THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE – 632 115

DEPARTMENT OF COMPUTER SCINCE

MASTER OF SCIENCE IN COMPUTER SCIENCE

[Under Choice Based Credit System (CBCS)]

w.e.f the academic year 2022-2023

SYLLABUS AND REGULATIONS

FOR UNIVERSITY DEPARTMENT

THIRUVALLUVAR UNIVERSITY

MASTER OF SCIENCE DEGREE COURSE

M.Sc. Computer Science
under CBCS

REGULATIONS
CBCS PATTERN

with effect from 2022-2023

Definitions:

Programme :"Programme" means a course of study leading to the award of a degree in a discipline.

Course :"Course" refers to a paper / practical / subject offered under the degree programme. Each Course is to be designed variously under lectures / tutorials/ laboratory or field work / seminar / practical training / Assignments / Term paper or Report writing etc., to meet effective teaching and learning needs.

i. **Core Courses:**
"The Core Courses" related to the programme concerned including practical's offered in the programme".

ii. **Elective Courses:**
"Elective courses" related to the core courses of the programme concerned, offered in the programme".

A detailed explanation of the above with relevant credits are given under **"Scheme of Examination along with Distribution of Marks and Credits"**

Duration : This means the stipulated years of study to complete a programme as prescribed by the University from time to time. Currently for the postgraduate programme the duration of study is TWO years. These regulations shall apply to the regular course of study in approved institutions of the University.

Credits: The weightage given to each course of study (subject) by the experts of the Board of Studies concerned.

The term 'Credit' refers to the weightage given to a course, usually in relation to the instructional hours assigned to it. For instance, a six hour course per week is assigned 6/5/4 credits, a five hour course per week is assigned 5/4/3 credits and a four hour course per week is given 4/3/2 credits. However, in no instance the credits of a course can be greater than the hours allotted to it.

The total minimum credits, required for completing a PG program is 90.

Credit System **:** The course of study under this regulation, where weightage of credits are spread over to different semesters during the period of study and the Cumulative Grade Point Average shall be awarded based on the credits earned by the students. A total of 90 credits are prescribed for the Postgraduate Programme offered in two years.

Choice Based **:** All Postgraduate Programmes offered by the University shall be under Choice Based Credit System.

Choice Based Credit System (CBCS): This is to enhance the quality and mobility of the students within and between the Universities in the country and abroad.

1. Eligibility for Admission to the Course:

A candidate who have passed the B.Sc./ B.C.A Degree Examination in Computer Science of this University or an Examination of any other University with more than one major with Computer Science accepted by the Syndicate as equivalent thereto shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination of this University after a Course of two academic years in the University Department / Colleges affiliated to this University.

No student shall be eligible for admission to a Master's degree programme in any of the faculties unless he/she has successfully completed a three year undergraduate degree or earned prescribed number of credits for an undergraduate degree through the examinations conducted by a University / autonomous institution or possesses such qualifications recognized by the Thiruvalluvar University as equivalent to an undergraduate degree. Provided that candidates for admission into the specific main subject of study shall also possess **such other qualifyingconditions as may be prescribed by the University in the Regulations**governing respective courses of study.

2. Duration of the Course:

The course shall extend over a period of **two years comprising**of four semesters with two semesters in one academic year. There shall not be less than 90 working days for each semester. Examination shall be conducted at the end of every semester for the respective subjects.

Each semester have 90 working days consists of 5 teaching hours per working day. Thus, each semester has 450 teaching hours and the whole programme has 1800 teaching hours. The odd semesters shall consist of the period from July to November and the even semesters from December to April.

3. Course of Study:

The course of study for Masters Degree Course in Computer Science shall consist of Core, Electivesubjects and a Compulsory subject (Human Rights) and a Project in the fourth semester.

THIRUVALLUVAR UNIVERSITY
MASTER OF SCIENCE DEGREE COURSE
M.Sc. COMPUTER SCIENCE
UNDER CBCS
(With effect from 2022 – 2023)

The course of study and the scheme of Examination

	Study Components		*ins. hrs / week*	*Credit*	*Title of the Paper*	*Maximum Marks*		
	Course Title					*CIA*	*Uni. Exam*	*Total*
SEMESTER I								
1	Core	Paper - 1	4	4	Mathematical Foundations for Computer Science	25	75	100
2	Core	Paper – 2	4	4	Programming and Data Structures in C	25	75	100
3	Core	Paper - 3	4	4	Advanced Data Base Management Systems	25	75	100
4	Practical	Paper - 1	3	3	Data Structures Lab	25	75	100
5	Practical	Paper - 2	4	3	Operating System Lab	25	75	100
6	Practical	Paper - 3	3	2	Advanced DBMS Lab	25	75	100
7	Value Added course	Paper - 1	4	2	Advanced Operating System	25	75	100
Internal Elective for same major students (Choose any one)								
8	Core Elective	Paper-1	4	3	A. Embedded System B. Mobile and Pervasive Computing C. Software Project Management	25	75	100
			30	**25**				
SEMESTER II						*CIA*	*Uni. Exam*	*Total*
1	Core	Paper – 4	4	4	Design and Analysis of Algorithms	25	75	100
2	Core	Paper – 5	4	4	Advanced Computer Networks	25	75	100
3	Core	Paper – 6	4	4	Web Programming	25	75	100
4	Practical	Paper – 4	4	2	Design and Analysis of Algorithms Lab	25	75	100
5	Practical	Paper – 5	3	3	Computer Networks Lab	25	75	100
6	Practical	Paper – 6	3	2	Web Programming Lab	25	75	100
Internal Elective for same major students (Choose any one)								
7	Core Elective	Paper-2	4	3	A. Data Mining and Warehousing B. Block Chain Technologies C. XML and Web Services	25	75	100
External Elective for other major students (Inter/multi-disciplinary papers) (Choose any one)								
8	Open Elective	Paper-1	2	2	A. Web Programming B. Cloud Computing C. Graphics and Animations	25	75	100

9	Compulsory Paper		2	2	Human Rights	25	75	100
			30	**26**				

	Study Components		***ins. hrs / week***	***Credit***	***Title of the Paper***	***Maximum Marks***		
	Course Title					***CIA***	***Uni. Exam***	***Total***
SEMESTER III								
1	Core	Paper – 7	4	4	Theory of Computation	25	75	100
2	Core	Paper – 8	4	4	Internet of Things	25	75	100
3	Core	Paper – 9	4	4	Data Analytics and Machine Learning	25	75	100
4	Practical	Paper – 7	4	2	IoT Lab	25	75	100
5	Practical	Paper – 8	4	2	Mini Project	25	75	100
6	Practical	Paper – 9	4	2	Data Science Lab with Python and R	25	75	100
Internal Elective for same major students (Choose any one)								
8	**Core Elective**	Paper-3	4	3	A. Soft Computing B.Cryptography and Network Security C.Ethical Hacking and Cryptography	25	75	100
External Elective for other major students (Inter/multi-disciplinary papers) (Choose any one)								
9	Open Elective	Paper-2	2	2	A. Cloud Computing B. Graphics and Animations C. Software Quality Assurance	25	75	100
10	**MOOC Courses**		-	2		25	75	100
11	**USRR**		-	2		25	75	100
			30	**27**				
SEMESTER IV						***CIA***	***Uni. Exam***	***Total***
1	Core	Paper – 10	4	4	Advanced Computer Architecture	25	75	100
2	Core	Paper – 11	4	4	Mobile Application Development	25	75	100
Internal Elective for same major students (Choose any one)								
3	**Core Elective**	Paper-4	4	3	A. Wireless Sensor Network B. Mobile Operating System C. Digital Image Processing	25	75	100
1	**Core**	**Project Compulsory**	18	5	Project with *viva voce*	100 (75 Project +25 viva)		100
Internal Elective for same major students (Choose any one)								
			30	**16**				
			120	**94**				

Subject	Papers	Credit	Total Credits	Marks	Total marks
Core	11	4	44	100	1100
Core PRACTICAL	9	2-3	21	100	900
Core PROJECT	1	5	5	100	100
Core ELECTIVE	4	3	12	100	400
Open ELECTIVE	2	2	4	100	200
Value Added course	1	2	2	100	100
USRR	1	2	2	100	100
MOOC Courses	1	2	2	100	100
COMPULSORY PAPER (Human Rights)	1	2	2	100	100
Total	**31**	**-**	**94**	**-**	**3100**

5. Continuous Internal Assessment Test:

The following assessment procedure will be followed for awarding the internal marks in the evaluation of the student's performances. The best 2 CIA test marks out of 3 CIA tests marks, will be taken for awarding the internal marks.

(a) CIA Test Marks : 15 marks
(b) Seminar : 5 marks
(c) Assignment : 5 marks
Total : 25 marks

6. Requirement to appear for the examinations

a) A candidate shall be permitted to appear for the university examinations for any semester (theory as well as practical) if

i. He/she secures **not less than 75%** of attendance in theory as well as in practicals
ii. (separate attendance registers shall be maintained for theory and practical) in thenumber of working days during the semester.

iii. In the case of married woman candidates the minimum attendance requirement shallbe not less than 55% of the total instructional days in theory as well as in practical.

iv. His/her conduct shall be satisfactory. Provided that it shall be open to the Syndicate,or any authority delegated with such powers by the Syndicate, to grant exemption toa candidate who has failed to earn 75% of the attendance in theory as well as inpractical, prescribed, for valid reasons, subject to usual conditions.

b) A candidate who has secured less than **75% but 65%** and above attendance in any semester separately for theory and practical, shall be permitted to take the examination on the recommendations of the Head of the Department to condone the lack of attendance on the payment of prescribed fees to the University, separately for theory and practical.

c) A candidate who has secured **less than 65% but 55%** and above attendance in any semester in theory as well as in practical, has to compensate the shortage in attendance in thesubsequent semester (in the next year) besides earning the required percentage of attendance in that semester and appear for both semester papers together at the end of the later semester, on the payment of prescribed fees to the University, separately for theory and practical. However, shortage of attendance in I-semester shall be compensated while studying in III semester, shortage of attendance in II-semester shall be compensated while studying in IV semester, shortage of attendance in III&IV-semesters shall be compensated after rejoining the course in the 3rdyear. Also, separate attendance registers shall be maintained in theory as well as practical, for compensating the shortage of attendance. During the hours of compensation of attendance, the candidate shall not be given attendance for the regular semester classes.

d) A candidate who has secured **less than 55%** of attendance in any semester separately for theory and practical shall not be permitted to appear for the regular examinations in that particular semester or in subsequent semesters. He/she has to rejoin/ re-do the semester in which the attendance is less than 55%, on the payment of prescribed fees to the University, separately for theory and practical, after getting prior approval of the University.

e) A candidate who has secured **less than 65%** of attendance in the final semester separately for theory and practical, has to compensate his/her attendance shortage in a manner as decided by the concerned Head of the department, after getting prior approval of the University. The candidate shall be permitted to rejoin in the 4thsemester, after completing his/her regular 2 year course.

7. Scheme of Examination:

a. Any theory examination is conducted only for 3 hours irrespective of total marks allotted for the examinations.

b. There shall be theory examinations at the end of each semester, for odd semesters in themonth of October / November; for even semesters in April / May. However, there shall bepractical examinations at the end of even semesters in general, with exceptions in a fewcourses as prescribed by the Boards of studies, concerned. A candidate who does not passthe examination in any course(s) shall be permitted to appear in such failed course(s) in thesubsequent examinations to be held in October / November or April / May.

c. All candidates admitted in first year, should get registered for the first semesterexamination, compulsorily. If registration is not possible owing to any reason includingshortage of attendance beyond condonation limit, belated joining or on medical grounds,the candidates are permitted to rejoin the course in the next year.

8. Restrictions to appear for the examinations:

Any candidate having arrear paper(s) shall have the option to appear in any arrear paper along with the regular semester papers, in theory as well as in practical, as long as the transitory provision is applicable.

9. Medium of Instruction and Examinations:

The medium of instruction for the courses is English only.

10. Question Paper Pattern

The Question Paper Pattern for the University theory examinations is as follows:

Time: 3 Hours Maximum Marks: 75

Part – A (10 X 2 = 20 marks)
Answer ALL Questions

(Two Questions from each unit)

Part – B (5 X 5 = 25 marks)
Answer ALL Questions

(Two Questions from each unit with internal Choice [either or type])

Part – C (3 X 10 = 30 marks)
Answer any Three Questions out of Five Questions

(One Question from each unit)

11. Passing Minimum

a). A candidate shall be declared to have passed the whole examination, if the candidate passes in all the theory papers and practical wherever prescribed as per the scheme of examinations by earning 90 credits in Core and Elective courses, including practical.

b). A candidate should get **not less than 50% in the University (external)** Examination,compulsorily, in all papers, including practical. Also the candidate who **secures not less than 50%** marks in the external as well as internal (CIA) examinations put together in any paper / practical shall be declared to have successfully passed the examination in the subject in theory as well as practical. There shall be no passing minimum for the CIA. The candidate who absents himself for CIA programmes, even after a repeated chance, will be awarded zero mark in the concerned subject (zero to 25 for theory and zero to 40 for practical).

12. Distribution of Marks:

The following are the distribution of marks for external and internal for University (external) examination and continuous internal assessment and passing minimum marks for **theory papers of PG programmes.**

Table – 1(A)

The duration of University examination for theory and practical subjects shall be 3 hours. Themaximum mark for each theory is 100 with 25 for Continuous Internal Assessment (CIA) and 75 for University Examination.

CIA Theory Exam		
I	Two tests	15 Marks
II	Assignments	5 Marks
III	Seminar	5 Marks
	Total	**25 Marks**

The maximum marks for each practical is 100 with 25 for Internal Assessment and 75 for University Examination.

CIA Practical Exam		
I	One test	20 Marks
II	Records	5 Marks
	Total	**25 Marks**

Semester Practical Exam		
1.	Experiment I	25Marks
2	Experiment II	25 Marks
3.	Viva Voce	15 Marks
4.	Record	10
	Total	**75 Marks**

13. Grading:

Once the marks of the CIA and end-semester examinations for each of the course are available, they shall be added. The mark thus obtained shall then be converted to the relevant letter grade, grade point as per the details given below:

Conversion of Marks to Grade Points and Letter Grade (Performance in a Course/Paper)

Range of Marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Distinction
75-79	7.5-7.9	D	
70-74	7.0-7.4	A+	First Class
60-69	6.0-6.9	A	
50-59	5.0-5.9	B	Second Class
00-49	0.0-	U	Re-appear
Absent	0.0	AAA	ABSENT

Ci= Credits earned for course i in any semester
Gi = Grade Point obtained for course i in any semester
n = refers to the semester in which such course were credited

Grade point average (for a Semester):

Calculation of grade point average semester-wise and part-wise is as follows:

- **GRADE POINT AVERAGE [GPA] = ΣiCiGi / ΣiCi**

$$\text{GPA} = \frac{Sum\ of\ the\ multipication\ of\ grade\ points\ by\ the\ credits\ of\ the\ courses\ offered\ under\ each\ part}{Sum\ of\ the\ credits\ of\ the\ courses\ under\ each\ part\ in\ a\ semester}$$

Calculation of Grade Point Average (CGPA) (for the entire programme):

A candidate who has passed all the examinations prescribed is eligible for the following partwise computed final grades based on the range of CGPA.

CUMULATIVE GRADE POINT AVERAGE [CGPA] = ΣnΣiCniGni / ΣnΣiCni

$$\text{GPA} = \frac{Sum\ of\ the\ multipication\ of\ grade\ points\ by\ the\ credits\ of\ the\ courses\ offered\ under\ each\ part}{Sum\ of\ the\ credits\ of\ the\ courses\ under\ entire\ programe\ each\ part}$$

CGPA	GRADE
9.0 and above but below 10.0	O
8.0 and above but below 9.0	D+
7.5 and above but below 8.0	D
6.5 and above but below 7.5	A+
6.0 and above but below 6.5	A
5.0 and above but below 6.0	B
0.0 and above but below 5.0	U

14. Improvement of Marks in the subjects already passed:

Candidates desirous of improving the marks awarded in a passed subject in their first attemptshall reappear once within a period of subsequent two semesters by paying the fee prescribed from time to time. The improved marks shall be considered for classification but not for ranking. When there is no improvement, there shall not be any change in the original marks already awarded. If candidate improves his marks, then his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be counted for the award of Prizes / Medals, Rank and Distinction. If the Candidate does not show improvement in the marks, his previous marks will be taken into consideration.

❖ No candidate will be allowed to improve marks in the Practicals, Project, Viva-voce and Field work.

15. Classification of Successful candidates:

A candidate who passes all the examinations including practicals securing following CGPA and Grades shall be declared as follows for **Part I or Part II:**

CGPA	Grade	Classification of Final Result
9.0 and above but below 10.0	O	First Class - Outstanding
8.0 and above but below 9.0	D+	First Class with Distinction
7.5 and above but below 8.0	D	
6.5 and above but below 7.5	A+	First Class
6.0 and above but below 6.5	A	
5.0 and above but below 6.0	B	Second Class

a. A candidate who has passed all the examination including practicals in the first appearance within the prescribed duration of the PG programme and secured a CGPA of 9 to 10 and equivalent grade "O" in Core and Elective subjects shall be placed in the category of **"First Class – Outstanding"**.

b. A candidate who has passed all the examination including practicals in the first appearance within the prescribed duration of the PG programmes and secured a CGPA of

7.5 to 9 andequivalent grades “D” or “D+” in Core and Elective shall be placed in the category of**“First Class with Distinction”**.

c. A candidate who has passed all the examination including practicals of the PG programmeand secured a CGPA of 6 to 7.5 and equivalent grades “A” or “A+” shall be declared tohave passed that parts in **“First Class”**.

d. A candidate who has passed all the examination including practicals of the PG programmes and secured a CGPA of 5.5 to 6 and equivalent grade “B” shall be declared to have passedthose parts in **“Second Class”**.

16. Conferment of the Degree:

No candidate shall be eligible for conferment of the Degree unless the candidate;

i. has undergone the prescribed course of study for a period of not less than four semesters in Thiruvalluvar the University or has been exempted from in the manner prescribed and haspassed the examinations as have been prescribed therefor.

ii. has completed all the components prescribed under core and elective subjects in the CBCSpattern to earn 90 credits.

17. Ranking

- A candidate who qualifies for the PG degree course passing all the examinations in the firstattempt, within the minimum period prescribed for the course of study from the date ofadmission to the course and secures I or II class shall be eligible for ranking. In the case ofcandidates who pass all the examinations prescribed for the course with a break in the firstappearance due to the reasons as furnished in the Regulations 6(a) (iii)supra are eligible for classification / Distinction.

The marks obtained in improvement examinations shall not be taken into consideration for ranking.

18. Revision of Regulations and Curriculum

The above Regulation and Scheme of Examinations will be in vogue without any change for a minimum period of three years from the date of approval of the Regulations. The University may revise /amend/ change the Regulations and Scheme of Examinations, if found necessary.

Board of Studies in Computer Science

S. No	Name and Address	Designation
1	**Dr. R. Gunasekaran,** Professor and Head, Department of Computer Technology, MIT Campus, Chrompet, Anna University, Chennai 600 044. Office: 04422516230, 9962690099 Email: gunasekaran@mitindia.edu gunasekaran.mit@gmail.com	**Chairman**
2	**Dr.G.Rajesh,** Assistant Professor Department of Information Technology Anna University, MIT Campus Chrompet, Chennai – 600044 raajiimegce@gmail.com, Mobile: 9788856412	**Member**
3	**Dr. K. Kottilingam,** Associate Professor Department of Information Technology SRM Institute of Science and Technology Kanttankulathur, Chennai- 603202 Email: kottilingam.k@ktr.srmuniv.ac.in, k.kottilingam@gmail.com Mobile: 8939933099, 7358089612	**Member**
4	**Dr.P.Sivasankar,** Assistant Professor Department of Electronics Engineering National Institute of Technical Teachers Training and Research, Taramani, Chennai - 600 113 Email: siva_sankar123@rediffmail.com siva_sankar123@yahoo.com, Mobile: 8778904218	**Member**
5	**Dr.C.Chandrasekar** Professor, Department of Computer Science Periyar University, Salem- 636 011 Email: ccsekar@gmail.com, Mobile: 9994599967	**Member**
6	**Dr. M. Aramudhan,** Associate Professor & Head Department of Information Technology, PerunthalaivarKamarajar Institute of Engineering and Technology, Nedungadu, Karaikal-609603, 9976511124, aranagai@yahoo.co.in	**Member**

7	**Dr.S.Janakiraman** Associate Professor Department of Computer Science Pondicherry University, Pondicherry – 605014 Mobile No: +91 94433 76328 Email: jana3376@yahoo.co.in	**Member**
8	**Dr.D. Loganathan** Professor, Department of Computer Science and Engineering, Pondicherry Engineering College, Pondicherry- 605014, drloganathan@pec.edu Mobile: 9486018682	**Member**
9	**Dr. S. Sagayaraj,** Associate Professor and Head, Dept of Computer Science, Sacred Heart College (Autonomous), Tiruppattur-635 601, Vellore Dt. 9443035624, sagisara@gmail.com	**Member**
10	**Mr. SubashThyagarajan** Senior Consultant, Cognizant Solutions India Sholinganallur, Chennai Email: mailsubash@gmail.com Mobile: 9840569491	**Member**

THIRUVALLUVARUNIVERSITY

M.Sc. COMPUTER SCIENCE SYLLABUS

UNDER CBCS

(With effect from 2022-2023)

SEMESTER –I **MAIN PAPER-1** **5H/5C**

MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

OBJECTIVES

- To understand and apply the class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- To impart discrete knowledge in computer engineering through finite automata and Context free.
- To understand the concepts and operations of matrix algebra needed for computing graphics modelling grammars.

UNIT – I

Matrices, Rank of Matrix, Solving System of Equations-Eigen Values and Eigen Vectors-Inverse of a Matrix - Cayley Hamilton Theorem

UNIT – II

Basic Definitions - Venn Diagrams and set operations - Laws of set theory - Principle of inclusion and exclusion - partitions- Permutation and Combination - Relations- Properties of relations - Matrices of relations - Closure operations on relations - Functions - injective, subjective and objective functions.

UNIT – III

Propositions and logical operators - Truth table - Propositions generated by a set, Equivalence and implication - Basic laws- Some more connectives - Functionally complete set of connectives- Normal forms - Proofs in Propositional calculus - Predicate calculus.

UNIT – IV

Languages and Grammars-Phrase Structure Grammar-Classification of Grammars-Pumping Lemma for Regular Languages-Context Free Languages.

UNIT – V

Finite State Automata-Deterministic Finite State Automata(DFA), Non Deterministic Finite State Automata (NFA)-Equivalence of DFA and NFA-Equivalence of NFA and Regular Languages.

REFERENCES

1. Hopcroft and Ullman, “Introduction to Automata theory, Languages and Computation”, Narosa publishing House, Delhi, 2002.
2. A.M. Natarajan, P. BalaSubaramani, A. Tamilarasi, “Operations Research” Pearson education, Asia, 2005.
3. PremKumar$_{rd}$ Gupta, D.S Hira, “Operation Research” S.Chand Company Ltd, New Delhi, 3 edition, 2003.
4. A.Tamilarasi, A.M.Natarajan, “Discrete Mathematics and its Application”, Khanna Publishers, 2nd edition, 2005.

5. Hamdy A. Taha, “Operation Research - An Introduction”, Pearson Edun., 2004.E – Learning source: ttp://www2.math.umd.edu/~jmr/241/calc.htm

SEMESTER –I **MAIN PAPER -2** **4H/3C**

PROGRAMMING AND DATA STRUCTURES IN C

OBJECTIVES

- Learning program independent view of data structures, including its representation and operations performed on them, which are then linked to sorting, searching and indexing methods to increase the knowledge of usage of data structures in algorithmic perspective.

UNIT-I

Abstract Data Types - Asymptotic Notations: Big-Oh, Omega and Theta – Best, Worst and Average case Analysis: Definition and an example – Arrays and its representations – Stacks and Queues – Linked lists – Linked list based implementation of Stacks and Queues –Evaluation of Expressions – Linked list based polynomial addition.

UNIT-II

Trees – Binary Trees – Binary tree representation and traversals – Threaded binary trees –Binary tree representation of trees – Application of trees: Set representation and Union-Find operations – Graph and its representations – Graph Traversals – Connected components.

UNIT-III

AVL Trees – Red-Black Trees – Splay Trees – Binary Heap – Leftist Heap

UNIT–IV

Insertion sort – Merge sort – Quick sort – Heap sort – Sorting with disks – k-way merging – Sorting with tapes – Polyphase merge.

UNIT-V

Linear Search – Binary Search - Hash tables – Overflow handling – Cylinder Surface Indexing– Hash Index – B-Tree Indexing.

TEXT BOOK

1. Ellis Horowitz and SartajSahni, Fundamentals of Data Structures, Galgotia Book Sorce, Gurgaon, 1993.
2. Gregory L. Heilman, Data Structures, Algorithms and Object Oriented Programming, Tata Mcgraw-Hill, New Delhi, 2002.

REFERENCES

1.Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, New Delhi, 1991.

2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.

ADVANCED DATABASE MANAGEMENT SYSTEMS

UNIT-I

Review of relational database – FDs Implication-Closure- Database System Architectures: Centralized and Client-Server Architectures- Design of Parallel Systems-Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

UNIT-II

3NF and BCNF, 4NF and 5NF-Decomposition and synthesis approaches- Basics of query processing-External sorting-file scans

UNIT-III

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems:

UNIT-IV

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2) - Taxonomy-Applications-Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases-TSQL2- Deductive Databases-RAID

UNIT-V

Basic Principles- Tuning the Guts- Index Tuning - Tuning Relational Systems-Transaction chopping

TEXT BOOKS

1. RamezElmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems, Sixth Edition , Pearson, 2011.
2. Thomas Cannolly and Carolyn Begg, ―Database Systems, A Practical Approach to Design, Implementation and Management, Fourth Edition, Pearson Education, 2008.
3. Database Tuning: Principles, Experiments, and Troubleshooting Techniques by Dennis Shasha and Philippe Bonnet

REFERENCES

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, ―Database System Concepts, Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, ―Advanced Database Systems, Morgan Kaufmann publishers,2006.

SEMESTER –I **VALUE ADDED COURCE – 1** **4H/3C**
(To choose either A or B or C)

ADVANCED OPERATING SYSTEMS

OBJECTIVES:

- To understand the concepts of distributed systems
- To get an insight into the various issues and solutions in distributed operating systems To learn about mobile and real-time operating systems
- To gain knowledge on the design concepts of mainframe operating systems

UNIT - I

BASICS OF OPERATING SYSTEMS : Overview – Synchronization Mechanisms – Processes and Threads – Process Deadlocks – Issues in Distributed Operating Systems – Communication Primitives – Limitations of a Distributed System

UNIT - II

DISTRIBUTED OPERATING SYSTEMS: Lamport‟s Logical Clocks – Vector Clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized, Distributed and Hierarchical Deadlock Detection Algorithms – Agreement Protocols

UNIT - III

DISTRIBUTED RESOURCE MANAGEMENT: Distributed File Systems – Design Issues – Google File System – Hadoop Distributed File System – Distributed Shared Memory – Algorithms for Implementing Distributed Shared Memory – Load Distributed Algorithms – Issues in Task Migration – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol

UNIT IV

MOBILE AND REAL TIME OPERATING SYSTEMS: Basic Model of Real Time Systems – Characteristics – Applications of Real Time Systems – Real Time Task Scheduling – Handling Resource Sharing. Mobile Operating Systems – Architecture – Layers – Microkernel Design – Kernel Extensions – Processes and Threads – Memory Management – File system – Android – iOS

UNIT - V

MAINFRAME AND LINUX OPERATING SYSTEMS: Mainframe – z/OS – Overview of z/OS Facilities – Virtual Storage and other Mainframe Concepts – Workload Management – I/O and Data Management – Supervising the Execution of Work in the System – Cross-memory Services – Characteristics of z/OS. Linux – Design Principles – Kernel Modules – Process Management – Scheduling – Memory Management – I/O Management – File System – Inter-process Communication

TEXT BOOKS

1. MukeshSinghal, NiranjanShivaratri, “Advanced Concepts in Operating Systems – Distributed, Database and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.
2. Rajib Mall, “Real-Time Systems: Theory and Practice”, Prentice Hall, 2006.

REFERENCES

1. Neil Smyth, “iPhone iOS 4 Development Essentials – Xcode”, Payload Media, Fourth Edition,2011.[18]
2. NikolayElenkov, “Android Security Internals: An In-Depth Guide to Android‟s Security Architecture”, No Starch Press, 2014.
3. Jonathan Levin, “Mac OS X and iOS Internals: To the Apple‟s Core”, John Wiley & Sons, 2012.
4. Andrew S. Tanenbaum and Herbert Bos, “Modern Operating Systems”, Fourth Edition, Prentice Hall, 2014.
5. Mike Ebbers, John Kettner, Wayne O‟Brien, Bill Ogden, “Introduction to the New Mainframe: z/OS Basics”, Third Edition, International Business Machines Corporation, 2011.
6. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley, Eighth edition, 2008.

SEMESTER –I **ELECTIVE PAPER - 1** **4H/3C**
(To choose either A or B or C)

A. EMBEDDED SYSTEM

OBJECTIVE:

- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

UNIT – I

INTRODUCTION Introduction to Embedded system - Embedded system vs General computing systems - History - Classification - Major Application AreasPurpose of Embedded systems - Smart running shoes: The innovative bonding of lifestyle with embedded technology. Characteristics and Quality Attributes of Embedded systems

UNIT – II

EMBEDDED SYSTEM Elements of an Embedded system - core of the embedded system: General purpose and domain specific processors, ASICs, PLDs, COTS Memory - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces - Embedded Firmware - Reset circuit, Brown-out protection circuit, Oscillator unit, Real-time clock, and Watchdog timer - PCB and Passive Components

UNIT – III

APPLICATIONS Embedded Systems- Washing machine: Application-specific - Automotive: Domain specific.Hardware Software Co-Design - Computational Models - Embedded Firmware Design Approaches - Embedded Firmware Development Languages - Integration and testing of Embedded Hardware and firmware.

UNIT – IV

DESIGNS RTOS based Embedded System Design: Operating System Basics - Types of operating Systems - Tasks, process and Threads - Multiprocessing and Multitasking - Task Scheduling- Task Communication - Task Synchronisation - Device Drivers - choosing an RTOS.

UNIT – V

COMPONENTS Components in embedded system development environment, Files generated during compilation, simulators, emulators and debugging - Objectives of Embedded product Development Life Cycle – Different Phases of EDLC - EDLC Approaches - Trends in Embedded Industry - Case Study: Digital Clock.

TEXT BOOK:

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

REFERENCE BOOKS:

1. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, TMH. Second Edition 2009

2. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley. Third Edition 2006
3. Cliff Young, Faraboschi Paolo, and Joseph A. Fisher, "Embedded Computing: A VLIW Approach to Architecture, Compilers and Tools", Morgan Kaufmann Publishers, An imprint of Elsevier, 2005.
4. David E. Simon, “An Embedded Software Primer” Pearson Education, 1999

SEMESTER –I **ELECTIVE PAPER -1** **4H/3C**
(To choose either A or B or C)

B. MOBILE AND PERVASIVE COMPUTING

OBJECTIVES:

- To enable the students to describe the concepts related to mobile and pervasive computing and to apply these concepts on the web applications.

UNIT - I

Technologies: Past, Present, Future: The Vine and fig tree dream – Pervasive Computing – The pervasive computing market – m-Business. Application Examples: Retail – Airline check-in and booking – Sales force automation – Healthcare – Tracking – Car Information systems – Email access via WAP and Voice.

UNIT - II

Device Technology: Hardware – Human-machine interfaces – Biometrics – Operating systems – Java for Pervasive devices – Outlook.

UNIT - II

Device Connectivity: Protocols – Security – Device management. Web Application concepts: History of the World Wide Web – World Wide Web architecture – Protocols – Transcoding – Client authentication via the internet.

UNIT - IV

WAP and beyond: Introduction – Components of the WAP architecture – WAP infrastructure – WAP security issues – Wireless Markup Language – WAP push – Products – i-mode – Outlook. Voice Technology: Basics of speech recognition – Voice standards – Speech applications – Speech and pervasive computing – Security.

UNIT - V

Pervasive Web application architecture: Background – Scalability and availability – Development of pervasive computing Web applications – Pervasive application architecture

REFERENCE BOOKS:

1. Pervasive Computing, Technology & Architecture of Mobile Internet Applications – Jochen Burkhardt, Horst Hennet. al – Pearsan – 11th Edition 2012.
2. Mobile Computing – Raj Kamal – Oxford University Press – Second Edition 2012.
3. Mobile Computing – Asoke K Taluhdar, Roopa R Yavagal – Tata McGrawHill Publication – 2011

C. SOFTWARE PROJECT MANGEMENT

OBJECTIVES:

- To outline the basic concepts of Software Project Management
- To highlight techniques for software cost estimation and activity planning.

UNIT I

Introduction to Software project management: Importance of Software Project Management- Software projects vs other projects–Activities - Plans, methods and Methodologies – Categorization of Software Projects – Stakeholders - Setting objectives – Management Principles – Management Control – Project portfolio Management- Evaluation individual projects – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II

Choosing methodologies and technologies- Software process and Process Models – Choice of Process models – incremental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II A Parametric Productivity Model – Staffing Pattern.

UNIT III

Activity planning: Objectives of Activity planning – Project schedules – project and Activities– Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method –Activity float- short the project duration – identifying critical activities – activity on –arrow networks Risk identification – Assessment – Planning - Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control Software Configuration Management – Managing contracts.

UNIT V

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams –Coordination dependencies – Communications genres – Communication plans.

TEXTBOOK

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES

1. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 7th Edition 2014.
2. Walker Royce: ―Software Project Management - Addison-Wesley, 5th Edition, 2013.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

DATA STRUCTURES LAB

1. Array based implementation of stack and queue.
2. Linked list implementations and problems related to linked list such as inverting list, concatenation, etc.
3. Linked list based implementation of stack and queue
4. Evaluation of expressions
5. Binary tree traversals
6. Graph traversals
7. Merge sort
8. Quick sort
9. Binary search
10. Binary Heap
11. AVL tree implementation
12. Hash Tables

OPERATING SYSTEMS LAB

OBJECTIVE: To develop programming skills in operating systems and their applications.

COURSE OUTCOMES: The Students will be able to.

- Have basic knowledge on UNIX Commands.
- Write Shell Programming and apply control structure. Programs on process creation and synchronization.
- Implement deadlock avoidance, and Detection Algorithms.
- Compare the performance of various CPU Scheduling Algorithms.
- Critically analyze the performance of the various page replacement algorithms Create processes and implement IPC

LIST OF EXPERIMENTS

1. Implement Process Management
2. Implement Shared memory and IPC.
3. Implement Threading Applications.
4. Implement Synchronization Applications using Semaphores.
5. Implement the following CPU scheduling algorithms
    a) Round Robin b) SJF c) FCFS d) Priority.
6. Implement an Algorithm for Dead Lock Avoidance.
7. Implement an Algorithm for Dead Lock Detection.
8. Implement all page replacement algorithms
    a) FIFO b) LRU c) LFU
9. Implement all file allocation strategies
    a) Sequential b) Indexed c) Linked.
10. Implement Virtualization Concepts.

SEMESTER –I **MAIN PRATICAL PAPER- 3** **3H/2C**

ADVANCED DATABASE MANAGEMENT SYSTEMS LAB

1. Introduction to DDL and DML
2. Views and Sub Queries
3. Using Group functions
4. Creating Object Tables and Types
5. Working with Database administration comments
6. Multiple Inheritances using object types
7. Study experiments on Mobile databases
8. Experiments on Normalization using Database tuning concepts
9. Installation of Mobile databases in Android Environment
10. Developing simple android apps using mobile databases

DESIGN AND ANALYSIS OF ALGORITHMS

OBJECTIVES

- Apply the algorithms and design techniques to solve problems
- Analyze the complexities of various problems in different domains. Analyze the performance of various algorithms.

UNIT-I

Introduction – Notion of Algorithm - Fundamentals of algorithmic problem solving – Important problem types – Fundamentals of the analysis of algorithm efficiency – analysis frame work – Asymptotic Notations and Basic Efficiency Classes-Mathematical analysis of non-recursive Algorithms – Non-recursive solution to the Matrix Multiplication - Mathematical analysis of recursive algorithms – Recursive solution to the Tower of Hanoi Puzzle.

UNIT-II

Divide and conquer Technique – Multiplication of large integers – Strassen's matrix multiplication – Closest pair and Convex Hull Problems - Greedy method – Prim's algorithm – Kruskal's algorithm – Dijkstra's algorithm.

UNIT-III

Dynamic Programming - Computing a binomial coefficient – Warshall's and Floyd' Algorithm – Application of Warshall's Algorithm to the digraph – Flyd's Algorithm for the all pairs shortest paths Problem - The Knapsack problem and Memory function

UNIT-IV

Backtracking – N-Queens problem – Hamiltonian circuit problem – Subset sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem.

UNIT-V

P, NP and NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem – Knapsack problem.

TEXTBOOK

1. AnanyLevitin "Introduction to the Design and Analysis of Algorithms" Pearson Education 2009.

REFERENCES

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, "Introduction to algorithms", Prentice Hall 1990.
2. S.K. Basu, "Design methods and Analysis of Algorithms", Prentice Hall, 2005.

SEMESTER –II **MAIN PAPER- 5** **4H/4C**

ADVANCED COMPUTER NETWORKS

UNIT-1

Data communications-components – Data Representation- Network types-LAN, WAN,MAN, WLAN- Internet History- Network Models- ISO –OSI model – TCP/IP model- Network requirements- Applications- Internet standards.

UNIT-2

Data and signals- Data rate limits- network performance- Multiplexing- FDM, TDM and WDM-Spread spectrum- FHSS-DSSS- Guided and un guided media- Switching-Error detection and correction- Medium access control.

UNIT-3

Network layer services- IPv4- IPv6- Fragmentation and reassembly- ICMPv6 – sub netting-Routing basics - Distance vector Routing- Link state routing- Path vector routing- RIP-OSPF-BGP-multicast routing- DVMRP-MOSPF.

UNIT-4

Connection oriented and connection less services- UDP services and applications – TCP services and operations-TCP connection management- TCP state transition diagram- congestion control-stop and wait- Go-Back-N Protocol (GBN)- Selective-Repeat Protocol.

UNIT-5

World Wide Web- HyperText Transfer Protocol (HTTP)- FTP- DNS- SMTP- Email services(SMTP, POP,IMAP, MIME)- DHCP- Telnet.

TEXT BOOK

1. Behrouz A. Forouzan, “Data communication and Networking”, Fift Edition, Tata McGraw – Hill,2013

2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011

3. James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, sixth Edition, Pearson Education, 2012

SEMESTER –II **MAIN PAPER- 6** **4H/4C**

WEB PROGRAMMING

OBJECTIVES

- To learn designing webpage using HTML & CSS
- To understand the concept of Database and Server side scripting language
- To understand the need of AJAX and developing applications using AJAX controls

UNIT – I

Web Technologies – HTML - Structure of a Page – Dynamic and Static Pages – Basic Document Structure – Attribute Groups – Text Formatting – Presentational, Phrase Elements – Lists - Editing Text - Character Entities for Special Characters – Links and Navigation - Links – Directories and Directory Structures – Creating Links– Colors, Images and Objects – Using Images as Links – Tables – Basic Table Elements and Attributes –Advanced Tables – Accessibility issues with Tables.

UNIT - II

Forms – Form Controls – Label - structuring forms – Focus- Frames – The Frameset, Frame No-frames elements – Creating Links between Frames – Nested Framesets- Depreciated and Browser Specific Markup – Fonts- Backgrounds – Formatting – Links – Lists – Tables- Miscellaneous Attributes – Cascading Style Sheets – CSS – CSS properties –Text Formatting – Text Pseudo-Classes – Selectors – Lengths - Percentages – More CSS – Backgrounds – Lists – Tables - Outlines- Positioning with CSS – Page Layout – Design Issues.

UNIT - III

Accessing PHP - Creating a Sample Application - Embedding PHP in HTML - Adding Dynamic Content -Accessing Form Variables - Understanding Identifiers - Examining Variable Types - Declaring and Using Constants - Understanding Variable Scope - Using Operators - Understanding Precedence and Associativity - Using Variable Functions - Making Decisions with Conditionals - Repeating Actions Through Iteration. PHP validations - Accessing MySQL Database from the Web with PHP.

UNIT - IV

Introduction to MY SQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.

UNIT - V

PHP with AJAX: Introducing Ajax-Ajax Basics-PHP and Ajax-Database Driven Ajax. PHP with SEO: Basic SEO-Provocative SE Friendly URLs-Duplicate Content- CMS: Wordpress Creatingan SE-Friendly Blog

TEXT BOOKS

1. Jon Ducket, “Web Programming with HTML, CSS & JavaScript”, Wiley Publishing, 2005.
2. Luke Welling, Laura Thomson “PHP and MySQL Web Development” Pearson Education Inc., Fourth Edition, 2008
3. JaimieSirovich and CristianDarie, “Professional Search Engine Optimization with PHP A Developer’s Guide to SEO”, Wiley Publishing, Inc., Indianapolis, Indiana ,2007
4. James Lee and Brent Ware, "Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", James Lee and Brent Ware, Dorling Kindersley(India) Pvt. Ltd, 2008
5. Lee Babin, “Beginning Ajax with PHP From Novice to Professional”, Apress, 2007

REFERENCES

1. Eric Rosebrock, Eric Filson, "Setting up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons,2004

SEMESTER –II **ELECTIVE PAPER- 2** **4H/3C**
(To choose either A or B or C)

A. DATA MINING AND WAREHOUSING

OBJECTIVES

- To expose the students to the concepts of Data warehousing Architecture and Implementation
- To Understand Data mining principles and techniques and Introduce DM as a cutting edge business intelligence
- To study the overview of application areas – Web mining, Text mining
- To identify Business applications and Trends of Data mining

UNIT I

Data warehouse: Roles and Structures - Data stores - Data warehouse – Marts - Data warehouse characteristics - Three-tier Data warehouse Architecture – Metadata - Metadata extraction - Query tools and Applications - Online Analytical Processing (OLAP) - Online Transaction Processing (OLTP). OLAP operations. Data warehouse schemas.

UNIT II

Data Mining:- Basic Tasks - Data Mining Functionalities - Data Mining Vs Knowledge Discovery and Databases - Data Processing - Data Cleaning - Data Integration and Transformation - Data Reduction - Data Discretization and Concept Hierarchy Generation.

UNIT III

Classification and Prediction:- Issues Regarding Classification and Prediction - Classification by Decision Tree Introduction - Bayesian Classification- Rule Based Classification - Classification by Back Propagation - Support Vector Machines.

Cluster Analysis:- Types of Data in Cluster Analysis - K-means clustering - Partitioning Methods - Hierarchical Methods - Density-Based Methods - Grid-Based Methods - Outlier Analysis.

UNIT IV

Association Rule Mining:- Introduction - Basic Algorithms - Apriori Algorithm - Efficient and Scalable Frequent Item Set Mining Methods - Mining Various Kinds of Association Rules - Association Mining to Correlation Analysis.

UNIT V

Spatial Data Mining: Spatial Data Overview - Spatial Data Mining Primitives - Generalization and Specialization –Temporal Mining: Introduction-Time series - Pattern detection - Temporal association rules.

TEXT BOOK

1. Jiawei Han, MichelineKamber and Jian Pei “Data Mining Concepts and Techniques”, Third Edition, Elsevier, Reprinted 2011.

REFERENCES

1. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw-Hill Edition, Tenth Reprint 2007.
2. K.P. Soman, ShyamDiwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
3. G.K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2007.

B. BLOCK CHAIN TECHNOLOGIES

OBJECTIVES

- To impart knowledge about Block Chain and its usages in projects
- To impart knowledge about Crypto currencies and implementation

UNIT - I

Block Chain - Introduction to crypto economics - Byzantine agreement - Extensions of BFT (Ripple, Stellar) - Blockchain Dynamics - Public and private blockchains - Hard and soft forks - Sharding Side chain - Verifiers – trust, cost and speed - Proof of work and other models.

UNIT- II

Smart Contracts - Distributed Virtual Machines, Smart Contracts, Oracles - Basics of contract law - Smartcontracts and their potential Trust in Algorithms, - Integration with existing legal systems - OpenZeplin, OpenLaw- Writing smart contracts.

UNIT - III

Cryptography and Other Technologies: Application of Cryptography to Blockchain - Using hash functions to chain blocks - Digital Signatures to sign transactions - Using hash functions for Proof-of-Work. - Putting the technology together – examples of implementations with their tradeoffs.

UNIT - IV

Implementation: Supply Chain and Identity on Blockchain - Blockchain interaction with existing infrastructure – Trust in blockchain data - Scaling Blockchain – reading and writing data. Differentiate nodes, sparse data and Merkle trees - Fixing on the fly – Layer 2 solutions - Lightning and Ethereum state channels

UNIT - V

Bitcoin - The big picture of the industry – size, growth, structure, players - Bitcoin versus Crypto-currencies versus Blockchain - Distributed Ledger Technology (DLT) - Strategic analysis of the space –Major players: Blockchain platforms, regulators, application providers, etc. - Bitcoin, HyperLedger, Ethereum, Litecoin, Zcash .

TEXT BOOKS

1. Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World, Don Tapscott and Alex Tapscott, Portfolio, 2018

REFERENCES

1. The Age of Cryptocurrency: How Bitcoin and the Blockchain Are Challenging the Global Economic Order, Paul Vigna and Michael J. Casey, Picador. 2016
2. Blockchain Technology Explained: The Ultimate Beginner's Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA And Smart Contracts, Alan T. Norman, CreateSpace Independent Publishing Platform, 2017

SEMESTER –II **ELECTIVE PAPAER- 2** **4H/3C**
(To choose either A or B or C)

C. XML AND WEB SERVICES

OBJECTIVES

- To examine fundamental XML technology
- To gain an understanding about the role of web services in commercial applications
- To learn the emerging standard protocols: SOAP, WSDL and UDDI.

UNIT - I

XML – benefits – Advantages of XML over HTML, EDI, Databases – XML based standards – DTD – XML Schemas – X-Files – XML processing – DOM – SAX – presentation technologies– XSL – XHTML – voiceXML – Transformation – XSLT – XLINK – XPATH.

UNIT - II

Introduction to JSON – JSON Comparison with XML – JSON syntax, Datatypes, Objects – Examples – JSON Schema: Hello World! – The type Keyword – Declaring a JSON schema – JSON schema reference: Type specific keywords – Generic Keywords – Combining schemas – The $schema Keyword – Regular Expression – Structuring a complex schema: Reuse.

UNIT - III

Business motivations for web services – B2B – B2C – Technical motivations – limitations of CORBA and DCOM – Service-oriented Architecture (SOA) – Architecting web services – Implementation view – web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer – process view – life in the runtime.

UNIT – IV

Introduction to SOAP – Basic SOAP syntax – Sending SOAP messages – Future of SOAP – Introduction to WSDL – Basic WSDL syntax- SOAP binding – Introduction of UDDI – UDDI API – Future of UDDI.

UNIT - V

Business to Business – Business to Customer – Different types of B2B Interaction – Components of E-business XML Systems – Enterprise Integration – ebXML – RosettaNet – Introduction of Web Content Management – Components of Content Management System – Role of XML in Web Content Management – Role of metadata (RDF and PRISM) in Web Content Management.

TEXT BOOKS

1. Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2002.
2. MichealDroettboom, “Understanding JSON Schema Release 1.0”, 2013.

REFERENCES

1. Ethan Cerami, “Web Services Essentials”, O’Reilly, Shroff Publishers & Distributors Pvt.Ltd, Fourth Edition, 2002
2. SandeepChatterjee and James Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Prentice Hall Edition, 2004.

SEMESTER –II **OPENELECTIVE PAPER- 1** **2H/2C**
(To choose either A or B or C)

A. WEB PROGRAMMING

OBJECTIVES

- To learn designing webpage using HTML & CSS
- To understand the concept of Database and Server side scripting language
- To understand the need of AJAX and developing applications using AJAX controls

UNIT – I

Web Technologies – HTML - Structure of a Page – Dynamic and Static Pages – Basic Document Structure – Attribute Groups – Text Formatting – Presentational, Phrase Elements – Lists - Editing Text - Character Entities for Special Characters – Links and Navigation - Links – Directories and Directory Structures – Creating Links– Colors, Images and Objects – Using Images as Links – Tables – Basic Table Elements and Attributes –Advanced Tables – Accessibility issues with Tables.

UNIT - II

Forms – Form Controls – Label - structuring forms – Focus- Frames – The Frameset, Frame No-frames elements – Creating Links between Frames – Nested Framesets- Depreciated and Browser Specific Markup – Fonts- Backgrounds – Formatting – Links – Lists – Tables- Miscellaneous Attributes – Cascading Style Sheets – CSS – CSS properties –Text Formatting – Text Pseudo-Classes – Selectors – Lengths - Percentages – More CSS – Backgrounds – Lists – Tables - Outlines- Positioning with CSS – Page Layout – Design Issues.

UNIT - III

Accessing PHP - Creating a Sample Application - Embedding PHP in HTML - Adding Dynamic Content -Accessing Form Variables - Understanding Identifiers - Examining Variable Types - Declaring and Using Constants - Understanding Variable Scope - Using Operators - Understanding Precedence and Associativity - Using Variable Functions - Making Decisions with Conditionals - Repeating Actions Through Iteration. PHP validations - Accessing MySQL Database from the Web with PHP.

UNIT - IV

Introduction to MY SQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.

UNIT - V

PHP with AJAX: Introducing Ajax-Ajax Basics-PHP and Ajax-Database Driven Ajax. PHP with SEO: Basic SEO-Provocative SE Friendly URLs-Duplicate Content- CMS: Wordpress Creatingan SE-Friendly Blog

TEXT BOOKS

1. Jon Ducket, “Web Programming with HTML, CSS & JavaScript”, Wiley Publishing, 2005.
2. Luke Welling, Laura Thomson “PHP and MySQL Web Development” Pearson Education Inc., Fourth Edition, 2008
3. JaimieSirovich and CristianDarie, “Professional Search Engine Optimization with PHP A Developer’s Guide to SEO”, Wiley Publishing, Inc., Indianapolis, Indiana ,2007
4. James Lee and Brent Ware, "Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", James Lee and Brent Ware, Dorling Kindersley(India) Pvt. Ltd, 2008
5. Lee Babin, “Beginning Ajax with PHP From Novice to Professional”, Apress, 2007

REFERENCES

1. Eric Rosebrock, Eric Filson, "Setting up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons,2004

B. CLOUD COMPUTING

UNIT - I

Fundamentals – Cloud computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why cloud computing Matters – Advantages of Cloud computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT- II

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services –On-Demand computing –Discovering Cloud Services Development Services and Tools – Amazon Ec2- Google App Engine – IBM Clouds.

UNIT -III

Centralizing Email communications –collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

UNIT -IV

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications–Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing – Collaborating on Databases – Storing and Sharing Files – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

UNIT -V

OGSA – Sample Use Cases – OGSA Platform Components – OGSI – OGSA Basic Services.Globus Toolkit – Architecture – Programming Model – High Level Services – OGSI.Net.Middleware Solutions.

TEXT BOOK

1. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online”, Que Publishing, 2008.

REFERENCES

1. Haley Bear, “Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs”, Que Publishing, 2009.
2. Thomas Erl, “Cloud Computing”, Paperback, 2014.
3. ArshdeepBahga, Vijay Madisetti, “Cloud Computing: A Handa-on Approach”, Universities Press, August 2014.
4. RajkumarBuyya and James Broberg, “ Cloud Computing: Principles and Paradigms”, Paperback, 2013

C. GRAPHICS AND ANIMATIONS

UNIT -I

Overview of Graphics Systems, Video Display Devices, Refresh Cathode Ray Tubes, Raster Scan and Random Scan Displays, Raster Scan and Random Scan Display Processor, Color CRT Monitors, 3D Viewing Devices, Stereoscopic and Virtual Reality Systems, Input Devices and Hard Copy Devices.

UNIT -II

Put primitives, Line drawing algorithms, Circle Drawing algorithms, Polynomials and curves, Area filling algorithms, character generation, Attributes of Output primitives, Anti aliasing techniques, Graphical User interfaces and Interactive Input Methods.

UNIT -III

2D Geometric Transformations, 2D viewing transformations, Clipping methods

UNIT -IV

3D Concepts, 3D Object representations, 3D Geometric Transformations, 3D Viewing and Visible Surface detection methods.

UNIT -V

Animation functions, Introduction to Computer Animation Languages, Colors Models and Illumination models.

TEXT BOOK

1. Donald Hearn and M. Pauline Baker, Computer Graphics , 2nd Edition, 2014, Pearson Education Publications

DESIGN AND ANALYSIS OF ALGORITHMS LAB

OBJECTIVES

- To enable the students to implement different computational methods and techniques.
- To develop understanding of diverse algorithms by implementing them systematically.

EXPERIMENTS

1. Apply the divide and Conquer technique to arrange a set of numbers using merge sort method.
2. Perform Strassen's matrix multiplication using divide and conquer method.
3. Solve the knapsack problem using Dynamic Programming.
4. Construct a minimum spanning tree using greedy method.
5. Perform Warshall's Algorithm using Dynamic Programming.
6. Solve Dijkstra's Algorithm using Greedy Technique.
7. Solve Subset Sum problem using Backtracking
8. Implement the 8-Queens Problem using backtracking.
9. Implement knapsack problem using backtracking.
10. Find the solution of traveling salesperson problem using branch and bound technique.

COMPUTER NETWORKS LAB

OBJECTIVE

- To learn about the low-level network programming concepts using APIs and Simulation tools. Experiments

EXPERIMENTS

1. Study on network devices and network commands.
2. Develop a socket program using TCP and UDP sockets
3. Create a chat application using sockets
4. Implementation of HTTP protocol
5. Development of sliding window protocol for flow control
6. Implementation of File transfer protocol
7. Write a code simulating ARP /RARP protocols.
8. Demonstration of distance vector routing and link state routing
9. Simulation and performance analysis of wired network using any simulator tool
10. Simulation and performance analysis of a wireless network using any simulator tool

WEB PROGRAMMING LAB

1. Text Formatting
2. Lists
3. Links and Navigation
4. Table Elements and Attributes
5. Form Elements
6. CSS
7. Variable and Operators
8. Control Statements
9. Functions
10. Database Application with MYSQL

HUMAN RIGHTS

UNIT-I

Definition of Human Rights - Nature, Content, Legitimacy and Priority - Theories on Human Rights - Historical Development of Human Rights.

UNIT-II

International Human Rights - Prescription and Enforcement up to World War II - Human Rights and the U .N .O. - Universal Declaration of Human Rights - International Covenant on Civil and Political Rights - International Convenant on Economic, Social and Cultural Rights and Optional Protocol.

UNIT-III

Human Rights Declarations - U.N. Human Rights Declarations - U.N. Human Commissioner.

UNIT-IV

Amnesty International - Human Rights and Helsinki Process - Regional Developments - European Human Rights System - African Human Rights System - International Human Rights in Domestic courts.

UNIT-V

Contemporary Issues on Human Rights: Children's Rights - Women's Rights - Dalit's Rights - Bonded Labour and Wages - Refugees - Capital Punishment.

Fundamental Rights in the Indian Constitution - Directive Principles of State Policy - Fundamental Duties - National Human Rights Commission.

TEXT BOOKS

1. International Bill of Human Rights, Amnesty International Publication, 1988.
2. Human Rights, Questions and Answers, UNESCO, 1982
3. Mausice Cranston - What is Human Rights
4. Desai, A.R. - Violation of Democratic Rights in India
5. Pandey - Constitutional Law.
6. Timm. R.W. - Working for Justice and Human Rights.

THEORY OF COMPUTATION

UNIT-II

Introduction- Basic Mathematical Notation and techniques- Finite State systems –Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with €-moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without €-moves – Equivalence of finite Automaton and regular expressions – Minimization of DFA- Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

UNIT-II

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions - Null productions – Greiback Normal form – Chomsky normal form – Problems related to CNF and GNF.

UNIT-III

Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFL – problems based on pumping Lemma.

UNIT-IV

Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines – The Halting problem – Partial Solvability – Problems about Turing machine- Chomskian hierarchy of languages.

UNIT-V

Unsolvable Problems and Computable Functions – Primitive recursive functions – Recursive and recursively enumerable languages – Universal Turing machine. Measuring And Classifying Complexity: Tractable and Intractable problems- Tractable and possibly intractable problems – P and NP completeness – Polynomial time reductions.

TEXT BOOK

1. Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2008.

2. John C Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007.

REFERENCES

1.H.R.Lewis and C.H.Papadimitriou, ―Elements of the theory of Computation, SecondEdition, PHI, 2003.

2. MichealSipser, ―Introduction of the Theory and Computation, Thomson Brokecole, 1997.

SEMESTER –III **MAIN PAPER -8** **4H/4C**

INTERNET OF THINGS

UNIT I INTRODUCTION TO INTERNET OF THINGS

Introduction to IoT- Elements of an IoT- Technology drivers- Business drivers -Typical IoT applications- Trends and implications- Physical design of IoT- Logical design of IoT-IoT levels and deployment templates.- IoT in Home automation, smart cities, Energy, agriculture, retail, logistics, environment, health &life style and industry.

UNIT IITECHNOLOGIES FOR IoT

IoT enabling technologies-M2M, – IEEE 802.15.4, WSN- sensors, actuators, WSN protocols, RFID, NFC,Zigbee, GSM, GPRS, Bluetooth - Cloud computing,Big Data analytics, Communication protocols, Embeded systems.

UNIT IIIIoT PROTOCOLS

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4,802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT IV DESIGN AND DEVELOPMENT

Design Methodology - Embedded computing logic – Microcontroller- Arduino - Board details - Node MCU- ESP8266- Pin configuration- interfacing. Introduction to python- python package for IoT.

UNIT 5 IoT APPLICATIONS

Home Automation -Smart Lighting -Smart Appliances - Intrusion Detection Smoke/Gas Detectors - Smart cities. Case Studies: e.g. sensor body-area-network.

TEXT BOOKS

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2017
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES

1. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 3)
2. https://nptel.ac.in/courses/106105166/
3. https://nptel.ac.in/courses/108108098/
4. https://www.arduino.cc/

DATA ANALYTICS AND MACHINE LEARNING

UNIT-I

Machine learning: What and why?-Types of Machine Learning - Supervised Learning - Unsupervised Learning – reinforcement- The Curse of dimensionality-Over fitting and linear regression- Bias and Variance - Learning Curve-Classification-Error and noise-Parametric vs. non-parametric models-Linear models

UNIT-II

Measuring (dis)similarity - Evaluating the output of clustering method-Spectral clustering - Graph Laplacian - Normalized graph Laplacian-Hierarchical clustering -Agglomerative clustering - Divisive clustering - Choosing the number of clusters-Bayesian hierarchical clustering-Clustering datapoints and features-Bi-clustering-Multi-view clustering-K-Means clustering

UNIT-III

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT-IV

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of HighPerformance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

UNIT-V

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation-Hybrid Recommendation Approaches.

TEXT BOOKS

1. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

3. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

4. EthemAlpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005

5. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

6. LaureneFausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Applications”, Pearson Education, 2008.

REFERENCES:

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. DietmarJannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

SEMESTER –III Field Study: Credit 2

Field Study and USRR (University Social Responsibility Report)

The aim of the Field Study is to help students connect with the society in the respective discipline. Following are the important features of the Field Study and the USRR:

1. **Aim:** The Field Study must aim at relating the subject of study with the society in so far as the application and the usefulness of the study are concerned

2. **Topic selection:** The topic for the Field Study must be chosen by the student in the second semester in the month of February; the process for the same shall begin on 1st February and shall end on the last working day of the month of February. Students are free to select the topic for the Field Study in consultation with the Experts and Faculty Members of their choice, both from within and outside the University

3. **Period and duration:** The Field Study shall be undertaken for a duration of 15 days in the summer vacation that falls immediately at the end of the second semester of the program and the same should be accounted for the Third Semester of the program

4. **USRR:** The USSR (University Social Responsibility Report) must be prepared by every student of the program written in 50 to 75 pages. The report shall be written based on the standard research methodology.

5. Review and evaluation schedule:

a. **Reviewing the Field work:** First week of July
b. **Report Review:** Second week of August
c. **Report submission:** First week of September
d. **Report Evaluation:** Third week of September

6. **Faculty Composition:** The following members may be nominated for confirming the topic and for evaluating the USRR:

a. Professor and Head of the concerned Department

b. One Faculty member with related field of specialization from the concerned Department

c. One senior faculty member from the Department of Sociology from other Institution

SEMESTER –III **ELECTIVE PAPAER- 3** **4H/3C**
(To choose either A or B or C)

A. SOFTCOMPUTING

OBJECTIVES:

- To understand the basic Concept of neural network, various models of Neural networks and supervised and unsupervised learning techniques
- To get familiar with the basis of Fuzzy logic , fuzzy relations, fuzzy inference system and defuzzification techniques

UNIT – I

Introduction: Neural Networks – Application scope of Neural Networks – Fuzzy Logic. Artificial Neural Networks: Fundamental Concept – Evaluation Neural Networks – Basic Models of Artificial Neural Networks: Learning - Terminologies of ANNs - McCulloch-Pitts Neuron - Linear Separability - Hebb Network.

UNIT – II

Supervised Learning Network: Perceptron Networks – Adaptive Linear Neuron - Multiple Adaptive Linear Neurons – Back-Propagation Networks. Associative Memory Networks: Introduction – Training Algorithm for Pattern Association – Hopfield Networks: Discrete Hopfield Networks.

UNIT – III

Unsupervised Learning Network: Introduction – Maxnet – Maxican Hat Net – Hamming Network - Kohonen Self-Organizing Feature Maps - Learning Vector Quantization-Adaptive Resonance theory Network.

UNIT – IV

Fuzzy logic: Introduction – Classical Sets – Fuzzy Sets. Fuzzy Relations: Cardinality of Fuzzy Relation – Operations and properties of Fuzzy Relations – Fuzzy Composition – Noninteractive fuzzy sets. Membership Functions: Introduction – Features of Membership functions – Fuzzification.

UNIT – V

Defuzzification: Introduction – Lambda cut for Fuzzy Sets and Relations – Defuzzification Methods. Fuzzy Arithmetic and Fuzzy Measures: Introduction – Fuzzy Arithmetic – Fuzzy Measures.

TEXT BOOK:

1. Dr. S. N. Sivanandam and Dr. S. N. Deepa, “Principles of Soft Computing”, Wiley, Second Edition, 2007.

REFERENCES:

1. Bart Kosko, “A dynamical system approach to Machine Intelligence, PHI,1992.
2. George J.Klirl Bo Yuen, “Fuzzy set s and Fuzzy Logic Theory **and Application”,** PHI, 1995.
3. NareshH.sinha, Madan M. Gupta, “ Soft Computing & Intelligent **System – Theory** & Application” - Academic press serving in Engineering, 1999.

SEMESTER –III **ELECTIVE PAPAER- 3** **4H/3C**
(To choose either A or B orC)

B. CRYPTOGRAPHY AND NETWORK SECURITY

UNIT -I
Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model, CIA model, Modular Arithmatic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem, Classical Cryptographic Techniques.

UNIT -II
Feistal Cipher Structure, Simplifies DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operations.

UNIT-III
Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie- Hellman Key Exchange, Elgamal Algorithm, Elliptic Curve Cryptography

UNIT-IV
Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures, Key Distribution Techniques, Kerberos.

UNIT-V
Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP, S/MIME.

TEXT BOOKS

1. Cryptography And Network Security, Principles And Practice, 4th Edition, William Stallings, Pearson Education
2. Modern Cryptography, Theory and Practice, Wenbo Mao, Prentice Hall
3. Network Security Essentials, Applications and Standards, William Stallings, Prentice Hall

SEMESTER –III **ELECTIVE PAPAER- 3** **4H/3C**
(To choose either A or B or C)

C. ETHICAL HACKING AND CRYPTOGRAPHY

UNIT-I
Introduction, Importance of Security, Elements of Security, Phase of Attack, Hacktivism, Ethical Hackers, Computer Crimes and Implication.

UNIT-II
Information gathering methodology, Foot printing tools , WHOIS Tool, DNS Information tool, Locating the network range, E-mail spiders, Locating network activity and Meta Search Engines.

UNIT-III
Objectives of scanning, Scanning methodologies , Scanning Tools – Enumeration Techniques , Enumeration Procedures – Enumeration Tools, Cracking password, Password cracking websites , Password guessing Algorithms , Password cracking Tools – Counter measure, Escalating Privileges, Executing Applications , Key loggers and spywares.

UNIT-IV
Overview of Cyber Security, Internet Governance, Challenges and Constraints, Cyber Threats, Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace, Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

UNIT-V
Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

TEXT BOOKS

1. Ethical Hacking and Countermeasures: Attack Phases, Cengage Learning, 2009.
2. Ethical Hacking and Countermeasures: Threats and Defense Mechanisms, Cengage Learning, 2009.
3. Michael T. Simpson, Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2012.
4. Cyber Laws AND IT Protection, CHANDER, HARISH, PHI Learning

SEMESTER –III **OPEN ELECTIVE PAPAER- 2** **2H/2C**
(To choose either A or B or C)

A. CLOUD COMPUTING

UNIT - I

Fundamentals – Cloud computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why cloud computing Matters – Advantages of Cloud computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT- II

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services –On-Demand computing –Discovering Cloud Services Development Services and Tools – Amazon Ec2- Google App Engine – IBM Clouds.

UNIT -III

Centralizing Email communications –collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

UNIT -IV

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications–Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing – Collaborating on Databases – Storing and Sharing Files – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

UNIT -V

OGSA – Sample Use Cases – OGSA Platform Components – OGSI – OGSA Basic Services.Globus Toolkit – Architecture – Programming Model – High Level Services – OGSI.Net.Middleware Solutions.

TEXT BOOK

1. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online”, Que Publishing, 2008.

REFERENCES

1. Haley Bear, “Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs”, Que Publishing, 2009.
2. Thomas Erl, “Cloud Computing”, Paperback, 2014.
3. ArshdeepBahga, Vijay Madisetti, “Cloud Computing: A Handa-on Approach”, Universities Press, August 2014.
4. RajkumarBuyya and James Broberg, “ Cloud Computing: Principles and Paradigms”, Paperback, 2013

SEMESTER – III **OPEN ELECTIVE PAPAER- 2** **2H/2C**
(To choose either A or B or C)

B. GRAPHICS AND ANIMATIONS

UNIT -I
Overview of Graphics Systems, Video Display Devices, Refresh Cathode Ray Tubes, Raster Scan and Random Scan Displays, Raster Scan and Random Scan Display Processor, Color CRT Monitors, 3D Viewing Devices, Stereoscopic and Virtual Reality Systems, Input Devices and Hard Copy Devices.

UNIT -II
Put primitives, Line drawing algorithms, Circle Drawing algorithms, Polynomials and curves, Area filling algorithms, character generation, Attributes of Output primitives, Anti aliasing techniques, Graphical User interfaces and Interactive Input Methods.

UNIT -III
2D Geometric Transformations, 2D viewing transformations, Clipping methods

UNIT -IV
3D Concepts, 3D Object representations, 3D Geometric Transformations, 3D Viewing and Visible Surface detection methods.

UNIT -V
Animation functions, Introduction to Computer Animation Languages, Colors Models and Illumination models.

TEXT BOOK
1. Donald Hearn and M. Pauline Baker, Computer Graphics , 2nd Edition, 2014, Pearson Education Publications

SEMESTER –III **OPEN ELECTIVE PAPAER- 2** **2H/2C**
(To choose either A or B or C)

C. SOFTWARE QUALITY ASSURANCE

UNIT-I

Ethical Basis for Software Quality – Total Quality Management Principles – Software Processes and Methodologies- The software quality challenge- Software errors, faults and failures- Software quality assurance – definition and objectives- SQA and software engineering.

UNIT-II

Software quality factors- Product operation- Product operation and Product transition quality factors- Alternative models of software quality factors- components of the software quality assurance system.

UNIT-III

Contract review- Development and quality plans- Integrating quality activities in the project life cycle- Reviews- Software testing – strategies- Software testing – implementation- CASE tools and their effect on software quality.

UNIT-IV

Procedures and work instructions- Supporting quality devices- Staff training and certification- Corrective and preventive actions- Configuration management-Documentation control - Software quality metrics.

UNIT-V

ISO 9001 and ISO 9000-3 - Capability Maturity Models- Bootstrap methodology- SPICE project and the ISO/IEC 15504 - IEEE software engineering standards - IEEE/EIA Std 12207- IEEE Std 1012- IEEE Std 1028

TEXT BOOK

1. Daniel Galin, “Software Quality Assurance:From theory to implementation", Pearson Publication, 2009.

REFERENCES

1. MilindLimaye, “Software Quality Assurance”, McGraw Hill, 2011.
2. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press.

SEMESTER –III **MAIN PRACTICAL PAPER -7** **4H/2C**

IOT LAB

1. Study of ESP8266(NodeMCU) and its Architecture.
2. Implementation of python – variables, operators and functions
3. Python Programs using loop statements, strings and modules
4. Python programs using file I/Os
5. Interfacing Sensor, Actuators & Cloud Services with NodeMCU
   (I) Controlling LED, switches , ADC values , PIR sensor
   (II) Connecting Ultrasonic, LM35, LDR sensors
   (III) Web Client (Connecting ESP 8266 with Wifi Router)
   (IV) Web Server (Publishing data to Web Server)
   (V) Interfacing of Servo Motor with NodeMCU
   (VI) Interfacing of Relay Switch and NodeMCU and control using cloud services
6. Implementation of MQTT Protocol using NodeMCU

SEMESTER –III **MAIN PRACTICAL PAPER -8** **4H/2C**

MINI PROJECT

REGULATIONS

a) Students should do their Mini Project work in the College during 3rd semester.
b) The Candidate should submit the filled in format as given in Annexure-I to the department for the approval during the 2nd week of July.
c) Each internal guide shall have maximum of eight Students.
d) Periodically the project should be reviewed minimum three times by the advisory committee.
e) The Students should prepare two copies of the project work and submit the same on the date fixed by the Department for the evaluation. After evaluation one copy is to be retained in the College Library and the student can hold one copy.
f) A Sample Cover page format of the Mini project work is enclosed in Annexure-II.
g) Format of the Title page and certificate are enclosed in Annexure-III.
h) The Students should use Presentation during their Mini Project Viva voce Examinations.
i) To pass the Mini Project and viva-voce a candidate should secure 50% marks. The candidate should compulsorily attend viva-voce examination to secure pass in that paper.

The evaluation of Mini Project is as follows:

The maximum mark for each Mini Project is 100 with 25 for Continuous Internal Assessment (CIA) and 75 for Semester Examination.

CIA Project Work		
I	First Review	10 Marks
II	Second Review	10 Marks
III	Third Review	5 Marks
	Total	**25 Marks**
Semester Project Work		
1.	Evaluation of Project work Documentation	55 Marks
2.	Viva voce	20 Marks
	Total	**75 Marks**

SEMESTER –III **MAIN PRACTICAL PAPER -9** **4H/2C**

DATA SCIENCE LAB WITH PYTHON AND R

1. Basics of Python for Data Analysis
2. Python libraries and data structures
3. Exploratory analysis in Python using Pandas
4. Data Munging in Python using Pandas
5. Building a Predictive Model in Python
6. Using the Nuts and Bolts of R programming
7. Using the data sets of R packages
8. K means clustering using R programming
9. Graphical representation Using R
10. Mini Project using Data analytics tools

SEMESTER –IV **MAIN PAPER- 10** **4H/4C**

ADVANCED COMPUTER ARCHITECTURE

UNIT I INSTRUCTION LEVEL PARALLELISM

ILP – Concepts and challenges – Hardware and software approaches – Dynamic scheduling – Speculation - Compiler techniques for exposing ILP – Branch prediction.

UNIT II MULTIPLE ISSUE PROCESSORS

VLIW & EPIC – Advanced compiler support – Hardware support for exposing parallelism – Hardware versus software speculation mechanisms – IA 64 and Itanium processors –Limits on ILP.

UNIT III MULTIPROCESSORS AND THREAD LEVEL PARALLELISM

Symmetric and distributed shared memory architectures – Performance issues – Synchronization – Models of memory consistency – Introduction to Multithreading

UNIT IV MEMORY AND I/O

Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time – Main memory and performance – Memory technology.Types of storage devices – Buses – RAID – Reliability, availability and dependability – I/O performance measures – Designing an I/O system.

UNIT V STORAGE SYSTEMS & CASE STUDIES

Advanced Topics in Disk Storage – Definition and Examples of Real Faults and Failures – I/O Performance, Reliability Measures and Benchmarks – Designing and Evaluating an I/O System – The Internet Archive Cluster Case Studies / Lab Exercises: INTEL i3, i5, i7 processor cores, NVIDIA GPUs, AMD, ARM processor cores – Simulators – GEM5, CACTI, SIMICS, Multi2sim and INTEL Software development tools.

TEXT BOOK:

1. John L. Hennessey and David A. Patterson, " Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th. edition, 2007.
2. William Stallings "Computer Organization and Architecture", Seventh Edition , Pearson Education, 2006.
3. K.Hwang, NareshJotwani, "Advanced Computer Architecture, Parallelism, Scalability, Programmability", Tata McGraw Hill, 2nd Edition 2010.

REFERENCES:

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture : A hardware/software approach" , Morgan Kaufmann /Elsevier Publishers, 1999.
2. Kai Hwang and Zhi.WeiXu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.

SEMESTER –IV **MAIN PAPER- 11** **4H/4C**

MOBILE APPLICATION DEVELOPMENT

OBJECTIVES:

- Understand system requirements for mobile applications.
- Generate suitable design using specific mobile development frameworks.
- Generate mobile application design.
- Implement the design using specific mobile development frameworks

UNIT I INTRODUCTION

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

UNIT II BASIC DESIGN

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV ANDROID

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V IOS

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

REFERENCES BOOKS:

1. Charlie Collins, Michael Galpin and Matthias Kappler, ―Android in Practice‖, DreamTech, 2012.
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, ―Beginning iOS 6 Development: Exploring the iOS SDK‖, Apress, 2013.
3. http://developer.android.com/develop/index.html.
4. James Dovey and Ash Furrow, ―Beginning Objective C‖, Apress, 2012.
5. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox,2012.
6. Reto Meier, ―PProfessional android Development‖, Wiley-India Edition, 2012.

SEMESTER –IV **ELECTIVE PAPAER- 4** **4H/3C**
(To choose either A or B or C)

A. WIRELESS SENSOR NETWORK

OBJECTIVES:

• To enable the students to learn and understand the fundamental concepts behind the Sensor Networks and its applications in the practical life.

UNIT - I

INTRODUCTION Unique constraints and challenges – advantages of WSNs – Sensor network applications –Collaborative processing – Key definitions of sensor networks Canonical Problem: Localization and tracing – tracking scenario – Problem formulation – distributed representation and inference of states – tracking multiple objects – sensor models – performance comparison and metrics

UNIT – II

NETWORKING SENSORS Networking sensors: Key assumptions – Medium access control – General issues – Geographic energy aware routing – attribute based routing - Infrastructure Establishment: Topology control – clustering – Time synchronization –Localization and localization service

UNIT – III

SENSOR TASKING AND CONTROL Sensor tasking and control: Task driven sensing – roles of sensor nodes and utilities – information based sensor tasking – joint routing and information aggregation

UNIT – IV

SENSOR NETWORK DATABASES Sensor network databases: Sensor database challenges – Querying the physical environment –Query interfaces – High level database organization – In-Network aggregation – Data centric storage – Data indices and range queries – Distributed hierarchical aggregation – temporal data

UNIT – V

SENSOR NETWORK PLATFORMS AND TOOLS Sensor Network platforms and tools: Sensor node hardware – sensor network programming challenges – node level software platforms –Node level simulations – State centric programming - Application and future directions: Emerging applications – future research directions

REFERENCES:

1. Wireless Sensor networks :FengZhao,LeonidasGuibas –Morgan Kaufmann Publications – 2012

2. Fundamentals of Wireless sensor networks Theory and Practice – WaltenegusDargie, Christian Poellabauer – Wiley – 2010

3. Protocols and Architectures for wireless sensor networks – Holger Karl, Andreas Willig,Wiley – 2011

SEMESTER –IV **ELECTIVE PAPAER- 3** **4H/3C**
(To choose either A or B or C)

B. MOBILE OPERATING SYSTEM

OBJECTIVES:

- To enable the students to learn the Android OS and to apply the android tools¬ to solve the real life problems.

UNIT - I

Role of Android OS – Android Execution Environment- Components-Activity Lifecycle-Service Lifecycle-Creating an Android Development Environmentstarting a New Android Application – Writing –Running- Android Development Environment for Real Time Applications-Android and Social Networking – Downloading the MJ Android Code – A Brief Tour of the MJ Android Code- The Project Root folder – Source Folder-Resource Folder-Building and Running the Micro jobs Application –Android SDK/Eclipse IDE-Loading and Starting the application –Running an application on the T- Mobile phone.

UNIT – II

Debugging Android Applications – Tools-Eclipse Java Editor-Java Errors- DebuggerLogcat-Android Debug Bridge (adb)-Dalvis Debug Motor Service (DDMS)- Traceview-Signing and Publishing Your Application- Testing Application-Create and Attach an Icon and Label-Cleanup for Release-Version the ApplicationObtaining and Signing the certificate and API key- Getting an Signing Certificate for an application- Getting an Signing Certificate while Debugging-Signing the Application-Retesting the Application –Publishing on Android Market - Signing Up as an android Developer.

UNIT – III

Persistent Data Storage : SQLite Data bases and Content Providers-Databases-Basic Structure of the MicroJobs Databases Class- Reading Data from the DatabaseModifying the Database-Content Providers-Introducing Notepad- Content Providers-Consuming a Content Provider-Location and Mapping-Location Based Services-Mapping-Google Maps activity-MapView and MapActivity-Working with MapViews-Pausing and Resuming a MapActivity-Controlling the Map with Menu Buttons- Controlling the Map with the KeyPad –Location without Maps-Manifest and Layout Files-Connecting to a Location Provider and Getting Location UpdatesUpdating the Emulated Location.

UNIT – IV

Building a View- Android GUI Architecture-Model-View—Controller-Putting It Together-Assembling a Graphical Interface- Writing up the Controller-Listening to the Model-Listening for Touch Events-Listening for Key Events-Alternative Ways to Handle Events-Advanced

Wiring: Focus and Threading-Android Views- Text View and Edit Text-Button and Image Button- Adapters and Adapter Views-Checkboxes, Radio buttons and Spinners- View Groups-Gallery and Grid View-List View and List Activity-Scroll View- Tab Host-Layouts-Frame Layout-Linear Layout-Table Layout-Absolute Layout-Relative Layout

UNIT – V

Rolling your own Widgets-Layout-Canvas Drawing-Drawables- Bitmaps-BlingShadows, Gradients and Filters-Animation-OpenGL Graphics-Simple Phone CallsQuick and Easy Phone Calls-Creating an Example Application to Run the call method-Embedding the code Snippet in a simple Application- Exploring the phone code through the Debugger-Creating an Instance of an Intent-Adding Data to an Instance of an Intent-Initiating a Phone call

TEXT BOOK:

1. Android application Development-Rick Rogers, John Lombardo, ZigardMednieks& Black Meiek O‘Reilly 2009 Edition

SEMESTER –IV **ELECTIVE PAPAER- 3** **4H/3C**
(To choose either A or B or C)

C. DIGITAL IMAGE PROCESSING

OBJECTIVES:

- To understand basic concepts such as image processing activities such as acquisition, enhancements, compression, segmentation etc.
- To apply the above activities in the real life problems.

UNIT - I

Introduction: What is Digital Image Processing? – Fundamentals Steps in Digital Image Processing – Components of an Image Processing System. Digital Image Fundamentals: Light and the Electromagnetic Spectrum – Image Sensing and Acquisition – Image Sampling and Quantization(Basic Concepts in Sampling and Quantization - Representing Digital Images - Spatial and Graylevel Resolution - Zooming and Shrinking Digital Images) – Some Basic Relationships between Pixels (Neighbors of a Pixel - Adjacency, Connectivity, Regions and Boundaries – Distance Measures).

UNIT – II

Image Enhancement in the Spatial Domain: Some Basic Gray level Transformations (Image Negative – Log Transformations – Power-law Transformations – Piecewise-Linear Transformation Functions)- Histogram Processing(Histogram Equalization- Histogram Matching)- Enhancement using Arithmetic/ Logic operations (Image subtraction – Image averaging) - Basics of Spatial Filtering – Smoothing Spatial Filters .

UNIT – III

Image enhancement in the frequency domain: Two Dimensional DFT and its inverse – Basics of filtering in the frequency domain - Lowpassfilters(Ideal, Butterworth) – Sharpening frequency domain filters (Ideal, Butterworth). Image Restoration: A model of the Image degradation / Restoration process – Spatial filtering (Mean filters – Order statistics filters – Adaptive filters).

UNIT - IV

Image Compression : Fundamentals (Coding Redundancy – Interpixel redundancy – Psychovisual redundancy – Fidelity criteria) - Image Compression Models (Source encoder and Decoder) – Error free compression (Variable length coding – LZW coding) — LossyCompression(Transform coding) - Image Compression Standards (Continuous tone still image , Video Compression Standards) .

UNIT – V

Image Segmentation: Detection of discontinuities (Point, line, Edge detections) – Thresholding(Basic Global and Adaptive) - Region based segmentation (Basic formulations – Region growing – Region splitting and merging)

REFERENCE BOOKS

1. Digital Image Processing - Rafael C. Gonzalez and Richard E.Woods, Pearson Education Limited 2004
2. Digital Image Processing and Analysis – B. Chanda and D.DuttaMajunder PHI Limited, 2004
3. Image Processing Analysis and Machine Vision - Milan Sonka , Vaclav Hlavac and Roger Boyle, Vikas Publications 2005.
4. Digital Image Processing - Pratt – Wiley Publications , 2004.
5. Digital Image Processing for Medical Applications-Geoff Doucherty, Cambridge University Press,2015.

SEMESTER –IV **MAIN PAPER- 12**

PROJECT WORK

REGULATIONS

a. Students should do their four months Project work in Company / Institutions during fourth semester.

b. The Candidate should submit the filled in format as given in **Annexure-IV** to the department for approval during the I[st] Week of January.

c. Each internal guide shall have maximum of eight Students.

d. Periodically the project should be reviewed minimum three times by the advisory committee.

e. The Students should prepare three copies of the project work and submit the same on the date fixed by the department for the evaluation. After evaluation, one copy is to be retained in the College Library and one copy is to be submitted to the University (Registrar) and the student can hold one copy.

f. A Sample Cover page format of the Project Work is enclosed in **Annexure-V.**

g. Format of the **Title page** and certificate are enclosed in **Annexure-VI.**

h. The Students should use Presentation during their Project Viva voce Examinations.

i. For the project work and viva-voce a candidate should secure 50% of the marks for pass. The candidate should compulsorily attend viva-voce examination to secure pass in that paper.

The evaluation of project is as follows:

CIA Project Work		
I	First Review	10 Marks
II	Second Review	10 Marks
III	Third Review	5 Marks
	Total	**25 Marks**
Semester Project Work		
1.	Evaluation of Project work Documentation	55 Marks
2.	Viva voce	20 Marks
	Total	**75 Marks**

The maximum mark for each Project is 100 with 25 for Continuous Internal Assessment (CIA) and 80 for Semester Examination.

ANNEXURE – I

THIRUVALLUVAR UNIVERSITY

College Name	:	
Course	:	
Student Name	:	
Register Number	:	
Title of the Project	:	
Name of the Internal Guide	:	
Qualification	:	
Teaching Experience	:	
Place	:	
Date	:	Signature of Internal Guide
Name of the HOD	:	
Designation	:	
Place	:	
Date	:	Signature of the HOD (with seal)

ANNEXURE-II

COLLEGE BONAFIDE CERTIFICATE
ACKNOWLDGEMENT
ABSTRACT
TABLE OF CONTENTS
TABLE OF FIGURES

CONTENTS

Title Page No.

ANNEXURE-III

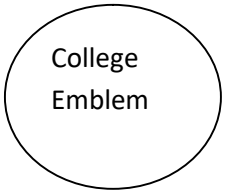
a. Format of the Cover Page

TITLE OF THE PROJECT WORK

Mini Project work submitted in partial fulfillment of the
requirements for the

degree of Master of Science in Computer Science
to
Thiruvalluvar University, Serkkadu, Vellore - Pin code

By
STUDENTNAME REG. NO.



MONTH – YEAR
THIRUVALLUVAR UNIVERSITY
PLACE with Pin Code

b. Format of the certificate

MINI PROJECT WORK

TITLE OF THE PROJECT WORK

Bonafide Work Done by

STUDENTNAME

REG. NO.

Mini Project Work submitted in partial fulfillment of the requirements for the

degree of Master of Science in Computer Science

to the Thiruvalluvar University, Serkkadu, Vellore – Pin code.

INTERNALGUIDE HEAD OF THE DEPARTMENT

Submitted for the Viva-Voce Examination held on _____

Internal Examiner External Examiner

ANEXURE-IV

THIRUVALLUVAR UNIVERSITY

College Name :

Course :

Student Name :

Register Number :

Title of the Project :

Address of Organization / Institution :

Name of the Internal Guide :

Qualification :

Teaching Experience :

Place :

Date : Signature of Internal Guide

Name of the HOD :

Designation :
Place:
Date : Signature of the HOD
(with seal)

Principal

ANNEXURE-V

Title Page
Original Copy of the Approved Proforma of the Project Proposal
Certificate of Authenticated work
Abstract
Acknowledgement
Table of Contents Table of Figures

CONTENTS

ANNEXURE-VI

a. Format of the Cover Page

TITLE OF THE PROJECT WORK

Project work submitted in partial fulfillment of the
requirements for thedegree of

Master of Science in Computer Science
to
Thiruvalluvar University, Serkkadu, Vellore - Pin code

By
STUDENTNAME REG. NO.

College
Emblem

MONTH – YEAR
THIRUVALLUVAR UNIVERSITY
PLACE with Pin Code

b. Format of the certificate

MINI PROJECT WORK

TITLE OF THE PROJECT WORK

Bonafide Work Done by

STUDENTNAME

REG. NO.

Project Work submitted in partial fulfillment of the
requirements for the degree of

Master of Science in Computer Science

to the Thiruvalluvar University, Serkkadu, Vellore – Pin code.

INTERNALGUIDE HEAD OF THE DEPARTMENT

Submitted for the Viva-Voce Examination held on _____

Internal Examiner External Examiner