produced to the University as when needed/requested. All the successful students list shall be forwarded to the University soon after publishing the results.

10. Supplementary chance

A candidate who fails to secure minimum marks (40%) for a pass in a course will be permitted to write the same examination one more time after three months of the completion of program. The students who do not complete the bridge program within one year shall not be registered for IInd semester MCA end semester examination conducted by the University and no further promotion shall be allowed for subsequent semesters too.

11. Scheme and curriculum for Bridge Program

Subject Code	Subject	Instructional Hour/Week (30 Hours/paper)			Marks	Credit
		L	P	Total		
BR01	Basics of Computing	30	----	30	50	0
BR02	Mathematical Foundations	30	----	30	50	0
BR03	LAB – C Programming Language	---	20	20	50	0

BR01 BASICS OF COMPUTING

UNIT- I **(05 Hours)**

Introduction to Programming:- Algorithms- Problem -Solving aspect – Implementation of algorithms – Properties of algorithms – The efficiency of algorithms – Flow chart- Pseudo Code, Programs and Programming Languages - compiler – Interpreter, Loader and Linker - Program execution – Classification of Programming Language-Structured Programming Concept- Top-down and bottom-up approaches.

UNIT- II **(07 Hours)**

Features of C, Evolution of C, Structure of a C Program, Compiling a C Program-C Character sets-identifiers-data types-keywords-statements- variable and constants- tokens-Operators- Storage classes-auto, register, static, extern, typedef- Type casting, I/O Functions. Control Constructs-Control statements-Conditional, switch Statements- Loops and Jumping statements - break, continue and goto Statement.

UNIT-III **(08 Hours)**

Introduction to Functions, Function Declaration and Prototypes, Storage Classes, Recursion, call by value and call reference. Arrays-One Dimensional Array, Two Dimensional, Strings, Linear search and Binary search algorithms. Understanding memory addresses- address operator- pointer- use of pointers- arrays and pointers – pointers and strings - array of pointers- pointer to pointer. Structure Definition-Structure Initialization- Arrays of Structures-Arrays within Structures-Structures within Structures-Structure Pointers. Union–Definition and Declaration- Accessing a Union Member-Initialization of a Union Variable- Use of User Defined Type Declarations.

UNIT- IV **(03 Hours)**

Introduction to File Handling in C- File- Defining and Opening a File- Reading and Writing in Files Reading and writing Data- Sequential File- Functions for Random Access to Files.

UNIT- V **(07 Hours)**

Introduction to computer- Components-architecture- types of computers-classification-CPU-types, speed, classification-memory: RAM, ROM, Cache, Secondary memory -I/O devices. Introduction to software-Operating systems-system software- types of software-types of operating systems. Network:-LAN,WAN,MAN, topology, networking devices. Internet:- IP address, classification, need of IP address, Working of IP address, WWW,URL, Domain names, Internet services and service providers, ISPs. Mobile Technology:-Cellular System Generations-Types of Mobile Devices, Types of mobile operating systems. IoT:-what and how, structure of IoT, IoT applications (Familiarity only).Block chain technology: - Basic awareness and definitions.

Text Book:

1. V Rajaraman, Neeharika Adabala, Fundamentals of computers, 6th edition, PHI.
2. Balagurusamy, Programming in ANSI C, 5thedn, TMH.
3. Pradeep K Sinha and Priti Sinha, Computer Fundamentals.

BR02 MATHEMATICAL FOUNDATIONS

UNIT –I (03 Hours)

Number systems: Decimal numbers, binary numbers, decimal-to-binary conversion-Binary arithmetic-1's and 2's complements-signed numbers- Arithmetic operations with signed numbers- Octal numbers- Hexadecimal Numbers-BCD numbers- Digital codes. Digital and Analog quantities- Binary digit-Logic Level- Basic logic operators- Basic logic functions.

UNIT- II (5 Hours)

Basic digital circuits:- Inverter- AND and OR gates- NAND and NOR gates- Excusive OR and Exclusive NAND gate- Boolean Algebra – operations and expressions- Laws and rules of Boolean Algebra- Demorgan's theorms- Simplifications using Boolean expressions and truth tables- Karnaugh map- SOP and POS minimizations- Simplification of Boolean expression using K-Map (up to four variables) –

UNIT-III (07 Hours)

Measures of Central Tendency: Mean, Median, Mode. Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Variance, Standard Deviation, Coefficient of Variation. Matrices and determinants:-matrix, types of matrices, operations on matrices, Determinants-properties of determinants-inverse of a matrix- Rank of a Matrix, Trace of a Matrix. Solving Linear Equations using Matrices.

UNIT- IV (07 Hours)

Errors and Approximations-Nonlinear equations–Bisection Method, Regula-Falsi Method, Secant Method, Newton-Raphson method. Eigen values and eigenvectors:- Power Method, Jacobi Method, Householder's Method. System of Linear equations:- Cramer's Rule, Gauss Elimination Method, Gauss-Jordan Method.

UNIT-V (08 Hours)

Numerical Differentiation: Based on equal-interval Interpolation, Derivatives using Newton's backward difference formula. Numerical Integration:-Trapezium rule, Trapezoidal rule, Simpson's rule. Differential equations: Preliminaries, Taylor series method, RungeKutta methods-Statistical description and modelling of data.

Text Books:

1. Thomas L Flyod-Digital Fundamentals, Pearson International Edition (9th Edition), Prentice Hall. (I and II Units)
2. BalachandraRao, C K Shantha – "Numerical Methods – with Programs in BASIC, FORTRAN, Pascal and C++". University Press (Unit V)
3. Babu Ram –"Numerical Methods", Pearson (Unit V)
4. M.K. Jain, S.R.K. Iyengar, R.K. Jain – Numerical Methods (Problems and Solutions), New Age International Publishers (Unit V)

CORE COURSE SYLLABUS

MCA1C01: DIGITAL FUNDAMENTALS AND COMPUTER ORGANIZATION

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Number systems and arithmetic operations, Different Binary codes, Gates, Boolean algebra & Laws, Combinational Circuits: Sum of product, Product of sum, simplification by Boolean methods-K-Map Simplification- up to six variables. Tabular method. Decoders, Multiplexer, De-multiplexer, Encoder, Binary Adders, Subtractors, Magnitude comparator.

UNIT II

Sequential circuits: Flip-flops, Analysis of Clocked Sequential Circuits, State Reduction and assignments, FF excitation tables, Design procedure Registers: shift registers, SISO, SIPO,.PISO, PIPO, Universal Shift Registers, Ripple Counters, Synchronous counters, Ring counter, Shift Counter, Up-down counters.

UNIT III

Historical Background of microprocessors – Architecture of 8086 - Addressing modes - Instruction set - Assembly Language Programming with MASM. **Basic computer structure**: Basic operational concepts. Number representation and arithmetic operations-Character representations -Performance. **Instruction set Architecture:** Memory locations and addresses, memory operations, instructions and instruction sequencing, addressing modes. Assembly language, stacks, subroutines, RISC v/s CISC.

UNIT IV

Basic Processing Unit: Fundamental concepts, Instruction execution, Hardware components, Instruction fetch and execution steps, control signals, Hardwired control, CICS style processors (3-bus organization, micro programmed control). Arithmetic - multiplication of unsigned numbers (array and sequential multipliers), multiplication of signed numbers (Booth algorithm), Fast multiplication (bit pair recoding), Floating point numbers and operations.

UNIT V

Memory system : Basic concepts, Semiconductor RAMS, ROMs, DMA, Memory hierarchy, Cache memory, performance requirements, virtual memory, memory management requirements, secondary storage devices- **Basic I/O**: Accessing I/O devices (device interface, program controlled I/O), Interrupts (enabling and disabling, handling multiple interrupts, controlling I/O device behavior, Processor control registers, exceptions). I/O organization: Bus structure, bus operation, arbitration, Interface circuits, interconnection standards (USB, PCI, Firewire, SCSI, SATA)- Introduction to pipeling and parallel processing architecture.

Text Book

1. Digital Fundamentals - T.L.Floyd and R.P.Jain
2. Microcomputer Systems: The 8086/8088 Family, Architecture, Programming, and Design – YuCheng Liu and Glenn A. Gibson, Prentice Hall, Inc.
3. Hamacher, Vranesic, Zaky, Manjikian, Computer Organization and Embedded Systems, 6thedn, Tata McGraw Hill.

References:

1. William Stallings, Computer Organization & Architecture – Designing for Performance, 9th Edn, Pearson
2. John P. Hayes, Computer Architecture and Organization, Third Edn, Tata McGraw Hill.
3. M. Morris Mano, Computer System Architecture, PHI 2003
4. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware and Applications, Walter A Triebel and Avtar Singh
5. The 8051 Micro Controller, Kenneth J Ayala.
6. Microprocessor and Interfacing: Programming and Hardware. - D.V Hall

MCA1C02 : SYSTEM SOFTWARE AND OPERATING SYSTEMS

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Assemblers: Elements of Assembly Language Programming, Overview of Assembly Process, Design of Two pass Assembler, Macros and Macro Processors, Macro definition, call and expansion, Nested Macro calls, Advanced Macro facilities, Design of Macro pre-processor.

UNIT II

Linkers: Linking and Relocation concepts, Design of linkers, Self relocating programs, Linking for over-lays, **Loaders**: introduction to loaders - functions of loaders- **Compilers:** Introduction to compilers -Different Phases- Lexical Analysis- role of the lexical analyzer, input buffering, specification of tokens, Recognition of tokens, lexical Analyzer generators, Lex.

UNIT III

Introduction to Operating systems: Different types of Operating system, Overview of Operating systems- Operating system structures -Process management: Processes, Process Scheduling – Inter Process communication - Communication in client server systems, Threads: Processes Vs Threads, Types of threads, Multicore and Multithreading.

CPU Scheduling: Scheduling algorithms, Multiple Processor Scheduling, Algorithm Evaluation- Advanced CPU scheduling. Process synchronisation: – Critical section Problem, Mutual Exclusion, Requirements, Semaphores, Monitors, Producer Consumer Problem, Readers Writers Problem, Deadlock Prevention, Detection and Recovery

UNIT IV

Memory Management- swapping, Contiguous memory allocation, Paging Segmentation, Segmentation with paging. Virtual memory- Demand paging, processes creation, page replacement, allocation of frames, thrashing. File system interface and Implementation- File concepts, access methods, directory structure, File system mounting, File sharing, Protection, File system structure, File system implementation, Directory implementation, Allocation methods, Free space managements, Efficiency and performance, Recovery, Log- structured file system.

UNIT V

I / O Systems - I / O hardware, Application I/O interface, Kernel I / O subsystem, Transforming I / O to hardware operations, STREAMS, Performances. Mass storage structure - Disk structure, Disk scheduling, Disk management, Swap space managements, RAID structure, Disk attachments, Stable storage implementation, Tertiary storage structure.

Text books:

1. D.M. Dhamdhere, "Systems Programming and Operating Systems", TMH, 2003.
2. Silberschatz, A., Galvin, P.B. & Gagne, G. "Operating System Concepts", 9th Ed. John Wiley & Sons-India.

References:

1. Dhamdhere, D. M. "Operating Systems", 2nd Ed. The McGraw - Hill Companies.
2. Ditel, Deital and Choffness, Operating Systems, Pearson, 3rdEdn
3. William Stallings, Operating Systems, Internals and Design Principles, 7th Edition Pearson,
4. SibsankarHaldar ,Alex a Aravind, "Operating Systems", Pearson Education India, Second impression.
5. Andrew S.Tanenbaum , Albert S.Woodhull, "The Minix Book- Operating Systems Design and Implementation", 3rd Edition Pearson(2016).

MCA1C03 : PYTHON PROGRAMMING

Contact Hours/ week: 4 **Credit: 4**

UNIT I

Introduction: History of Python Programming, Thrust Areas Of Python, Installing Anaconda Python Distribution, PyCharm IDE and Jupyter Notebook, Creating And Running First Python Project, Parts of Python Programming Language-identifiers, keywords, statements and expressions, variables, operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversion, The *typedef()* function and Is operator, Dynamic and Strongly typed language,

UNIT II

Control Flow Statement- Decision control flow statement *(if, if ...else, if...elif...,* nested *if*), Loop (*while, for*),*continue*, *break* statements, Catching Exception Using *try* and *except* Statement Functions- Built-In Functions Commonly used Modules, Function definition and calling the function, The *return* statement and *void* function, scope and life time of variables, default parameters, Keyword arguments, *args and **kwargs, Command Line Arguments, Strings- Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

UNIT III

Lists- Creating List, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions used on lists, list Methods, The *del* statement, Dictionaries- Creating Dictionary, Accessing and Modifying *key:value* Pairs in Dictionaries, Built-In Functions used on Dictionaries, Dictionary Methods, The *del* statement. Tuples and Sets- Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using *zip()* Function, Sets, Set Methods, Frozenset,

UNIT IV

Files- Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary files, The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules, Regular Expression Operations- Using Special Characters, Regular expression Methods, Named Groups in Python Regular Expressions, Regular expression with *glob* Module. Object-Oriented Programming- Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attribute versus Data Attribute, Encapsulation, Inheritance, Polymorphism.

UNIT V

Exceptions: Errors in python program-Compile time errors, Runtime errors, logical errors- Exception handling-types of exception- The except block- assert statement- User-defined Exceptions- Logging the exceptions: GUIs in Python: Root Window-Fonts and colours – Working with containers-Canvas, Frames, Widgets, Button widgets, Arranging widgets in the Frame, Label widget, Message Widget, Text widget, scrollbar widget, Check button widget, Radio button widget, Entry widget, Spinbox widget, List box widget, Menu widget- Table creation.

Text Book-

1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372
2. Alberto Fernandez Villan, Mastering OpenCV 4 with Python, Packt Publishing Ltd
3. Dr. R Nageswara Rao, Core Python Programming, 2nd edition, Dreamtech Publisher, 2019

Reference Books

1. Geron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 1st Edition,O'Reilly Media, 2017. ISBN – 13: 978-1491962299.
2. Wesley J. Chun, *Core Python Programming*, Second Edition, Publisher: Prentice Hall Pub

MCA1 C04 : DATA COMMUNICATION AND COMPUTER NETWORK

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction, Basic concepts- Line configuration, Topology, Transmission mode, Categories of networks, Internetworks, Transmission media - Twisted pair Cable, Coaxial Cable, Optical Fiber, Satellite Communication, Cellular Telephony, Terrestrial Microwave, OSI and TCP/IP models.

UNIT II

Physical layer, Signals-Digital and analog signals, Periodic and Aperiodic signals, Composite signals, Digital data transmission- parallel transmission and serial transmission, DTE-DCE interface, EIA232interface, X.21, Modems, Multiplexing-Frequency Division Multiplexing, Time Division Multiplexing and Wave Division Multiplexing, Switching-Circuit Switching, Packet Switching and Message Switching

UNIT III

Data link layer, Types of Errors-Single-Bit Error and Burst Error , Error detection –Vertical Redundancy Check(VRC),Longitudinal Redundancy Check(LRC) ,Cyclic Redundancy Check(CRC) , Error correction-Single-Bit Error correction, Hamming Code Data compression-Huffman code, Data link control-Line discipline, Flow control, Error control, Ethernet, CSMA/CD, TOKEN BUS, POLLING, SONET/SDH.

UNIT IV

Network layer, Networking and Internetworking devices-Repeaters, Bridges, Routers, Gateways, other Devices, Logical addressing, Internet protocols, Address mapping, Error reporting and multicasting, Delivery, Forwarding and Routing algorithms, Distance Vector Routing, Link State Routing, The Dijkstra Algorithm.

UNIT V

Transport Layer, Process-to-Process Delivery: UDP, TCP, and SCTP, Congestion Control and Quality of Service, Application Layer, Domain Name System, Remote Logging, Electronic Mail, and File Transfer, WWW and HTTP, Network Management: SNMP, Network security, Cryptography

References:

1. Data Communications and networking, Fourth Edition by Behrouz A. Forouzan, McGraw Hill 2001.
2. Computer Networks, Fourth Edition by Andrew S. Tanenbaum, Prentice-Hall 2003
3. Data and computer communication, Eighth Edition by William Stallings, Prentice-Hall 2007

MCA1 C05 : LINUX ADMINISTRATION

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction: Important parts of kernel; Major services in a UNIX system: init, login from terminals, syslog, periodic command execution crown and at; Boot process: The LILO boot process: LILO parameters, /etc/lilo.conf; The GRUB boot process; The /boot directory and files; initrd file and mkinitrd; Run levels: /etc/inittab, start-up script /etc/rc.d/rc.sysinit; System Configuration: The /etc/sysconfig/... files,kernel modules; kernel daemon; /etc/conf. modules and module parameters; /lib/modules/... directory structure and contents.

UNIT II

File system configuration: file system types, /etc/fstabloyout and meaning; Basic user environment: /etc/skel/... and home directories, Window manager configuration file locations; System Security: Host security: tcp_wrappers and /etc/hosts.allow and /etc/hosts. deny, /etc/security, shadow password, ile permissions, users groups and umask; Adding and deleting users; System maintenance: Syslogd, klogd and /etc/syslog.conf; Using a remote syslog; The system crontab, dailyscript, tmpwatch and logrotate; Using and managing the system log files; Basic system backup and restore operations; Emergency rescue operations.

UNIT III

Inter Process Communication programming : Create a process- fork() system call, Parent and Child Process, Process ID, User and Group ID Half Duplex Unix Pipes, Named Pipes, (First In First Out), Streams and messages, System V IPC :Message Queues, Semaphores, Shared memory, Sample programs for IPC that uses Pipes, FIFO; Socket Programming: Overview, socket address, Elementary Socket System Calls: socket, socket pair, bind, connect, listen, accept, send, sendto, recv, recvfrom, close, Byte ordering routines, Byte Operations, Address conversion routines, Simple client Programs that uses some reserved ports, Simple Client / Server Program using unreserved ports

UNIT IV

TCP / IP Network Configuration: Introduction to TCP / IP network, Protocols, IP address, Hostname, Configuring a Host : setting the host name, assigning IP address, broad cast, net mask and name server address, Editing Host and network files, Interface Configuration: loop back interface, Ethernet interface, The SLIP and PPP interface, Configuring Gateway, Routing through gateway, Network commands: ifconfig, netstat, route. Network applications Configuration: File Transfer Protocol (FTP) and Trivial File Transfer Protocol (TFTP), Network File Systems (NFS), Network Information System(NIS),Hyper Text Transfer Protocol (HTTP) and Web server, Server Message Block (SMB) Protocol and Samba server, Dynamic Host configuration Protocol (DHCP) Firewalls, Remote booting.

UNIT V

Domain Name Services (DNS) and Mail services: working of DNS, Host name Resolution Name lookup with DNS, Reverse Lookup, Domain Name Servers and Zones, DNS database: SOA, NS, MX, A and PTR records, Secondary and primary DNS, Zone change notification, root servers, internet root domains, configuring DNS, Using nslookup. Simple Mail Transfer Protocol (SMTP), Post office Protocol(POP) Multipurpose Internet Mail Extension (MIME), SMTP and POP3 command, Mail routing, Configuring A mail server.

Reference Books :

1. Evi Nemeth , et al, Linux Administration Hand Book , PHI 2003

2. Nicholas Wells, Linux Installation and Administration, Thomson Vikas 2000.

3. Olaf Kirch& Terry Dawson, Linux Network Administrators Guide, O'relly, 2003

4. Hunt, Linux DNS server Administration, BPB Publication, 2003

5. W Richard Stevens, Unix Network Programming, PHI, 2002

MCA2 C01: ALGORITHMS AND DATA STRUCTURE

Contact Hours/ week: 4 **Credit: 4**

UNIT I

Introduction to algorithm design: Steps in developing algorithm, methods of specifying an algorithm, important problem types: Combinatorial problems, Geometric problems, Graph problems, Numerical problems, Searching, Sorting and String processing. Basic technique for design of efficient algorithm: Brute Force approach, Divide-and-Conquer approach, Branch-and-Bound technique. Greedy approach, Dynamic programming, Backtracking.

UNIT II

Algorithm analysis: Importance of algorithm analysis, time and space complexity. Growth of functions: asymptotic notations, cost estimation based on key operations- Big Oh, Big Omega, Little Oh, Little Omega and Theta notations. Analyzing algorithm control structures, solving recurrences: Iteration method, Substitution method, Recursion Tree method, Master's Theorem, problem solving using Master's Theorem case 1, case 2 and case 3. Case study: Analysis of Strassen's algorithm for matrix multiplication, Analysis of Merge sort. Complexity Classes: P, NP, NP Hard and NP Complete problems.

UNIT III

Data structures: Definition and classification. Linear data structure: Array- operations, polynomial representation with arrays; concept of recursion, types of recursion. Case study with Tower of Hanoi problem. **Stack**: operations on stack. Application of stack - postfix expression evaluation , conversion of infix to postfix expression. **Queues:** operation on queue. Circular queue, dequeue and priority queue. Application of queue: job scheduling. **Linked list:** single linked list, structure and implementation; operations – traversing, add new node, delete node, reverse a list, search and merge two singly linked lists. Circular linked list– advantage. Queue as circular linked list. Doubly linked list, operations – add/delete nodes, advantages.

UNIT IV

Non- linear data structure: Tree- basic terminologies and properties; representation of binary tree, operations on binary tree; type of binary tree, forest, B tree, B+ tree and Trie. Tree traversal: in order, pre order and post order traversals. Binary search tree. Application of tree, AVL tree, Huffman algorithm. Sets: representations and operations of sets: Hash table, linked lists, tree and bit vector.

UNIT V

Sorting Techniques: Insertion sort, Bubble sort, Selection sort, Quick sort and Merge sort. Comparison of sorting algorithms. **Searching:** basic terminologies, linear search: linear search with array, linear search linked lists. Non-linear search techniques, binary search, binary tree searching. **Graphs:** basic terminologies, representation of graph, matrix representation of graphs. Graph traversals - depth-first traversal – breadth-first traversal - applications of graphs – shortest-path algorithm – Dijkstra's algorithm -minimum spanning tree – Prim's and Kruskal's algorithms.

REFERENCE BOOKS:

1. Thomas H Cormen, Charles E Leiserson, and Ronald L Rivest, Introduction to Algorithms, 3rd Edition, Prentice Hall of India Private Limited, New Delhi.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Design and Analysis of Computer Algorithms, Addison Wesley.
3. Pallaw, V K, Design and Analysis of Algorithms, Asian Books Private Ltd, 2012.
4. Pandey H M, Design and Analysis of Algorithms, University Science Press, 2013
5. Oded Goldreich, P,NP and NP- Completeness, Cambridge University Press, 2011.

MCA2 CO2: PROGRAMMING IN JAVA

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Features of Java: - Bytecode, Java Virtual Machine (JVM), Java Applets and Applications, Java file name and directory structure; Packages of Java API. Data Types, Variables, Arrays, Type Conversion and Casting; Operators; Control Statements. **Class:-** Class Fundamentals, Declaring Objects, Constructors, access specifier, static, Nested and Inner Classes, Command-Line Arguments, this Keyword; Garbage Collection. String handling. Collection class. Inheritance, method overloading, Method Overriding, Dynamic Method Dispatch, Abstract Classes

UNIT II

Packages:- Importing Packages; Interface: Defining an Interface, Implementing Interfaces; **Exception Handling:** try, catch, throw, throws, and finally, Java's Built-in Exceptions; **Thread**:- Synchronization, Messaging, Runnable interface, Inter thread communication, Deadlock, Suspending, Resuming and stopping threads, Multithreading. I/O streams, **File streams:** I/O Streams, File Input Stream and File Output Stream, Data Input and O/P Streams, Buffered I/P and O/P Streams, FileClass, Reader and Writer Streams, Random Access File.

UNIT III

Applets: Applet lifecycle, working with Applets, The HTML APPLET tag. Working with Graphics. **Abstract Window Toolkit (AWT):** AWT Classes, Window Fundamentals, Component, Container, Panel, Window, Frame. working with Frame Windows, AWT Controls, Layout Managers, and Menus. Event Handling: Events, Event Sources, Event Classes, Event Listener Interfaces, Adapter Classes. Java

UNIT IV

Database connectivity:- JDBC architecture- drivers- database connections- statements- resultsets- transactions-metadata-stored procedures-error handling- blobs and clobs- **Remote Method Invocation:** RMI architecture; RMI object services; defining remote objects; key RMI classes for remote object implementations; stubs and skeletons; accessing remote object as a client; factory classes; dynamically loaded classes; configuring clients and servers for remote class loading; remote object activation,

UNIT V

Java Servlets: life cycle; http servlets, post, head and other requests; Servlet responses; error handling; security; servlet chaining; thread safety; cookies; session tracking; HTTP session binding listener; databases and non-html content. **CORBA:** architecture, IDL, creating CORBA objects, registering with naming service, finding and using remote objects.

Reference Book:

1. Herbert Schildt, The complete reference Java2 ,7thed, Mc, Graw Hill.
2. David Flanagan, Java in a Nutshell A desktop quick Reference, 2 Edition, OReilly&AssociatesInc
3. Rajkumar, Java programming, pearson, 2013
4. HarimohanPandey, Java Programming, Pearson, 2012
5. David Flanagan,Jim Parley, William Crawford & Kris Magnusson , Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
6. Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001 7. JaisonHunder& William Crawford, Java Servlet Programming, O'REILLY, 2002

MCA2 C03: DATABASE MANAGEMENT SYSTEMS

Contact Hours/ week: 4 **Credit: 4**

UNIT I

Introduction to Database Management Concepts- Database Systems versus File Systems. Three level Architecture of databases. Overview of relational, network, hierarchical data models. The ER and EER. Relational Algebra and Relational calculus. **Relational database design** - Functional dependencies -1st, 2nd, 3rd, 4th, BCNF, 5th Normal form.

UNIT II

SQL: Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, join, Exist, Any, All, joined relations, embedded SQL, QBE. **PostgreSQL** – data type – tables – psql – operations on tables – sub queries – views – operators & functions – indices – arrays – transactions and cursors, Administrating PostgreSQL – authentication and Encryption – Database management – User and group management – PostgreSQL programming – PL/pgSQL.

UNIT III

Transaction processing-desirable properties of transaction. Transactions and Schedules –Characterising Schedules based on Recoverability, Serializability of schedules. Concurrency Control in databases: Locking Techniques-time stamp ordering, multi version concurrency Control –granularity of data items.

UNIT IV

Distributed Database System Architectures – Centralized, Client–Server and Server System Architectures – Parallel and Distributed Systems. Parallel Databases - I/O Parallelism – Interquery, Intraquery, Intraoperation and Interoperation Parallelism - Design of Parallel Systems. Distributed Databases - Homogeneous and Heterogeneous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols -Concurrency Control in Distributed Databases - Distributed Query Processing - Heterogeneous Distributed Databases.

UNIT V

Data Analysis and Mining - Decision-Support Systems - Data Analysis and OLAP - Data Warehousing -Data Mining. Information Retrieval - Relevance Ranking Using Terms - Relevance Using Hyperlinks - Synonyms, Homonyms and Ontologies - Indexing of Documents - Measuring Retrieval Effectiveness - Web Search Engines - Information Retrieval and Structured Data.

REFERENCE BOOKS:

1. Silbersehatz, Korth and Sudarshan, Database system concepts, 6th edition MGH 2011
2. Ramakrishnan and Gehrke, Database Management Systems, 3rd Edn, Mc Graw Hill, 2003
3. Elmasri and Navathe, Fundementals of Database systems, 5th Edition, Pearson 2009
4. C.J.Date-A.Kannan, S.Swamynathan "An introduction to Database System" 8th Edition, Pearson education O'Reilly, Practical PostgreSQL Shroff Publishers(SPD) 2002.
5. Carlo Zaniolo,Stefano Ceri, Christos Faloat ,V.S.Subrahmanian,Roberto Ziart "Advanced Database System", Morn Kaufmann publishers 2005

MCA2 C04: WEB TECHNOLOGY

Contact Hours/ week: 3 **Credit: 3**

UNIT I

HTML5: New Elements -Structural Elements, New Form/Input Elements, New Attributes Canvas, Video and Audio, Web Storage, Geolocation. The JavaScript Language- Introduction to JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects.

UNIT II

Host Objects: Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree DOM Event Handling. Scripting with HTML5.JQuery: jQuery Library, jQuery Basics, jQuery Getters and Setters, Altering Document Structure, Handling Events with jQuery.

UNIT III

PHP: Syntax and variables, Control and functions, string and arrays, creating functions, reading data in web pages, advanced object oriented programming, Session, Cookies, FTP and HTTP, Integrating payment system; Working with database: connecting to MySQL, making MySQL queries, fetching data building in error checking, MySQL functions, displaying queries in tables.

UNIT IV

Introduction to Web 2.0: Difference between Web 1.0 and Web 2.0, MVC Architecture. Scripting XML and JSON: XML Basics, XML request and responses, XML Parsing, XML in a string, XPath, XSTL.JSON Requests and responses, JSON Parsing. Ajax: Using XML and JSON, Syndication: RSS and Atom Feeds.

UNIT V

Content Management System: Introduction, need of CMS, Understanding CMS technologies, Different types of CMS: Portals, Wikis, Blog etc, their features and possible uses. Web services: Introduction, Web service architecture - RPC, SOA, REST, Web service standards – SOAP, WSDL, UDDI. Mash-ups: Introduction.

Reference Textbooks:

1. Jeffrey C. Jackson, Web Technologies: A Computer Science Perspective, Prentice Hall
2. David Flanagan, JavaScript: The Definitive Guide, 6th Edn. O'Reilly Media.2011
3. Bob Breedlove, et al, Web Programming Unleashed, Sams Net Publishing, 1stEdn
4. Steven Holzner, PHP: The Complete Reference, McGraw Hill Professional, 2008
5. Steve Suehring, Tim Converse, Joyce Park, PHP6 and MY SQL Bible, John Wiley & Sons,2009
6. Pedro Teixeira, Instant Node.js Starter, Packt Publishing Ltd., 2013
7. Anthony T. HoldenerIII, Ajax: The Definitive Guide, O'Reilly Media, 2008
8. Nirav Mehta, Choosing an Open Source CMS: Beginner's Guide Packt Publishing Ltd, 2009
9. James Snell, Programming Web Services with SOAP, O'Reilly 2002

MCA3 C01: SOFTWARE ENGINEERING

Contact Hours/ week: 4 **Credit: 4**

UNIT I

Software and Software Engineering: Nature of software and web apps, The software process, Software Engineering principles. **Agile Development:** Agility- Agility and cost of change, Agile process, Extreme programming, Other agile process models. **Project Management Concepts:** The management spectrum, People, Product, Process, Project, W5HH principle. Decomposition techniques, Empirical estimation models. **Project scheduling:** Basic concepts, Project scheduling, Defining a task set for software project Scheduling. **Risk Management:** Reactive Vs proactive risk strategies, Software risks, Risk Identification, Risk projection, Risk refinement, Risk mitigation, Monitoring, Management,

UNIT II

Quality Concepts: Software quality, Software quality dilemma, Achieving software quality. **Review Techniques:** Cost impact of software defects, Defect amplification and removal, Review metrics and their use, Informal reviews, Formal technical reviews. **Software Configuration Management:** Software configuration management, The SCM process, Configuration management for web apps.

Understanding Requirements: Requirements engineering, Eliciting requirements, Building requirements model, Negotiating requirements, Validating requirements. **Requirements Modeling:** Requirements modeling strategies, Flow oriented modeling, Creating a behavioral model, Requirements modeling for web apps.

UNIT III

Design Concepts: The design process, Design concepts, the design model. Software architecture, Architectural Design, Architectural mapping using data flows. **Component Level Design:** Cohesion, Coupling. Component level design for web apps, Component based development. **User Interface Design:** The golden rules, User interface analysis and design, Interface analysis, Interface design steps, Web apps interface design, Design evaluation. **Web apps Design:** Web apps design quality, Design goals, Design pyramid for web apps, Web apps interface design, Aesthetic design, Content design, Architecture design, Navigation design, Component level design.

UNIT IV

Testing Conventional Applications: Software testing fundamentals, white box testing, Basis path testing, Control structure testing, Black box testing. **Testing Web Applications:** Testing concepts for web apps, content testing, User interface testing, Component level testing, Navigation testing, Configuration, Performance and security testing. **Maintenance and Re Engineering:** Software maintenance, Reengineering, Software reengineering, Reverse engineering, Restructuring, Forward engineering.

UNIT V

Overview of object-oriented systems, objects, attributes, encapsulation, class, class hierarchy, polymorphism, inheritance, Introduction to UML, basic expression of classes, attributes, and operations, Class diagrams: generalization and association constructs, composition and aggregation. Actors, Actor Identification, Use case diagrams, Object interaction diagrams: collaboration diagrams, sequence diagrams, State diagrams: basic state diagrams, nested states, concurrent states and synchronization, Activity diagrams, Abuses of inheritance, danger of polymorphism.

TEXT BOOKS

1. Software Engineering – Roger S Pressman, 'Software Engineering: A Practitioner's Approach, 7 th Edition, McGraw-Hill International Edition, 2010.
2. Bahrami.A, Object Oriented System Development, McGraw Hill. (UNIT V)

REFERENCE BOOKS

1. Richard Fairey, 'Software Engineering concepts, Tata McGraw-Hill 2009 reprint
2. Ian Sommerville, 'Software Engineering'. 6th Ed., Addison Wesley
3. Waman S Jawadekar, 'Software Engineering Principles and Practice', Tata McGraw Hill, 2004
4. PankajJalote., Software Engineering - A precise Approach, Wiley India, 2011

MCA3C02: THEORY OF COMPUTATION

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Propositional Logic: Basic logical operations, conditional statement, bi-conditional statement, converse, inverse and contrapositive statement, well-formed formula, tautology, contradiction, equivalence of formula, laws to determine equivalence, tautological implication, duality law, normal forms- (CNF, DNF, PCNF, PDNF), Predicate calculus- rules of inference, valid arguments, types of quantifiers, properties of quantifier.

Set Theory: Set, types of set, operations and laws, algebra of sets and duality, inclusion and exclusion principle, Cartesian product- **Relations:** Definition, properties of relation, set operations on relation, types of relation, equivalence class, relation matrix and graph of relation, partition and covering of set, poset, composition of relation, recurrence relation

UNIT II

Probability: Preliminary concept- experiment, random experiment, event(simple and compound), sample space, mutually exclusive event, exhaustive event, impossible event, complement of an event, equally likely event, definition and types of probability- classical approach, axiomatic approach, frequency approach, addition theorem, independent and dependent events, condition probability, multiplication theorem, Bayes theorem.

Random Variable- Discrete random variable, probability distribution of discrete random variable; Joint Distribution- conditional probability distribution, independent random variable, marginal distribution function, conditional probability density function

UNIT III

Introduction to the Theory of computation and Finite Automata: Mathematical preliminaries and notation, Proof techniques, Three basic concepts: languages, grammar & automata. Some applications. Finite automata: Deterministic Finite Acceptors, Nondeterministic Finite Acceptors, Equivalence of deterministic and nondeterministic finite acceptors, Reduction of the number of states in finite automata

Regular Languages and Regular grammars: Regular expressions, connection between regular expressions and regular languages , regular grammars Properties of Regular Languages: closure properties of regular languages, identifying non regular language

UNIT IV

Context-free grammars & languages:-Context-free grammars, parsing and ambiguity. Simplification of Context free Grammars and Normal forms: methods of transforming grammars, two important normal forms. Pushdown automata for context-free languages-Non deterministic pushdown automata, PDA and context-free languages, deterministic pushdown automata and deterministic context-free languages. Properties of Context-Free Languages: pumping lemmas for context free languages and linear languages, closure properties for context-free languages

UNIT V

Turing machineStandard Turing machine, combining Turing machines for complicated tasks, Turing's thesis. Other models of Turing machine : Minor variations on the Turing machine theme, Turing machine with complex storage, nondeterministic Turing machine, a universal Turing machine, Linear bounded automata. Limits of Algorithmic computation: Problems that cannot be solved by Turing machines, Undecidable Problems for Recursively enumerable Languages, The Post Correspondence problem.

Text Book :

1. J.P. Tremblay, R. Manohar- Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill
2. An introduction to Formal Languages and Automata, Peter Linz, 4thedn, Narosa publishing House

Reference Books:

1. Kenneth H Rosen - Discrete Mathematics and its Applications with Combinatorics and graph Theory, Seventh Edition, McGraw Hill
2. Walpole, Myers,Ye- Probability and Statistics for Engineers and Scientists, Pearson Edition

MCA3 C03: COMPUTER GRAPHICS WITH OPENGL

Contact Hours/ week: 4 **Credit: 4**

UNIT 1

Overview of Graphics systems: Video display devices, Raster scan systems, Graphic workstations and viewing systems, Input devices, Graphics software, introduction to OpenGL.

Graphics Output Primitives: Coordinate reference frames, Line drawing algorithms (DDA and Bresenham's), OpenGL curve functions, Circle generating algorithms (Midpoint circle), Pixel addressing and Object geometry, fill area primitives, Polygon fill areas.

UNIT 2

Attributes of graphics primitives: Color and Gray scale, point attributes, Line attributes, Fill-Area attributes, General Scan-line polygon fill algorithm, Scan-Line fill of convex-polygons, Boundary fill and flood fill algorithms, Antialiasing.

Two-dimensional viewing: 2D viewing pipeline, Clipping window, normalization and viewport transformation, Clipping algorithms, point clipping, line clipping (Cohen-Sutherland, Nichol-Lee Nichol), Polygon Fill-area clipping (Sutherland – Hodgeman).

UNIT 3

Geometric Transformations: Basic 2D transformation, Matrix representation and Homogeneous coordinates, Inverse transformations, 2D composite transformations, Reflection and shear, Raster methods for geometric transformations, Transformations between 2D coordinate systems. 3D Geometric transformations, 3D translation, 3D rotation (coordinate axis rotation, General 3-d rotation, Quaternion methods for 3D rotation), 3D scaling, 3D composite transformations, transformations between 3D coordinate systems.

UNIT 4

Three-dimensional viewing : Overview of 3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformations, orthogonal projections (axonometric and isometric, orthogonal projection coordinates, clipping window and orthogonal projection view volume, Normalization transformation), Oblique parallel projections (Cavalier and cabinet projections, Clipping window and Oblique parallel-projection view volume, Oblique parallel projection transformation matrix, normalization transformation), Perspective projections (transformation coordinates, perspective-projection equations, vanishing points, view volume, transformation matrix, symmetric and oblique perspective-projection frustum, Normalized perspective-projection transformation coordinates), 3D clipping algorithms (region codes, point and line clipping, polygon clipping)

UNIT5

3D Object representation: Quadric surfaces, super quadrics, blobby objects, spline representations. Visible surface detection methods: Classification, Back-face detection, depth-Buffer method, Abuffer method. Wireframe visibility methods. Illumination models and surface rendering methods: Light sources, Surface lighting effects, Basic illumination models (Ambient light, Diffuse reflection, Specular reflection and the Phong model), polygon rendering methods (constant intensity surface rendering, Gouraud surface rendering, Phong surface rendering), Ray tracing methods – basic Ray-tracing algorithm.

Text Book:

1. Hearn and Baker, Computer Graphics with OpenGL, 3rdedn, Pearson.

Reference Books:

1. Hill Jr. and Kelly, Computer Graphics using OpenGL, 3rdEdn, Pearson
2. Shreiner, Sellers, Kessenich, Licea-Kane, OpenGL programming guide, 8thedn, Pearson.
3. Foley, Van Dam, Feiner, Hughes, Computer Graphics- Principles and practice, Second Edition in C, Pearson Education.

MCA3 CO4: PRINCIPLES OF INTELLIGENT SYSTEMS

Contact Hours/ week: 4 **Credit: 4**

UNIT 1

Introduction to soft Computing Paradigm, Artificial Neural Networks – fundamental concepts, Evolution, Basic models, important terminologies, MP – Neuron, Linear separability, Hebb network. Supervised learning networks – Perceptron network: Theory, Learning rule, Architecture, Training process, Training algorithm for single output class. Back-propagation network : theory, Architecture, Training process, Learning factors, testing.

UNIT 2

Associative Memory networks: introduction, Training algorithms for pattern association: Hebb rule, Outer Products rule. Auto associative Memory Networks: Theory, architecture, training process and algorithm, testing. Unsupervised Learning networks: Kohenen self-Organizing feature maps: Theory, Architecture, Training algorithm. Adaptive Resonance Network – Theory: fundamental architecture, operating principle and algorithm. ART-1: Architecture, training process and algorithm.

UNIT 3

Introduction: Fuzzy systems – Historical perspective, Utility and limitations, uncertainty and information, fuzzy sets and membership, Chance vs Fuzziness. Classical sets and Fuzzy sets: Classical set (Operations, properties, mapping to functions). Fuzzy sets (operations, properties, Alternative fuzzy set operations). Classical Relations and Fuzzy relations: Cartesian product, crisp relations (cardinality, operations, properties, composition), Fuzzy relations (cardinality, operations, properties, Fuzzy Cartesian products and composition), Tolerance and equivalence relation, Crisp equivalence and tolerance relations, Fuzzy tolerance and equivalence relations

UNIT 4

Properties of membership functions, Fuzzification and Defuzzification: Features of the membership functions, various forms, Fuzzification, Defuzzification to crisp sets, λ-cuts for fuzzy relations, Defuzzification to scalars. Logic and Fuzzy systems: Classical logic, proof, Fuzzy logic, approximate reasoning, other forms of the implication operation. Natural language, Linguistic hedges, Fuzzy rule based systems, Graphical techniques for inference. Development of membership functions: Membership value assignments (intuition, inference, rank ordering)

UNIT5

Genetic Algorithms: Fundamentals of genetic algorithm: history, basic concepts, creation of offsprings, working principle, Encoding, fitness function, reproduction. Genetic modeling: inheritance operators, cross over, inversion and deletion, Mutation operators, Bit- wise operators used in GA, Generational cycle, convergence, application (any one).

Text Books:

1. Sivanandan, Deepa, Principles of Soft Computing, 2ndEdn, Wiley India.
2. Rajasekharan and Viajayalakshmipai, Neural Networks, Fuzzy Logic and Genetic Algorithm, PHI, 2003. (For Unit 5)

Reference Books:

1. B. Yegnanarayana, Artificial Neural Networks, PHI
2. Satish Kumar, Neural Networks a class room approach, 2ndEdn, McGraw Hill.
3. Ross, Fuzzy Logic with Engineering Applications, 3rdEdn, Wiley India

ELECTIVES COURSES

STREAM- 1 : COMPUTATIONAL BIOLOGY

MCA 2E01: INTRODUCTION TO BIOINFORMATICS AND BIOSCIENCE

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction to Bioinformatics: History of Bioinformatics, definition of Bioinformatics, Bioinformatics versus Computational Biology, objectives of Bioinformatics. Biological data, file format, conversion of file format, Data retrieval system.

UNIT II

Basics of Biology: Characteristics of life; Levels of organization in nature: atoms to biosphere; different kingdoms; branches of Biology; Cell Biology: Cell as the structural and functional unit of life, Cell theory, Structural components of a cell, Types of cells, Comparison between plant and animal cells, Evolution: Evolution at molecular level, mutations, cell division.

UNIT III

Basics of Biochemistry: Bio molecules and its properties; acids and bases. Small molecules: sugars, fatty acids, amino acids, nucleotides. Macromolecules: monomer, polymer, carbohydrates, lipids, proteins, nucleic acids; cofactors and vitamins.

UNIT IV

Basics of Genetics: Definition and scope of genetics. Acquired characters inheritance, genotype and phenotype, Mendel's principles, Multiple alleles-definition; Flow of genetic information, gene structure, expression and regulation.

UNIT V

Basics of Biotechnology: Recombinant DNA technology, putting new genes into cells, Genetic engineering, Gene cloning Vs Animal cloning, PCR, DNA probes, DNA finger printing, gene therapy.

REFERENCE BOOKS

1. Mount D, Bioinformatics: Sequence & Genome Analysis, Cold spring Harbor press.
2. Alphey, Luke. DNA sequencing: from experimental methods to bioinformatics. Bios Scientific Publishers Ltd, 1997.
3. Basir, Seemi Farhat. Textbook of immunology. PHI Learning Pvt. Ltd., 2012
4. Coico, Richard, and Geoffrey Sunshine. Immunology: a short course. John Wiley & Sons, 2015.
5. Cooper, Geoffrey M., and Robert E. Hausman.The cell. Vol. 85. Sunderland: Sinauer Associates, 2000.
6. Durgin, Jane M., and Zachary I. Hanan.Thomson Delmar Learning's Pharmacy Practice for Technicians. Cengage Learning, 2005.
7. Grace, Eric S. Biotechnology unzipped: Promises and realities. Joseph Henry Press, 2006
8. Reed, Philip A. Book Review-The Biotech Century, 1999.
9. Simon, Eric J., et al. Campbell essential biology. Pearson, 2015.
10. Starr, Cecie, et al. Biology: The unity and diversity of life. Nelson Education, 2015.

MCA 3E02: ALGORITHMS IN COMPUTATIONAL BIOLOGY

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Basic Algorithms in Computational Biology: Exhaustive search methods and their applications in Computational Biology- Motif finding- Tandem repeats.

UNIT II

String matching algorithms: pattern matching in strings, suffix, prefix, factor, substring, exact string matching, exact tandem repeat, Characteristics of Brute Force algorithm, Boyer- Moore algorithm, KMP algorithm, Horspool algorithm and Karp-Rabin algorithm. Concept of dynamic programming.

UNIT III

Data matrices: Measure of similarity, binary data measures, count data measures, continuous data measures, proximity matrices, string matric, clustering algorithm.

UNIT IV

Sequence Alignment: Pair-wise sequence alignment, Need of Scoring schemes- Penalizing gaps; Scoring matrices for amino acid, PAM Probability matrix and Log odds matrix; BLOSUM; Dot-plot visualization; Needleman-Wunsch algorithm- effect of scoring schemes- e- values; BLAST and FASTA, Smith – Waterman algorithm for local alignment.

UNIT V

Multiple sequence alignment: n dimensional dynamic programming. Tools for MSA: Muscle and T-Coffee. Phylogenetic Algorithms: Clustering based methods- UPGMA and neighbor joining, Optimality based: Fitch-Margoliash and minimum evolution algorithm; Character based methods- Maximum Parsimony and Maximum Likelihood methods; Evaluation of phylogenetic trees- significance.

TEXT BOOK:

1. Dan Gusfiled, Algorithms on Strings Trees and Sequences, Cambridge University Press.
2. Pevzner P A, Computational Molecular Biology: An Algorithmic Approach, MIT Press Cambridge, MA, 2000.
3. John D MacCuish and Norah E. MacCuish, Clustering in Bioinformatics and Drug Discovery, CRC Press 2011.

REFERENCE:

1. Richard M. Karp. Mathematical challenges from genomics and molecular biology, Notices of the American Mathematical Society, vol. 49, no. 5, pp. 544-553
2. Mount D, Bioinformatics: Sequence & Genome Analysis, Cold spring Harbor press
3. Jeremy J. Ramsden, Bioinformatics: An Introduction, Springer.
4. Glyn Moody, Digital Code of Life: How Bioinformatics is Revolutionizing Science, John Wiley & Sons Inc
5. Tao Jiang, Ying Xu and Michael Q. Zhang, Current Topics in Computational Molecular Biology, Ane Books.

MCA 4E03: BIOLOGICAL DATABASES AND SCRIPTING LANGUAGES

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Basic concept of open access bibliographic resources related to life sciences, the significances and the need for such resources , the major content of the databases, how to search and use these resources/databases with special references to Pub Med.

UNIT II

Types of data: Binary data, count data, continuous data, categorical data, mixed type data. Data matrices, measures of similarity. Contents and formats of databases entries, retrieval of data using text based search using ENTREZ, sources of data, method for deposition of data to databases.

UNIT III

Introduction to the major resources: NCBI, EBI and ExPASy. Nucleic acid sequence databases, GenBank, EMBL, DDBJ. Protein Sequence Databases: SWISSPROT, Tr-EMBL, PIR-PSD, Genome Databases at NCBI, EBI, TIGR, SANGER.

UNIT IV

Scripting Languages for Bioinformatics-I: Python: Python environment, IDLE, Core Containers, Basic Operators & Control Structures, File Handling, Creating Modules & Packages, Regular Expressions, Basic Object Oriented concepts, CGI programming, Database connectivity, Bio-Python.

UNIT V

Scripting Languages for Bioinformatics-II: Perl: Perl environment, Datatypes, Basic Operators & Control Structures, File Handling, Basic string manipulations using built-in functions, Regular Expressions, CGI programming, Database connectivity, Bio-Perl.

Text Books

1. Des Higgins (Ed), Willie Taylor (Ed), Bioinformatics: Sequence, Structure and Databanks - A Practical Approach, 3rd Edition, New Delhi Oxford University Press, ISBN: 0195667530.
2. Stevens, Tim J., and Wayne Boucher. Python Programming for Biology. Cambridge University Press, 2015.
3. Schwartz, Randal L., and Tom Phoenix. Learning perl. O'Reilly & Associates, Inc., 2001

REFERENCES

1. Stephen Misener and Stephen A. Krawetz, Bioinformatics: Methods and Protocols, 1st Edition, Humana Press, ISBN: 1617371564.
2. Prakash S Lohar, Bioinformatics, MJP publishers, Chennai, ISBN: 9788180940668.
3. Asheesh Shanker, Vinay Sharma and Ashok Munjal, A Textbook of Bioinformatics, 1st Edition, Rastogi Publications, New Delhi, ISBN: 9788171339174.
4. Allen Downey et.al.Learning with Python. Dreamtech Press, 2015.
5. Arbuckle, Daniel. Python Testing: Beginner's Guide. Packt Publishing Ltd, 2010
6. Feiler, Jesse. Perl 5 Programmer's Notebook. Prentice Hall PTR, 1999
7. R. Kelly Rainer, Brad Prince. Modern Perl.Wiley, 2015.
8. Yu Zhang. An introduction to Python programming, Springer, 2016
9. Wall, Larry, Tom Christiansen, and Randal L. Schwartz. "Programming perl." (1999).
10. Sedgewick, Robert, Kevin Wayne, and Robert Dondero. Introduction to programming in Python: An interdisciplinary approach. Addison-Wesley Professional, 2015.

MCA 4E04: MOLECULAR MODELLING AND SIMULATION

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Overview of molecular modelling: molecular modelling methods - semi-empirical method and empirical method. Model Types: static, dynamical and probabilistic models.

UNIT II

System modelling: concept, principles of mathematical modelling, static physical model, stochastic activities, continuous and discrete simulation. Probability concepts in simulation, random number generations and their testing, stochastic variable generation, model execution - event driven versus time driven.

UNIT III

Computational gene mapping: genetic mapping, gene expression, gene prediction methods, gene prediction tools, mutational analysis, introduction to restriction mapping and map assembly, mapping with restriction fragment fingerprints, Lander-Waterman statistics. Software Packages for Phylogenetic Analysis - PHYLogeny Inference Package (Phylip), Phylogenetic Analysis using Parsimony (PAUP) and Phylogenetic Analysis by Maximum Likelihood (PAML). Microarray technology: techniques for microarray data analysis, microarray databases. Scatter Plots, principal component analysis, cluster analysis, applications of microarray technology.

UNIT IV

Structural modelling: use of sequence patterns for protein structure prediction. Prediction of protein secondary structure from the amino acid sequences. Prediction of three dimensional protein structures. Protein structure classification - two major classification schemes- CATH and SCOP. Protein structure prediction– Steps involved in homology modelling. Protein- Protein interactions, prediction methods for Protein-Protein interactions, Protein-Protein interaction Databases, computer assisted drug design (CADD) - protein based drug design cycle, drug discovery pipeline.

UNIT V

Molecular visualization: molecular visualization, visualization of protein structures. Software tools for 3D molecular graphic visualization- Rasmol - basic operations and steps in Rasmol to visualize the molecule, advantages of Rasmol, advantages of Swiss- PdbViewer. Docking simulations - rigid docking and flexible docking.

Text Books

1. Stephen Misener and Stephen A. Krawetz, Bioinformatics: Methods and Protocols, 1st Edition, Humana Press, ISBN: 1617371564.
2. Geoffrey Gordan, System Simulation, 2nd Edition, PHI, ISBN: 9788120301405.
3. Tamar Schlick, Molecular Modeling and Simulation: An Interdisciplinary Guide, 2nd Edition, Springer, ISBN: 1461426502.
4. Narsingh Dev, System Modelling with Digital Computer, PHI, ISBN: 0138817898.
5. Andrew Leach, Molecular Modelling: Principles and Applications, Prentice Hall. 2nd Edition, ISBN: 81317286092001.
6. Prakash S Lohar, Bioinformatics, MJP publishers, Chennai, ISBN: 9788180940668.

References

1. Asheesh Shanker, Vinay Sharma and Ashok Munjal, A Textbook of Bioinformatics, 1st Edition, Rastogi Publications, New Delhi, ISBN: 9788171339174.
2. Des Higgins (Ed), Willie Taylor (Ed), Bioinformatics: Sequence, Structure and Databanks - A Practical Approach, 3rd Edition, New Delhi Oxford University Press, ISBN: 0195667530.

STREAM -2: NATURAL LANGUAGE PROCESSING

MCA 2E01: ARTIFICIAL INTELLIGENCE

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction - Overview of AI applications. Introduction to representation and search. The Propositional calculus, Predicate Calculus, Using Inference Rules to produce Predicate Calculus expressions, Application – A Logic based financial advisor.

UNIT II

Introduction to structure and Strategies for State Space search, Graph theory, Strategies for state space search, Using the State Space to Represent Reasoning with the Predicate calculus (Sate space description of a logical system, AND/OR Graph). Heuristic Search: introduction, Hill-Climbing and Dynamic Programming, The Best-first Search Algorithm, Admissibility, Monotonicity and informedness, Using Heuristics in Games.

UNIT III

Building Control Algorithm for State space search – Introduction, Production Systems, The blackboard architecture for Problem solving. Knowledge Representation – Issues, History of AI representational schemes, Conceptual Graphs, Alternatives to explicit Representation, Agent paradigms: the hierarchical paradigm, the reactive paradigm, and the hybrid paradigm. Agent based and distributed problem solving.

UNIT IV

Theory of Fuzzy Sets: Classical Sets vs Fuzzy Sets, Types of Fuzzy Sets, Operations on Fuzzy Sets, Zadeh's Extension Principle, Fuzzy Relations, Fuzzy Relational Equations, Possibility Theory and Fuzzy Measures. Applications of Fuzzy Sets: Approximate Reasoning, Fuzzy Relational Inference, Fuzzy Controllers, Efficiency and Effectiveness of inference schemes, Functional Approximation capabilities.

UNIT V

Optimization techniques: Particle Swarm Optimization, Ant Colony Optimization, Random Hill Climbing for local search optimization, Tabu Search, Simulated Annealing, Differential Evolution, Genetic Algorithm, Examples

TEXT BOOK:

1. George F Luger, Artificial Intelligence – Structures and Strategies for Complex probel solving, 5thEdn, pearson.
2. Prateek Joshi, AI with Python. Packt, Birmingham – Mumbai. 2017. Freely downloadableat: https://el.b-ok2.org/book/3397036/d90e17

REFERENCE BOOKS:

1. E. Rich, K. Knight, S B Nair, Artificial intelligence, 3rdEdn, McGraw Hill.
2. S. Russel and p. Norvig, Artificial intelligence – A Modern Approach, 3rdEdn, pearson
3. D W Patterson, introduction to Artificial Intelligence and Expert Systems, PHI,

MCA 3E02: ARTIFICIAL NEURAL NETWROK AND DEEP LEARNING

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction to Machine Learning: Concept of learning task, inductive learning and the concepts of hypothesis space, introduction to different types of machine learning approaches, examples of machine learning applications, different types of learning; supervised learning, unsupervised learning, reinforcement learning. Setting up your machine learning platform; training, validation and testing, over-fitting and under-fitting, different types of error calculation

UNIT II

Supervised Learning: Introduction, learning a class from example, learning multiple classes, model selection and generalization, linear regression and feature selection, Bayesian and Decision Tree learning; classification tree and regression tree, multivariate methods for learning; multivariate classification and regression.

UNIT III

Unsupervised Learning: Introduction, clustering; mixture densities, k-means clustering, expectation maximization algorithm, mixture latent variable models, Latent Dirichlet Allocation, spectral and hierarchical clustering, Dimensionality reduction; principal component allocation, linear discriminant analysis, canonical correlation analysis.

UNIT IV

Introduction to Artificial Neural Network: Understanding brain, perceptron, Multi-Layer perceptron as universal approximator, general architecture of artificial neural network, feed forward and backpropagation, different linear and nonlinear activation functions for binary and multi class classification.

UNIT V

Introduction to Deep Learning: Fundamentals of deep learning, Deep Feedforward Networks, Regularization for Deep Learning, Optimization for Training Deep Models, Introduction to Convolutional Networks, Sequence Modelling using Recurrent Nets, overview of LSTM, fundamentals of Generative adversarial Network.

References:

1. Ethem Alpaydin, Introduction to Machine Learning- 3rd Edition, PHI.
2. Tom M. Mitchell, Machine Learning, McGraw-Hill
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning), MIT Press, 2016.
4. Kuntal Ganguly, Learning Generative Adversarial Networks, Packt Publishing, 2017

MCA 4E03: FOUNDATIONS OF NATURAL LANGUAGE PROCESSING

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction to Language: Linguistic Knowledge, Grammar, Language and Thought, computational linguistics vs NLP, why NLP is hard, why NLP is useful, classical problems. Words of Language, Content Words and Function Words, Lexical categories, Regular expressions and automata. Morphology: Morphemes, Rules of Word Formation, Morphological parsing and Finite state transducers.

UNIT II

N-grams: simple N-grams, smoothing, Applications, language modelling. Word classes and POS tagging: t tag sets, techniques: rule based, stochastic and transformation based. Introduction to Natural Language Understanding- Levels of language analysis- Syntax, Semantics, Pragmatics.

UNIT III

Grammars and Parsing- Grammars for Natural Language: CFG, Probabilistic Context Free Grammar, statistical parsing. Features and Unification: Feature structures and Unification of feature structures. Lexical semantics, formal semantics and discourse. WSD, Information retrieval: Boolean, vector space and statistical models.

UNIT IV

Knowledge Representation and Reasoning- FOPC, Elements of FOPC. Discourse processing: monologue, dialogue, reference resolution, Conversational Agent. Text coherence. Dialogue acts: Interpretation of dialogue acts, plan inference model, clue-based model. Semantics: Representing meaning, Semantic analysis, Lexical semantics.

UNIT V

Applications: Natural Language Generation: architecture, surface realization and discourse planning. Machine Translation: rule-based techniques, direct translation, Statistical Machine Translation (SMT), parameter learning in SMT.

Textbook:

1. Daniel Jurafsky and James H Martin. Speech and Language Processing
2. Hobson Lane, Cole Howard, Hannes Hapke. Natural Language Processing in action
3. Victoria fromkin, Robert Rodman and Nina Hyams, An Introduction to language,

MCA 4E04 : NATURAL LANGUAGE PROCESSING WITH PYTHON

Contact Hours/ week: 3 **Credit: 3**

UNIT 1

Language Processing and Python: Computing with Language: Texts and Words, Texts as Lists of Words, Simple Statistics, Making Decisions and Taking Control, Automatic Natural Language Understanding. **Accessing Text Corpora and Lexical Resources:** Accessing Text Corpora, Conditional Frequency Distributions, Reusing Code, Lexical Resources, WordNet

UNIT 2

Processing Raw Text: Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation. **Formatting:** From Lists to Strings-Writing Structured Programs: Basics, Sequences, Questions of Style, Functions: The Foundation of Structured Programming, Doing More with Functions, Program Development, Algorithm Design, A Sample of Python Libraries.

UNIT 3

Categorizing and Tagging Words: Using a Tagger, Tagged Corpora, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging, How to Determine the Category of a Word?

Learning to Classify Text: Supervised Classification, Further Examples of Supervised Classification, Evaluation, Decision Trees, Naive Bayes Classifiers, Maximum Entropy Classifiers, Modeling Linguistic Patterns.

UNIT 4

Extracting Information from Text: Information Extraction, Chunking, Developing and Evaluating Chunkers, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction, Sentiment Analysis. **Analyzing Sentence Structure:** Dependencies and Dependency Grammar, Grammar Development.

UNIT 5

Managing Linguistic Data: Corpus Structure: a Case Study, The Life-Cycle of a Corpus, Acquiring Data, Working with XML, Working with Toolbox Data, Describing Language Resources using OLAC Metadata. NLP applications: Sentiment Analysis, Text Summarization and Question answering

TEXTBOOK:

1. Steven Bird, EwanKlein, and Edward Loper, Natural Language Processing with Python O'Reilly Media, Inc.2009. Freely accessible at: https://www.nltk.org/book/
2. Dipanjan Sarkar , Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from Your Data, Bangalore, Karnataka India. 2016.

STREAM- 3: DATA SCIENCE

MCA 2E01: STATISTICAL FOUNDATIONS FOR DATA SCIENCE

Contact Hours/ week: 3 **Credit: 3**

UNIT I

ALGEBRA OF PROBABILITY

Algebra of sets - fields and sigma - fields, Inverse function -Measurable function –Probability measure on a sigma field – simple properties - Probability space – Random variables and Random vectors – Induced Probability space – Distribution functions –Decomposition of distribution functions.

UNIT II

EXPECTATION AND MOMENTS OF RANDOM VARIABLES

Definitions and simple properties - Moment inequalities – Holder, Jenson Inequalities – Characteristic function – definition and properties – Inversion formula. Convergence of a sequence of random variables - convergence in distribution - convergence in probability almost sure convergence and convergence in quadratic mean - Weak and Complete convergence of distribution functions – Helly - Bray theorem.

UNIT III

DISTRIBUTION THEORY

Distribution of functions of random variables – Laplace, Cauchy, Inverse Gaussian, Lognormal, Logarithmic series and Power series distributions - Multinomial distribution - Bivariate Binomial – Bivariate Poisson – Bivariate Normal - Bivariate Exponential of Marshall and Olkin - Compound, truncated and mixture of distributions, Concept of convolution - Multivariate normal distribution (Definition and Concept only)

UNIT IV

SAMPLING DISTRIBUTION

Sampling distributions: Non - central chi - square, t and F distributions and their properties - Distributions of quadratic forms under normality -independence of quadratic form and a linear form - Cochran's theorem.

UNIT V

ORDER STATISTICS

Order statistics, their distributions and properties - Joint and marginal distributions of order statistics - Distribution of range and mid range -Extreme values and their asymptotic distributions (concepts only) - Empirical distribution function and its properties – Kolmogorov - Smirnov distributions – Life time distributions -Exponential and Weibull distributions - Mills ratio – Distributions classified by hazard rate

Textbooks:

1. Modern Probability Theory, B.R Bhat, New Age International, 4th Edition, 2014.

2. An Introduction to Probability and Statistics, V.K Rohatgi and Saleh, 3rd Edition, 2015.

Reference Books:

1. Introduction to the theory of statistics, A.M Mood, F.A Graybill and D.C Boes, Tata McGraw-Hill, 3rd Edition (Reprint), 2017.

2. Order Statistics, H.A David and H.N Nagaraja, John Wiley & Sons, 3rd Edition, 2003.

MCA 3E02 : FOUNDATIONS OF DATA SCIENCE

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction to Data Science

Definition – Big Data and Data Science Hype – Why data science – Data Scientist- Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modelling –Presentation. Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

UNIT II

Data Pre-processing

The basic data types- Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling. Introduction to Bayesian Estimation , Multiple Imputation-Imputation Phase, Analysis and Pooling Phase. Feature selection algorithms: filter methods, wrapper methods and embedded methods, Forward selection backward elimination, Relief, greedy selection.

UNIT III

Data Mining Functionalities -I

Association rules mining, basic concepts and applications, overview of Frequent Pattern mining algorithms.
Cluster analysis (basic concepts, without going into detailed algorithms) -Types of data in clustering, categorization of clustering methods, algorithms (one from each category)

UNIT IV

Data Mining Functionalities II

Outlier analysis - Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data. Classification and prediction (basic concepts, without going into detailed algorithms) - Decision tree induction, Bayesian classification, K-nearest neighbour classification,
Techniques for improving accuracy of classifiers – Evaluation of performance of classifiers.

UNIT V

ANN & Deep Learning

Logistic Regression – Multi Layer Perceptron and backpropagaton algorithm. Deep Learning Deep Feedforward Networks – Optimization of Deep Learning – Convolution Networks – Recurrent Nets, Auto encoders.

Textbooks:

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016
2. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O'Reilly, 1st edition, 2018
3. J. Han and M. Kamber: Data Mining: Concepts and Techniques By Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition.
4. Charu C. Aggarwal ,"Data Mining The Text book", Springer, 2015.
5. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016.
6. Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka, Deep Learning Using Python, Wiley-India, 1st Edition, 2019.
7. Craig K. Enders, "Applied Missing Data Analysis", The Guilford Press, 2010

MCA 4 E03: BIG DATA ANALYTICS

Contact Hours/ week: 3 **Credit: 3**

UNIT I

UNDERSTANDING BIG DATA:-What is big data? – why big data? –Data, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II

NOSQL DATA MANAGEMENT :Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships –graph databases – schema less databases – materialized views – distribution models – sharding — version – Map reduce –partitioning and combining – composing map-reduce calculations.

UNIT III

BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

UNIT IV

MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution –MapReduce types – input formats – output formats

UNIT V

HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model –cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation –HiveQL queries-case study.

Note : Internal assessment : all assignments shall be based on implementation of selected concepts covered in the theory. 50% weightage of test shall be given to demonstrations and viva based on implementation.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations",1st Edition, O'Reilley, 2012.

Reference Books:

1. VigneshPrajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

MCA 4E04: PYTHON FOR DATA SCIENCE

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Pandas – Handling Missing Data, Hierarchical Indexing, Concat and appending, Merge and Join, Aggregation and grouping, Pivot tables, Vectoring string operations, working with time series. (12 Hours)

UNIT II

Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks, Customizing Matplotlib: Configurations and Stylesheets, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap, Visualization with Seaborn. (12 Hours)

UNIT III

Introducing Scikit-Learn, Hyperparameters and Model Validation, Feature Engineering , Linear Regression, Support Vector Machines, Decision Trees and Random Forests, Principal Component Analysis, Manifold Learning, k-Means Clustering, Kernel Density Estimation. (12 Hours)

UNIT IV

Tensorflow – Artificial Neural network – Training Deep Neural network. (9 Hours)

Textbook:

1. Jake VanderPlas, Python Data science Handbook, O Reilly, 2016
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow, O Reilly, 2017
3. Allen B. Downey, Think Python, O Reilly

STREAM- 4: INTERNET OF THINGS

MCA 2E01 INTRODUCTION TO SENSORS

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Signals and Systems Fundamentals, principal of sensor and actunator, sensors vs transducers, classification of sensors, characterstics of sensors: resonance, damping , Q factor, stress analysis, I/O curve

UNIT II

Different Sensor Parameters: Static and Dynamic characteristics, Sensor Calibration: Linear and non-linear calibration, Sensor Response Features: Response and recovery time of first and second order systems, Information normalization and coding

UNIT III

Principles of signal conditioning and digitization, Signal-Level and Bias Changes, Linearization, Digital Conversions, Filtering: Introduction to digital filters, State-Space Filters, Frequency-domain filters

UNIT IV

Selecting complimentary, redundant sensors, optimization of sensor positioning and configuration, multi-sensor data fusion and Intelligent dynamic sensor networks.

UNIT V

Thermal Sensors, mechanical sensors, magnetic sensors, optical sensors, smart sensors, bio sensors.

Text Books:

1. Doebelin, E.O. and Manic, D.N., Measurement Systems: Applications and Design, McGrawHill (2004).
2. Sawhney, A.K. and Sawhney, P., A Course in Electrical and Electronic Measurements and Instrumentation, DhanpatRai (2008).

REFERENCE BOOKS:

1. Jacob Fraden "Handbook of Modern Sensors: Physics, Designs, and Applications" Fifth Edition, Springer, 2016.
2. Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India (2003).
3. Nakra, B.C. and Chaudhry, K.K., Instrumentation, Measurement and Analysis, TMH (2003).

MCA 3E02: INTRODUCTION TO CLOUD COMPUTING

Contact Hours/ week: 3 **Credit: 3**

UNIT I

UNDERSTANDING CLOUD COMPUTING:- Cloud computing is a model for enabling ubiquitous, convenient, on-demand access to a shared pool of configurable computing resources. Cloud computing paradigm possesses tremendous momentum but its unique aspects exacerbate security and privacy challenges. Cloud computing enables increasing number of IT services to be delivered over the Internet. The cloud platform enables business to run successfully without dedicated hardware, software and services.

UNIT II

UNDERSTANDING CLOUD COMPUTING:-Hardware and Infrastructure: Clients – Security – Network –Services; Accessing the Cloud: Platforms – Web Applications – Web API; Cloud Storage.

UNIT III

USING CLOUD PLATFORMS:- Understanding Abstraction and Virtualization– Capacity Planning – Exploring Platform as a Service – Using Google web services

UNIT IV

CLOUD SERVICES AND APPLICATIONS:- Understanding Service Oriented Architecture– Moving Applications to the cloud – Working with cloud based storage – Working with productive software.

UNIT V

DEVELOPING APPLICATIONS, THIN CLIENTS AND MIGRATION:- Develop applications using Google, Microsoft – Google App Engine – Microsoft Windows Azure – Virtualizing your Organization – Server Solutions.

TEXT BOOKS:

1. Anthony Velte, Toby Velte and Robert Elsenpeter, "Cloud Computing – A Practical Approach", 1st Edition, McGraw Hill. 2010.
2. Rajkumar Buyya and Vecchiola, Selvi, "Mastering Cloud Computing", 1st Edition, McGraw Hill. 2013.
3. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, John Wiley & Sons, 2010.

Reference Books:

4. Massimo Cafaro and Giovanni Aloisio, "Grids, Clouds and Virtualization", Springer, 2011.
5. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publications, 2011.
6. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008

MCA 4E03 : INTERNET OF THINGS

Contact Hours/ week: 3 **Credit: 3**

UNIT I

INTRODUCTION AND BACKGROUND:- Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, Logical Design of IoT: IoT functional Blocks, IoT Communication Blocks, IoT communication APIs, IoT Enabling Technologies: WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Systems.

UNIT II

IOT HARDWARE, DEVICES AND PLATFORMS:- Basics of Arduino: The Arduino Hardware, The Arduino IDE, Basic Arduino Programming, Basics of Raspberry pi: Introduction to Raspberry Pi, Programming with Raspberry Pi, CDAC IoT devices: Ubimote, Wi-Fi mote, BLE mote, WINGZ gateway, Introduction to IoT Platforms, IoT Sensors and actuators.

UNIT III

IOT PROGRAMMING 1:- Arduino Programming: Serial Communications, Getting input from sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication. (Supported with demonstration).

UNIT IV

IOT PROGRAMMING 2:- Programming with Raspberry Pi: Basics of Python Programming, Python packages of IoT, IoT Programming with CDAC IoT devices.

UNIT V

DOMAIN SPECIFIC IOT:- Home automation, Smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, Industry and Health & Life style secors. Case Studies: A Case study of Internet of Things Using Wireless Sensor Networks and Smartphones, Security Analysis of Internet-of-Things: A Case Study of August Smart Lock, OpenIoT platform.

TEXT BOOKS

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Margolis, Michael. "Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects. " O'Reilly Media, Inc.", 2011.
3. Monk, Simon. Raspberry Pi cookbook: Software and hardware problems and solutions. " O'Reilly Media, Inc.", 2016.

REFERENCE BOOKS

1. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012.

2. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.

3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.

4. Al-Fuqaha, Ala, et al. "Internet of things: A survey on enabling technologies, protocols, and applications." IEEE Communications Surveys & Tutorials 17.4 (2015): 2347-2376.

5. Tsitsigkos, Alkiviadis, et al. "A case study of internet of things using wireless sensor networks and smartphones." Proceedings of the Wireless World Research Forum (WWRF) Meeting: Technologies and Visions for a Sustainable Wireless Internet, Athens, Greece. Vol. 2325. 2012.

6. Ye, Mengmei, et al. "Security Analysis of Internet-of-Things: A Case Study of August Smart Lock."

MCA 4E04: IOT IMPLEMENTATION AND CASE STUDIES

Lecture: 1 hour **Practical: 2 hours** **Tutorial: 1 hour**

Note to faculty / BOE :

Assessment: CA shall be based on the list of experiments.
ESE shall be based on the case study report, presentation, demonstration and viva

List of Experiments Case study	**Practical Hours**
1. Controlling LEDs blinking pattern through UART.	3
2. On-chip Temperature measurement through ADC.	3
3. Communication of two Motes over the radio frequency.	3
4. Generation of alarm through Buzzer.	3
5. Proximity detection with IR LED.	3
6. Demonstration of a Peer-to-Peer network topology using Coordinator and end device network device types	3
7. IP based sensor monitoring through Ubi-Sense	3
8. IP based lighting control through Data Acquisition Card	3
9. Transmitting the measured physical value from the UbiSense over the Air.	3
10. Pushing data from device to cloud	3
11. Case Study	15

STREAM- 5: IMAGE PROCESSING AND COMPUTER VISION

MCA 2 E01 FOUNDATIONS OF DIGITAL IMAGE PROCESSING AND PATTERN RECOGNITION

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Steps in Digital image Processing, Elements of Visual perception, Image Sensing and Acquisition, Image sampling and quantization, Basic pixel relationships, Basic Intensity Transformation functions – Negatives, Log transforms, Power law transformations, Piecewise Linear Transformation functions.

UNIT II

Histogram processing, Fundamentals of spatial filtering, smoothing spatial filters, Sharpening spatial filters. Filtering in the Frequency domain: DFT of one and two variables, Properties of 2-D DFT, Basics of filtering in the Frequency domain. Image smoothing filters (Ideal Lowpass, Gaussian Lowpass), Image sharpening filters (ideal High pass, Gaussian High pass, Laplacian in the Frequency domain. Selective filtering – Notch filters.

UNIT III

Image restoration and reconstruction: Model, noise models, restoration in the presence of noise only – spatial filtering, Periodic noise reduction by frequency domain filtering. Linear, Position – invariant degradation. Color models – RGB and HIS.

UNIT IV

Image segmentation: Fundamentals, Point and line and edge detection, Thresholding, Region-based thresholding- Representation and description: Representation – Boundary following and chain codes, skeletons. Boundary descriptors – Simple descriptors, shape numbers. Regional descriptors – simple descriptors.

UNIT V

Applications of Pattern Recognition – Baye's Theorem – Multiple Features – Conditionality Independent Features – Decision Boundaries – Unequal Costs of Error – Estimation of Error Rates – Kernel and Window Estimator – Nearest Neighborhood Classification Techniques – Adaptive Decision Boundaries – Adaptive Discriminant Functions- Introduction to clustering:- Hierarchical clustering – Partitional clustering

Reference Books:

1. Fundamentals of Digital Image Processing, Anil K. Jain, PHI.
2. Pattern Recognition and Image Analysis, Earl Gose and Richard Johnsonbaugh Steve Jost, PHI.
4. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Addinson – Wesley.
5. Image Processing Theory Algorithms and Architecture, M. A. SID – AHMED, McGraw Hill Inc.

MCA 3E02 : ARTIFICIAL NEURAL NETWROK AND DEEP LEARNING

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction to Machine Learning: Concept of learning task, inductive learning and the concepts of hypothesis space, introduction to different types of machine learning approaches, examples of machine learning applications, different types of learning; supervised learning, unsupervised learning, reinforcement learning. Setting up your machine learning platform; training, validation and testing, over-fitting and under-fitting, different types of error calculation.

UNIT II

Supervised Learning: Introduction, learning a class from example, learning multiple classes, model selection and generalization, linear regression and feature selection, Bayesian and Decision Tree learning; classification tree and regression tree, multivariate methods for learning; multivariate classification and regression.

UNIT III

Unsupervised Learning: Introduction, clustering; mixture densities, k-means clustering, expectation maximization algorithm, mixture latent variable models, Latent Dirichlet Allocation, spectral and hierarchical clustering, Dimensionality reduction; principal component allocation, linear discriminant analysis, canonical correlation analysis.

UNIT IV

Introduction to Artificial Neural Network: Understanding brain, perceptron, Multi-Layer perceptron as universal approximator, general architecture of artificial neural network, feed forward and backpropagation, different linear and nonlinear activation functions for binary and multi class classification.

UNIT V

Introduction to Deep Learning: Fundamentals of deep learning, Deep Feedforward Networks, Regularization for Deep Learning, Optimization for Training Deep Models, Introduction to Convolutional Networks, Sequence Modelling using Recurrent Nets, overview of LSTM, fundamentals of Generative adversarial Network.

Reference books:

1. Ethem Alpaydin, Introduction to Machine Learning- 3rd Edition, PHI.
2. Tom M. Mitchell, Machine Learning, McGraw-Hill
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning), MIT Press, 2016.
4. Kuntal Ganguly, Learning Generative Adversarial Networks, Packt Publishing, 2017

MCA 4E03 : ADVANCED CONCEPTS IN IMAGE PROCESSING AND COMPUTER VISION

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Morphological Image Processing: Erosion and dilation, opening and closing, Hit-or-miss transformation, Morphological algorithms (Boundary extraction, Thinning, thickening, skeletons, pruning). **Image compression:** Fundamentals, Compression methods (Huffman, Arithmetic coding, LZW coding, run Length coding, Wavelet coding). Digital watermarking

UNIT II

Basics of medical image sources: Radiology- The electromagnetic spectrum-Computed Tomography-Magnetic Resonance Tomography–ultrasound-nuclear medicine and molecular imaging-other imaging techniques-radiation protection and dosimetry. **Medical image representation:** Pixels and voxels – algebraic image operations - gray scale and color representation- depth-color and look up tables - image file formats- DICOM- other formats- Analyze 7.5, NifTI and Interfile, Image equality and the signal to noise ratio

UNIT III

Steganography and digital watermarking: Principles of steganography and digital watermarking and their applications. Secret Sharing- Introduction, History of secret sharing, principle of secret splitting, phases of secret sharing, Access Structures, Threshold Schemes, Shamir's Scheme, Applications.

UNIT IV

Visual Cryptography- Introduction- History of Visual Cryptography, Construction of Visual Cryptography Schemes, basis matrices- Construction of 2-out-of-2 Visual Cryptography Schemes

UNIT V

Visual Cryptography schemes: Construction of 2-out-of-2 Visual Cryptography Schemes with Square Pixel Expansion, Construction of Visual Cryptography Schemes with Consistent Image Size. Visual Cryptography Schemes- Construction of 2-out-of-n Visual Cryptography Schemes, Basis Matrices for 2-out-of-n Visual Cryptography Schemes, Construction of n-out-of-n Visual Cryptography Schemes, Basis Matrices for n-out-of-n Visual Cryptography Schemes, Construction of k-out-of-n Visual Cryptography Schemes, Basis Matrices for k-out-of-n Visual Cryptography Schemes.

TEXT BOOKS:

1. Gonzalez and Woods, Digital Image Processing, 3rdEdn, Pearson. (UNIT I)

2. Wolfgang Birkfellner, „Applied Medical Image Processing – A Basic course", CRC Press, 2011. (UNIT II)

3. BorkoFurht, EdinMuharemagic and Daniel Socek, Multimedia Encryption and Watermarking, Springer (UNIT III)

4. Stelvio Cimato, Chung-Nung Yang – CRC Press 2012. (UNIT IV & UNIT V)

MCA 4 E04 : IMPLEMENTATION OF IMAGE PROCESSING AND COMPUTER VISION

Lecture: 1 hour **Practical: 2 hours** **Tutorial: 1 hour**

Note to faculty / BOE :
Assessment: CA shall be based on the list of experiments.
ESE shall be based on the case study report, presentation, demonstration and viva

UNIT I

Python for image processing- Functional Programming, JSON and XML in Python, NumPy with Python, Pandas, **OpenCV –** introducing OpenCV, installing OpenCV

UNIT II

Image Basics in OpenCV- Accessing and Manipulating pixels in OpenCV with BGR Images, Accessing and Manipulating pixels in OpenCV with gray scale images, BGR order in OpenCV,

UNIT III

Handling Files and Images- Reading and Writing Images- Different operations- Enhancement-segmentation-feature extraction- Neural Network Classifiers- Deep Learning tools in Python.

UNIT IV

List of Experiments

Sl.	Exp. No	Description
1	IMG1	Digital image conversion from RGB to gray, gray to binary
2	IMG2	Image Transformations
3	IMG 3	Image enhancement using histogram equalization
4	IMG 4	Sharpening and smoothing filters
5	IMG 5	Fourier Transform on images
6	IMG 6	Edge detection
7	IMG 7	Noise Analysis
8	IMG 8	Image Compression and Bit plane slicing
9	IMG 9	Morphological operations
10	IMG 10	Image Thresholding
11	IMG 11	Implementation of different image segmentation technique
12	IMG12	Implementation of different visual cryptographic thresholding schemes
		Case study

TEXT BOOK:

1. Alberto Fernandez Villan, Mastering OpenCV 4 with Python, Packt Publishing Ltd
2. Gonzalez and Woods, Digital Image Processing, 3rdEdn, Pearson.
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning), MIT Press, 2016.
4. Kuntal Ganguly, Learning Generative Adversarial Networks, Packt Publishing, 2017

STREAM- 6 : SOFTWARE ENGINEERING

MCA 2E01: OPERATION RESEARCH

Contact Hours/ week: 3 **Credit: 3**

UNIT 1

Linear programming: Formulation, Graphical Solution-2 variables, Development of Simplex Method, Artificial Variable Techniques, Big- M method, Two-Phase method, Reversed Simplex method.

UNIT II

Duality in LPP and it's formulation, Dual Simplex Method, Bounded variable method, Applications of LPP, Transportation problems, Assignment Problem, Traveling Sales persons problem.

Unit III

Integer Programming problem (IPP), Cutting Plane algorithm, Branch and bound method of solving IPP, Dynamic programming problems and it's characteristics, Deterministic Dynamic Programming Problem.

UNIT IV

Sequencing Problem, Processing n jobs through two machines and their mechanics, Processing n jobs through m machines, Processing 2 jobs through m machines, Project scheduling by PERT / CPM, Difference between PERT / CPM, Constructing the network, Critical path analysis, Float of an activity, Three time estimated for PERT, project cost by CPM.

UNIT V

Stochastic process, Classification of stochastic process, Discrete parameter Markov chains, Continuous Parameter Markov Chains, Birth and Death Processes, Queuing model and it's characteristics, Classification of Queuing Model (M/M/1): FCFS(birth and death model).

REFERENCE BOOKS

1. Thaha H.A.- Operation Research, 9THEdn, Pearson
2. Sharm J.K, Mathematical Models in Operation Research, TMGH, 1989.
3. Trivedi, . Probability, Statistics with Reliability, Queuing and Computer Science Applications, PHI
4. Winston, Operations Research Applications and Algorithms, 4thedn, CENGAGE, 2003

MCA 3E02: SOFTWARE ARCHITECTURE

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Software Architecture - Foundations - Software architecture in the context of the overall software life cycle – Key architectural Principles, Common Application Architecture, Design Principles, Architectural Styles - CASE study of Architectures Designing, Describing, and Using Software Architecture - IS2000: The Advanced Imaging Solution - Global Analysis – Factors affecting the architecture development of a software.

UNIT II

Conceptual Architecture View, Module Architecture View, Styles of the Module Viewtype - Execution Architecture View, Code Architecture - View. Component-and-Connector Viewtype - Styles of Component-and-Connector Viewtype - Allocation Viewtype and Styles – Documenting Software Interfaces, Documenting Behavior - Building the Documentation Package.

UNIT III

Archetypes and Archetype Patterns. Model Driven Architecture with Archetype Patterns. Literate Modelling, Archetype Pattern. , Customer Relationship Management (CRM) Archetype Pattern, Product Archetype Pattern, Quantity Archetype Pattern, Rule Archetype Pattern. Design Patterns, Creational Patterns, Patterns for Organization of Work, Access Control Patterns.

UNIT IV

Service Oriented Architecture, Service Variation Patterns, Service Extension Patterns, Object Management Patterns Adaptation Patterns, Communication Patterns, Architectural Patterns, Structural Patterns, Patterns for Distribution.

UNIT V

Patterns for Interactive Systems. Adaptable Systems, Frameworks and Patterns, Analysis Patterns, Patterns for Concurrent and Networked Objects, Patterns for Resource Management, Pattern Languages, Patterns for Distributed Computing.

REFERENCE BOOKS

1. Hofmeister, Nord, Soni, Applied Software Architecture, Addison-Wesley
2. Paul Clements et al., Documenting-software-architectures-views-and-beyond, 2ndedn, Pearson 3. Arlow&Neustadt, Enterprise Patterns And MDA-Building Better Software With Archetype Pattern An UML., Pearson, 2004
4. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Pattern-Oriented Software Architecture, Vol 1 - A System Of Patterns, Wiley.
5. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns, Pearson

MCA 4E03: SOFTWARE PROJECT MANAGEMENT

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Software Project and Characteristics, Project Constraints, Project Life Cycle and Process Life Cycle. Factors in Designing a Project Structure, Types of Project Organization Structures, Different Management Styles. Project Enabling Processes and Project Facilitating Processes. Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, Software Project Management activities, SPM Framework, Common problems with software projects.

UNIT II

Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Elements of a Project Plan.Steps to a Well-Defined Project Plan. Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Methods of representing WBS, Application of the WBS. Structure of a Software Project Management Plan.

UNIT III

Software project estimation, Software Effort estimation techniques. Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Activity Planning, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts. Project Schedule Management. Ways to Organize Personnel.

UNIT IV

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 V

Concept of Software Quality, Activities of Software: Quality Planning, Quality Assurance, Quality Control, Tools and techniques for Quality Control. Software Quality Attributes, Software Quality Indicators, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring

REFERENCE BOOKS:

1. Manish Kumar Jha, Software Project Management, DhanpatRai& Co
2. Bob Hughes, Mike Cotterell, Software Project Management, Rajib Mall : Tata McGraw Hill

MCA 4E04 : SOFTWARE TESTING AND QUALITY ASSURANCE

Contact Hours/ week: 3 **Credit: 3**

UNIT I

TESTIING ENVIRONMENT AND TEST PROCESSES World-Class Software Testing Model – Building a Software Testing Environment - Overview of Software Testing Process – Organizing for Testing – Developing the Test Plan – Verification Testing – Analyzing and Reporting Test Results – Acceptance Testing – Operational Testing – Post Implementation Analysis

UNIT II

TESTING TECHNIQUES AND LEVELS OFTESTING Using White Box Approach to Test design - Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs –Using Black Box Approaches to Test Case Design – Random Testing – Requirements based testing –Decision tables –State-based testing – Cause-effect graphing – Error guessing – Compatibility testing – Levels of Testing - Unit Testing - Integration Testing - Defect Bash Elimination. System Testing - Usability and Accessibility Testing – Configuration Testing - Compatibility Testing - Case study for White box testing and Black box testing techniques.

UNIT III

INCORPORATING SPECIALIZED TESTING RESPONSIBILITIES Testing Client/Server Systems – Rapid Application Development Testing – Testing in a Multiplatform Environment – Testing Software System Security - Testing Object-Oriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software – Testing a Data Warehouse - Case Study for Web Application Testing.

UNIT IV

TEST AUTOMATION Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.

UNIT V

SOFTWARE TESTING AND QUALITY METRICS Testing Software System Security - Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics. Test the software by applying testing techniques to deliver a product free from bugs

REFERENCES:

1. William Perry, "Effective Methods of Software Testing", Third Edition, Wiley Publishing 2007 2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2007.
3. Naresh Chauhan , "Software Testing Principles and Practices " Oxford University Press , New Delhi , 2010.
4. Dale H. Besterfiled et al., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).
5. Stephen Kan, "Metrics and Models in Software Quality", Addison – Wesley, Second Edition, 2004.
6. LleneBurnstein, " Practical Software Testing", Springer International Edition, Chennai, 2003
7. RenuRajani,Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill,2004.
8. Edward Kit, " Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
9. Boris Beizer, " Software Testing Techniques" – 2 nd Edition, Van Nostrand Reinhold, New York, 1990
10. Adithya P. Mathur, " Foundations of Software Testing – Fundamentals algorithms and techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

STREAM -7: CYBER FORENSIC

MCA 2 E01 FUNDAMENTALS OF CYBER SECURITY

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Security Fundamentals- 4As Architecture Authentication Authorization Accountability- Social Media, Social Networking and Cyber Security. **Cyber Laws-**IT Act 2000-IT Act 2008-Laws for Cyber-Security, Comprehensive National Cyber-Security Initiative CNCI – Legalities.

UNIT II

Cyber Attack and Cyber Services: Computer Virus – Computer Worms – Trojan horse. **Vulnerabilities** - Phishing - Online Attacks – Pharming - Phoarging – Cyber Attacks - Cyber Threats - Zombie- stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood.

UNIT III

Cyber Security Management: Risk Management and Assessment - Risk Management Process - Threat Determination Process -Risk Assessment - Risk Management Lifecycle. **Security Policy Management** - Security Policies - Coverage Matrix - Business Continuity Planning - **Disaster Types** - Disaster Recovery Plan - Business Continuity Planning Process.

UNIT IV

Vulnerability - Assessment and Tools: Vulnerability Testing - Penetration Testing Black box- white box Architectural Integration: Security Zones - Devices viz Routers, Firewalls, DMZ, Configuration Management - Certification and Accreditation for Cyber Security.

UNIT V

Authentication and Cryptography: Authentication - Cryptosystems - Certificate Services. **Securing Communications:** Securing Services - Transport – Wireless - Steganography and NTFS Data Streams.
Intrusion Detection and Prevention Systems: Intrusion - Defense in Depth - IDS/IPS -IDS/IPS Weakness and Forensic Analysis. **Cyber Evolution:** Cyber Organization - Cyber Future

Text Books:

Matt Bishop, "Introduction to Computer Security", Pearson, 6th impression, 2005

Reference Books:

Thomas R, Justin Peltier, John, "Information Security Fundamentals", Auerbach Publications.
AtulKahate, "Cryptography and Network Security", 2nd Edition, Tata McGrawHill.
Nina Godbole, SunitBelapure, "Cyber Security", Wiley India 1st Edition 2011.
Jennifer L. Bayuk and Jason Healey and Paul Rohmeyer and Marcus Sachs, "Cyber Security Policy Guidebook", Wiley; 1 edition , 2012
Dan Shoemaker and Wm. Arthur Conklin, "Cybersecurity: The Essential Body Of Knowledge", Delmar Cengage Learning; 1 edition (May 17, 2011) .
William Stallings, "Cryptography & Network Security - Principles & Practice", Prentice Hall, 3rd Edition, 2002.

MCA 3E02 : INFORMATION SECURITY

Contact Hours/ week: 3 **Credit: 3**

UNIT I

History, what is Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The Security SDLC. Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

UNIT II

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk,Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture.

UNIT III

Security Technology, IDS, Scanning and Analysis Tools. Cipher Principles, DES, Crypto analysis of DES, AES, Block Cipher Design Principles and Modes of Operation.

UNIT IV

Deffie Hellman Key Exchange, Key Management, Elliptic curve Cryptography, Confidentiality using Symmetric Encryption, Public Key Cryptography and RSA

UNIT V

Message Authentication Codes, Hash Functions, MD5, SHA. RIPEMD and HMAC Standards-Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME.

Textbooks:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Learning India 2011.
2. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 6 CRC Press LLC, 2012.
3. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", 7th Edition Tata McGraw-Hill, 2012.
4. William Stallings, "Cryptography and Network Security – Principles and Practices", 6th Edition, 2016.

Reference books:

1. AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2013.
2. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2015.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fifth Edition, Pearson Education, 2015.

MCA 4E03 : CYBER FORENSICS AND MALWARE DETECTION

Contact Hours/ week: 3 **Credit: 3**

UNIT I

Introduction to Cyber Forensics; Windows Forensics; Linux Forensics, Mac OS Forensics; Anti-forensics; Network Forensics; Mobile Forensics; Cloud Forensics

UNIT II

Malware Forensics; Web Attack Forensics; Emails and Email Crime, Bitcoin Forensics; Cyber Law and Cyberwarfare; Data Recovery & Data Analysis

UNIT III

Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types- viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.

UNIT IV

STATIC ANALYSIS:- Analyzing Windows programs, Anti-static analysis techniques- obfuscation, packing, metamorphism, polymorphism. **DYNAMIC ANALYSIS:-**Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques- anti-vm, runtime-evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching

UNIT V

Malware Functionality: Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection. **Malware Detection Techniques**: Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences

(Suggested Lab based Assignments for internal assessment)

1.	Set up a safe virtual environment to analyse malware
2.	Quickly extract network signatures and host-based indicators
3.	Overcome malware tricks like obfuscation, anti-disassembly, anti-debugging, and anti-virtual machine techniques
4.	Develop a methodology for unpacking malware and get practical experience with five of the most popular packers
5.	Install Reanimator in your Windows machine and scan the system for Malware and prepare one report for the same

Text Books:

1. Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations: Reddy, Niranjan, Published by Apress, Berkeley, CA, DOIhttps://doi.org/10.1007/978-1-4842-4460-9, Print ISBN 978-1-4842-4459-3, 2019
2. Practical malware analysis The Hands-On Guide to Dissecting Malicious Software by Michael Sikorski and Andrew Honig ISBN-10: 159327-290-1, ISBN-13: 978-1-59327-290-6, 2012 2

Reference Books:

1. Malware Detection A Complete Guide - 2019 Edition, Gerardus Blokdyk, Published by 5STARCooks, 2019, ISBN: 0655900845, 9780655900849

MCA 4E04: INTRUSION DETECTION AND INCIDENT RESPONSE

Contact Hours/ week: 3 **Credit: 3**

UNIT I
Introduction to computer incident, legal environment, Network security and attacks, basics of incident detection, parameters for assessment of intrusion detection, Intrusion detection system and Detection approaches, Misuse detection, anomaly detection, specification based detection, hybrid detection and statistics

UNIT II
Centralized, Distributed, Cooperative Intrusion Detection, Tiered architecture, Intrusion detection in security, Tool Selection and Acquisition Process, Bro Intrusion Detection, Prelude Intrusion Detection, Cisco Security IDS, Snorts Intrusion Detection, NFR security, Architecture models of IDs and IPs

UNIT III
Basics of Incident Response, Preparing for Incident Response, Live Data Collection, Preparation, Identification, Containment, Eradication, Recovery

UNIT IV
Introduction to legal evidence preparation for incident response, Forensics Duplication, Network Surveillance/Evidence, statistical Analysis

UNIT V
Investigating Windows, Investigating Unix, Malware Triage, ways of detecting residual after attacks

Case studies: various intrusion scenarios and their incident response and evidence gathering along with possible solutions.

Suggested Lab based Assignments for internal assessment:
1. Intrusion detection system and Detection approaches
2. Intrusion detection in security, Tool Selection and Acquisition Process
3. Preparing for Incident Response, Live Data Collection, Preparation, Identification
4. Forensics Duplication, Network Surveillance/Evidence, statistical Analysis
5. Any one intrusion scenarios and their incident response

Text Books:

1. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010
2. Luttgens, Jason T., Matthew Pepe, and Kevin Mandia. Incident response & computer forensics. McGraw-Hill Education, 2014

Reference Books:

1. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006
2. Casey, Eoghan. Digital evidence and computer crime: Forensic science, computers, and the internet. Academic press, 2011.

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