ST. THOMAS' COLLEGE (AUTONOMOUS)
THRISSUR, KERALA – 680001

Affiliated to University of Calicut
Nationally reaccredited with 'A' Grade

CURRICULUM AND SYLLABUS
FOR
POSTGRADUATE PROGRAMME
IN
COMPUTER SCIENCE

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM
(w.e.f. 2020 Admission onwards)

CONTENTS

REGULATIONS FOR THE DEGREE OF MASTER OF SCIENCE (COMPUTER SCIENCE)

w.e.f. Academic Year 2020 - '21 onwards

1. PROGRAMME OUTCOME (PO)

At the end of post graduate program at St. Thomas' College (Autonomous), a student would have:

PO1:	Attained profound **expertise in respective discipline**.
PO2:	Acquired **ability to function in multidisciplinary domains**.
PO3:	Attained ability to exercise **research intelligence** in investigations and innovations.
PO4:	Learnt ethical principles and be committed to **professional ethics**.
PO5:	Incorporated **self-directed and life-long learning**.
PO6:	Obtained ability to maneuver in diverse contexts with **global perspective**.
PO7:	Attained **maturity to respond to one's calling**.

2. PROGRAMME SPECIFIC OUTCOME (PSO)

PSO 1	Evaluate complex real world problems by applying principles of theoretical computing, engineering and mathematical models.
PSO 2	Understand concepts and applications in the field of Computer Sciences *viz.* Web Technology, Data Mining, Data Warehousing, Security, Network and communication technologies.
PSO 3	Identify, analyse, and synthesize scholarly literature relating to the field of computer science to design, analyze and interpret data to find solutions
PSO 4	Conceive Project Management capabilities to solve real world problems in accordance to the need of the industry, in a stipulated time frame

3. ADMISSION

1. The admission to M.Sc. Computer Science programmes shall be as per the rules and regulations of the College.
2. The eligibility criteria for admission shall be as announced by the College from time to time.
3. Separate rank lists shall be drawn up for reserved seats as per the existing rules.
4. The college shall make available, to all the admitted students, information's regarding all the courses including electives offered with syllabus and credit for the entire course.
5. There shall be a uniform calendar prepared by the College for the conduct of the programme.
6. There shall be provision for inter collegiate and inter University transfer in the 2nd and 3rd semester within a period of two weeks from the date of commencement of the semesters.
7. There shall be provision for credit transfer subject to the conditions specified by the Board of Studies concerned.
8. There shall be a uniform calendar prepared by the College for the registration, conduct/schedule of the courses, examinations and publication of results.

3. READMISSION

1. There shall be provision for readmission of students, as per the prevailing rules of the College.
2. For readmission, the vacancy should be within the sanctioned strength.
3. This readmission is not to be treated as college transfer.
4. There should be a gap of at least one semester for readmission.
5. The candidate seeking readmission to a particular semester should have registered for the previous semester examination.
6. Readmission shall be taken within two weeks from the date of commencement of the semester concerned.
7. The Principal can grant readmission to the student, subject to the above conditions, and inform the matter of readmission to the Controller of Examinations within one month of such readmission.

8. If change in scheme occurs while readmission, provision for credit transfer will be subject to the common guidelines prepared by Board of Studies/ Faculty concerned.

4. Duration Of The Programme

1. The minimum duration for completion of a four semester PG Programme is two years and the maximum period for completion is 4 years.
2. The duration of each semester shall be 90 working days, inclusive of examinations, spread over five months.
3. Odd semesters shall be held from June to October and even semesters from November to March.

5. Programme Structure

1. The programme includes three types of courses, *viz.*, Core courses (Code C), Elective Courses (Code E) and Audit Courses (Code A).
2. Every student of the MSc Computer Science programme shall have to work on a project/dissertation of not less than 8 credits under the supervision of a faculty member as per the curriculum. Project/dissertation shall be treated as Core Course. Project Work is mandatory for all regular programmes and Comprehensive Viva-voce is optional and these shall be done in the end semester. The combined Credit for the Project Work and Comprehensive Viva-voce shall not be more than 8 (eight) credits subject to a minimum of 4 (four) credit for Project Work. All students have to submit a Project Report/Dissertation in the prescribed structure and format as a part of the Project Work undertaken.
3. Total credit for the programme shall be 80 (eighty), this describes the weightage of the course concerned and the pattern of distribution is as detailed below
   i) Total Credit for Core Courses shall not be less than 58 (fifty-eight) and not more than 68 (sixty-eight).
   ii) Total Credit for Elective Course shall not be less than 12 (twelve) and not more than 20 (Twenty).
   iii) Total Credits for Comprehensive Viva-voce and Project Work combined together shall be 8 (eight) subject to a minimum of 4 (four) credit for Project Work.
   iv) Total credit in each semester shall vary between 14 to 22 (Excluding audit courses).
   v) No course shall have less than 2 credits and more than 5 credits.
4. Elective courses shall be spread over third and fourth Semesters.
5. Audit Courses: There will be two Audit Courses (Ability Enhancement Course & Professional Competency Course) with 4 credits each. These have to be done one each

in the first two semesters. The credits will not be counted for evaluating the overall SGPA and CGPA. Students have to obtain only minimum pass requirements in the Audit Courses.

6. A student shall accumulate a minimum of 80 credits for the successful completion of the programmes. (Excluding audit courses)

6. REGISTRATION

1. A student shall be permitted to register for a programme at the time of admission.
2. A student who registers for a programme shall complete it within 4 years.
3. Students shall be normally permitted to register for the examination, if they have required minimum attendance. If the student has a shortage of attendance in a semester, the student shall be permitted to move to the next semester and can write the examination for the entire courses of the semester in which shortage of attendance occurs as supplementary examination, only after the completion of the entire programme. In such cases, a request from the student may be forwarded through the Head of the department to the Controller of Examinations within two weeks of the commencement of the semester. There will not be any repeat semester from 2020 admission onwards.
5. The students who have attendance within the limit, but could not register for the semester examinations, have to apply for token registration, within two weeks of the commencement of the next semester.

7. ATTENDANCE

1. The students admitted in the PG programmes shall be required to attend at least 75 percent of the total number of classes (theory/practical) held during each semester. The students having less than prescribed percentage of attendance shall not be allowed to appear for the End Semester Examination.
2. Condonation of shortage of attendance for a maximum of 9 days (10% of the working days in a semester) in the case of single condonation and 18 days (20% of the working days in a semester) in the case of double condonation in a semester subject to a maximum of two times (for single condonation only) during the whole period of Post Graduate programme may be granted by the College as per the existing procedures. In the case of double condonation, only one condonation shall be allowed during the entire programme.
3. Benefit of condonation of attendance will be granted to the students on health grounds, for participating in University Union activities, meeting of the University

bodies /Govt. bodies and participation in other extracurricular activities on production of genuine supporting documents, with the recommendation of the Head of the Department concerned.

4. A student who is not eligible for such condonation shall be observed the provisions as per clause 6.4 of this regulation. The principal should intimate the details of these candidates at the commencement of the next semester.
5. Women students can avail maternity leave as per the existing university rules.

8. EXAMINATION

1. There shall be End Semester Examination at the end of each semester.
2. Practical examinations shall be conducted at the end of even semesters. There will be one internal and one external examiner for the conduct of End Semester Practical examination.
3. Project Work / Dissertation shall be evaluated at the end of the programme only. There shall be both Internal and External evaluation for the Project Work.
4. There shall be one end-semester examination of 3 hours duration for each theory course and practical course.

9. EVALUATION AND GRADING

(a) Evaluation: The evaluation scheme for each course shall contain two parts; (a) Internal / Continuous Assessment (CA) and (b) External / End Semester Evaluation (ESE).

2. Evaluation of Audit Courses: The examination and evaluation shall be conducted by the respective department itself. The Question paper shall be for a minimum 20 weightage and the exam shall be for a duration of 2 hours.

The evaluation for each course except the audit course shall contain two parts

(a) Internal evaluation :20% weightage

(b) External evaluation: 80% weightage

Both the internal and External evaluation shall be carried out using direct grading system as per the general guidelines of university and regulation of St. Thomas' College (Autonomous).

To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal grade. The course teacher shall maintain the academic record of

each student registered for the course, which shall be forwarded to the Controller of Examinations , through the Academic Management System.

Internal evaluation must consist of following components

Sl. No	Component
1	Sessional Examinations (2)
2	Seminar
3	Assignment
4	Attendance

The criteria and percentage of weightage assigned to various components for internal evaluation are as follows:

(a) Theory

Sl. No	**Component**	**Percentage**
1	Examination /Test	40%
2	Seminars / Presentation	20%
3	Assignment	20%
4	Attendance	20%

(b)

(b) Practical

Sl. No	Component	Percentage
1	Lab Skill	40%
2	Records/viva	30%
3	Practical Test	30%

(c)

Grades shall be given for the internal evaluation are based on the grades A+, A, B, C, D and E with grade points 5,4, 3, 2, 1 and 0 respectively and the overall grades shall be as per the ten point scale.

Note:

- All students should have a rough record (observation note book) in which they write all the works to be carried out in the lab prior to his/her entering the lab. (S)he may also note down the input and output that (s)he gives for program verification in the observation note book (rough record).

- All lab works should be neatly recorded in a Laboratory Record Book (Fair Record) in written form. However program results can be pasted in the left hand side of the fare record.
- Chairperson, Board of Examination (PG) has to prepare the modalities of the practical papers (list of experiments to be done, number of minimum experiments required in the practical record, etc) and distributed to all departments concerned, at the beginning of each semester itself. Model lists of experiments are provided with the syllabus for each practical session.
- No candidate will be permitted to attend the end-semester test unless he/she produces certified record of the laboratory.

10. INTERNAL EVALUATION – CONTINUOUS ASSESSMENT

Internal Examination

The average of the two examinations/tests can be used to obtain the letter grades as per the following table

Average %/grade range of 2 tests	Grade	Grade point
90 - 100% ….(4.5 to 5)	A+	5
75 – 89.99%...(3.75-4.49)	A	4
60 – 74.99%...(3.0 to 3.74)	B	3
40 – 59.99%...(2 to 2.99)	C	2
Below 40% (Below 2.0)	D	1
Absent	E	0

Letter grades of attendance can be derived as per the following table

Range of attendance	Grading	Grade point

>=90%	A+	5
85% >=Attendance<90%	A	4
80% >=Attendance<85%	B	3
75% >=Attendance<80%	C	2
50% >=Attendance<75%	D	1
<50%	E	0

11. EXTERNAL / END SEMESTER EVALUATION (ESE)

1. The semester-end examinations in theory courses shall be conducted by the College in accordance to the prevailing rules of the University and the evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation.
2. After the external evaluation, only Grades are to be entered in the space provided in the answer script for individual questions and calculations need to be done only up to the Cumulative Grade Point (CGP) and all other calculations including grades are to be done by the University.
1. Students shall have the right to apply for scrutiny as per rules within the time permitted for it.
3. Photocopies of the answer scripts of the external examination shall be made available to the students for scrutiny on request by them as per rules.
4. The external evaluation shall be done immediately after the examination preferably in a Centralized Valuation Camp.
5. The language of writing the examination shall be English.
6. Pattern of questions for external/ESE (theory courses):
   a. Questions shall be set to assess the knowledge acquired, standard, and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. Due weightage shall be given to each module based on content/teaching hours allotted to each module.
   b. It has to be ensured that questions covering all skills are set. The setter shall also submit a detailed scheme of evaluation along with the question paper.
   c. A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.
   d. The question shall be prepared in such a way that the answers can be awarded A+, A, B, C, D, E Grades.
   e. Weightage: Different types of questions shall be given different weightages to quantify their range given in the following model:

Sl. No.	Type of Questions	Individual weightage	Total Weightage	Number of questions to be answered

1	Short Answer type questions	2	2´4 = 8	4 out of 7
2	Short essay/ problem solving type	3	3´4 = 12	4 out of 7
3	Long Essay type questions	5	5´2 = 10	2 out of 4
Total			30	18

f. Questions should be asked as far as possible from all modules following a uniform distribution.

A sample ESE evaluation sheet of a theory course is illustrated below:

7. End Semester Evaluation in Practical Courses shall be conducted and evaluated by both Internal and External Examiners.

Mark distribution for practical courses shall be as follows:

Component	**Weightage**
Algorithm/Flow diagram/UI diagram/Class	6
Implementation	6
Result/ Output	6
Record	6
Viva	6
Total	**30**

A sample ESE evaluation sheet of a theory course is illustrated below:

Type of Question	**Grade Awarded**	**Grade Point**	**Weightage**	**Weighted Grade Point**	**Calculation**
Algorithm/Flow					

diagram/UI diagram/Class Diagram	A	4	6	24	114/30 = 3.80
Implementation	A	4	6	24	
Result/ Output	B	3	6	18	
Record	A	4	6	24	
Viva	A	4	6	24	
Total			**30**	**114**	**O**

12. EVALUATION OF PROJECT WORK / DISSERTATION

1. There shall be External and Internal evaluation for Project Work done and the grading system shall be followed.
2. One component among the Project Work evaluation criteria shall be Viva-voce (Project Work related) and the respective weightage shall be 40%.
3. Consolidated Grade for Project Work is calculated by combining both the External and Internal in the Ratio of 4:1 (80% & 20%).
4. For a pass in Project Work, a student has to secure a minimum of P Grade in External and Internal examination combined. If the students could not secure minimum P Grade in the Project work, they will be treated as failed in that attempt and the students may be allowed to rework and resubmit the same in accordance with the college exam stipulations. There shall be no improvement chance for Project Work.
5. The External and Internal evaluation of the Project Work shall be done based on the following criteria and weightage as detailed below :

Sl. No	Criteria	% of Weightage	Weightage	
			External	Internal
1	Relevance of the topic and Statement of problem, Methodology & Analysis Quality of Report & Presentation	60%	24	6
2	Viva-voce	40%	16	4
Total Weightage		100%	40	10

The first component for 60% weightage can be sub-divided into following project implementation components:

SlNo	Components	Weightage	
		External	**Internal**
1	Relevance of the Topic, Statement of Objectives, Methodology	2	2
2	Quality of Literature Survey/Product Review	2	
3	Quality of Analysis Phase	2	
4	Quality of Design Phase	2	
5	Quality of Implementation/Simulation	4	2
6	Quality of Testing/Result Analysis	2	
7	Quality of Contributions	2	
8	Identification of Future Work	1	2
9	Quality of Project Report	4	
10	Publications/Presentations out of the Project Work*	1	
11	Quality of Presentation	1	
12	Demonstration of the Project Work	1	
13	General Viva Voce	16	4
	Total	40	10

13. DIRECT GRADING SYSTEM

1. Direct Grading System based on a 10 – Point scale is used to evaluate the performance (External and Internal Examination of students)
2. For all courses (Theory & Practical)/Semester/Overall Programme, Letter grades and GPA/SGPA/CGPA are given on the following way :
   a. First Stage Evaluation for both Internal and External done by the Teachers concerned in the following Scale :

Grade	Grade Points
A+	5
A	4
B	3
C	2
D	1
E	0

b. The Grade Range for both Internal & External shall be:

Letter Grade	Grade Range	Range of Percentage (%)	Merit Indicator
O	4.25 - 5.00	85.00 - 100.00	Outstanding
A+	3.75 - 4.24	75.00 - 84.99	Excellent
A	3.25 - 3.74	65.00 - 74.99	Very Good
B+	2.75 - 3.24	55.00 - 64.99	Good
B	2.50 - 2.74	50.00 - 54.99	Above Average
C	2.25 - 2.49	45.00 - 49.99	Average
P	2.00 - 2.24	40.00 - 44.99	Pass
F	< 2.00	Below 40	Fail
I	0	-	Incomplete
Ab	0	-	Absent

3. No separate minimum is required for Internal evaluation for a pass, but a minimum P Grade is required for a pass in the external evaluation. However, a minimum P grade

is required for pass in a course.

4. A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch.
5. Improvement of Course- The candidates who wish to improve the grade / grade point of the external examination of a course/s they have passed already can do the same by appearing in the external examination of the concerned semester along with the immediate junior batch
6. Betterment Programme One time- A candidate will be permitted to improve the CGPA of the Programme within a continuous period of four semesters immediately following the completion of the programme allowing only once for a particular semester. The CGPA for the betterment appearance will be computed based on the SGPA secured in the original or betterment appearance of each semester whichever is higher.

14. SEMESTER GRADE POINT AVERAGE (SGPA) - CALCULATION

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

After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below.

Semester Grade Point Average - SGPA (Sj) = **Σ**(Ci x Gi) / Cr

(SGPA= Total Credit Points awarded in a semester / Total credits of the semester)

Where 'Sj' is the j^{th} semester , 'Gi' is the grade point scored by the student in the i^{th} course

'Ci ' is the credit of the i^{th} course, 'Cr' is the total credits of the semester.

15. CUMULATIVE GRADE POINT AVERAGE (CGPA) - CALCULATION

Cumulative Grade Point Average (CGPA) = **Σ** (Ci x Si) / Cr

(CGPA= Total Credit points awarded in all semesters/Total credits of the programme)

Where C_1 is the credit of the I^{st} semester S_1 is the SGPA of the 1^{st} semester and Cr is the total number of credits in the programme. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme. The SGPA and CGPA shall be rounded off to 2 decimal points.

For the successful completion of a semester, a student should pass all courses and score

a minimum SGPA of 2.0. However, the students are permitted to move to the next semester irrespective of their SGPA.

16. GRADE CARD

The college shall issue grade card, to its students, on completion of each semester.

17. AWARD OF DEGREE

The successful completion of all the courses with P grade shall be the minimum requirement for the award of the degree.

18. POSITION CERTIFICATE

Position certificates shall be issued to candidates who secure first positions and shall be finalised after the revaluation. The position shall be prepared in the order of merit based on the CGPA scored by the students. Grace Grade points awarded to the students shall not be counted for fixing the position.

19. GRIEVANCE REDRESSAL COMMITTEE

Department Level Committee: The college shall form a Grievance Redressal Committee in each department comprising of course teacher, one senior teacher and elected representative of Students (Association Secretary) as members and the Head of the Department as Chairman. The committee shall have initial jurisdiction over complaints against Continuous Assessment.

College Level Committee: There shall be a college level grievance redressal committee comprising of student adviser, two senior teachers , two staff council members (one shall be elected member) and elected representative of students (College Union Chairperson) as members and the Principal as Chairman. This committee shall address all grievances relating to the internal assessment grades of the students.

20. M.Sc COMPUTER SCIENCE - PROGRAMME STRUCTURE

LEGEND	
Item	Description
C	Credits
E	External Component (%)
I	Internal Component (%)
L	Lecture Hours
P	Practical Hours
T	Total

SEMESTER I

No	Course Code	Course Name	C	Weightage			Hours/Week		
				I	E	T	L	P	T
1.1	CSS1C01	Discrete Mathematical Structures	4	1	4	5	4	0	4
1.2	CSS1C02	Advanced Data Structures	4	1	4	5	3	2	5
1.3	CSS1C03	Theory of Computation	4	1	4	5	4	0	4
1.4	CSS1C04	The Art of Programming Methodology	4	1	4	5	2	2	4
1.5	CSS1C05	Computer Organization Architecture	4	1	4	5	4	0	4
1.6	CSS1L01	Practical I	2	1	4	5	0	4	4
1.7	CSS1A01	Introduction to Research (Ability Enhancement Audit Course)	4	5	0	5	0	0	0
Total Credits (Excluding Audit Course): 22							**17**	**8**	**25**

SEMESTER II

No	Course Code	Course Name	C	Weightage			Hours/Week		
				I	E	T	L	P	T
2.1	CSS2C06	Design and Analysis of Algorithms	4	1	4	5	4	0	4
2.2	CSS2C07	Operating System Concepts	4	1	4	5	3	2	5
2.3	CSS2C08	Computer Networks	4	1	4	5	2	2	4
2.4	CSS2C09	Computational Intelligence	4	1	4	5	4	0	4
2.5	CSS2C10	Principles of Software Engineering	4	1	4	5	4	0	4
2.6	CSS2L02	Practical II	2	1	4	5	0	4	4
2.7	CSS2A02	Term Paper (Professional Competency Audit Course)	4	5	0	5	0	0	0
Total Credits (Excluding Audit Course): 22							**17**	**8**	**25**

SEMESTER III

No	Course Code	Course Name	C	Weightage			Hrs/Week		
				I	E	T	L	P	T
3.1	CSS3C11	Advanced Database Management System	4	1	4	5	3	1	4
3.2	CSS3C12	Object Oriented Programming Concepts	4	1	4	5	2	3	5
3.3	CSS3C13	Principles of Compilers	4	1	4	5	4	0	4
3.4	CSS3E01	Elective I	4	1	4	5	4	0	4
3.5	CSS3E02	Elective 2	4	1	4	5	4	0	4
3.6	CSS3L03	Practical III	2	1	4	5	0	4	4

Total Credits: 22				**17**	**8**	**25**

List of Elective Courses for CSS3E01	
Course Code	Course Name
CSS3E01a	Computer Graphics
CSS3E01b	Introduction to Soft Computing
CSS3E01c	Web Technology
CSS3E01d	Bioinformatics
CSS3E01e	Computer Optimization Techniques
CSS3E01f	Numerical and Statistical Methods

List of Elective Courses for CSS3E02	
Course Code	Course Name
CSS3E02a	Pattern Recognition
CSS3E02b	Wireless and Mobile Networks
CSS3E02c	Cryptography and Network Security
CSS3E02d	Advanced Web Technology
CSS3E02e	Virtualisation and Cloud Computing
CSS3E02f	Data Warehousing and Data Mining

SEMESTER IV

No	Course Code	Course Name	C	Weightage			Hours/Week		
				I	E	T	L	P	T
4.1	CSS4E03	Elective 3	3	1	4	5	5	0	5
4.2	CSS4E04	Elective 4	3	1	4	5	5	0	5
4.3	CSS4P01	Project Requirements Analysis & Design Related Discussion					3	1	4

		Project Coding, Testing & Implementation Related Discussion	8	1	4	5	2	2	4
		Project Evaluation & Assessment					2	0	2
		Project Lab Work					0	5	5
Total Credits (Excluding Audit Course): 14							**17**	**8**	**25**

List of Elective Courses for CSS4E03	
Course Code	Course Name
CSS4E03a	Data Compression
CSS4E03b	Pervasive Computing
CSS4E03c	System Security
CSS4E03d	Molecular Simulation and Modelling
CSS4E03e	Fundamentals of Big Data
CSS4E03f	Web Engineering

List of Elective Courses for CSS4E04	
Course Code	Course Name
CSS4E04a	Digital Image Processing
CSS4E04b	Advanced Topics In Database Design
CSS4E04c	Software Development for Portable Devices
CSS4E04d	Storage Area Networks
CSS4E04e	Semantic Web
CSS4E04f	Advanced Java Programming

SEMESTER I

FIRST SEMESTER				
Course code	**CSS1C01**			
Name of the course	**Discrete Mathematical Structures**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
1.1	**CORE**	4 (4:0:0)	**4**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Apply operations on set and propositional calculus.	6	U	F	P01	PSO1
CO2	Verify the validity of an argument using propositional and predicate logic.	8	An	C	P01	PSO1
CO3	Apply operations of relations and functions in discrete structures.	8	Ap	P	P01	PSO1
CO4	Understand concepts of Lattices and Boolean Algebra	10	U	C	P01	PSO1
CO5	Understand applications of Lattices and Boolean algebra in computer science domain.	12	U	F	P01	PSO1
CO6	Identify Group, Ring and Field in Group Theory	14	U	C	P01	PSO1

CO7	Understand concepts of tree, graph theory and applications in computer science domain.	8	U	C	P01	PSO1
CO8	Apply the concepts of graph theory and trees to formulate problem solving	6	Ap	P	P01	PSO1

Course Outline

Unit I [14 T]: Sets and Mathematical Logic: Set Theory - Types of sets, Set operations, Principles of Inclusion and Exclusion. Mathematical Logic - Propositional Calculus - Statement, Connectives, Conditional and Biconditional, Equivalence of Formula, Well Formed Formula, Tautologies, Duality Law, Functionally Complete Sets of Connectives, Normal Forms, Theory of Inference for the Statement Calculus, Predicate Calculus - Statement Functions, Variables and Quantifiers, Free and Bound Variables, Theory of Inference for the Predicate Calculus.

Unit II [8 T]: Functions and Relations: Functions – Types of Functions, Composition of Functions and Inverse Functions. Relations - Relations and Their Properties, Functions as relations, Closure of Relations, Composition of relations, Equivalence Relations and Partitions. Partial Ordering, Hasse Diagram. The Pigeon Hole Principle.

Unit III: [22 T] Lattices and Boolean Algebra - Lattices and Algebraic Systems, Principles of Duality, Basic Properties of Algebraic Systems Defined by Lattices, Distributive Lattices and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Boolean Expressions.

Unit IV [14 T]: Group Theory – Definition and Elementary Properties - Permutation Groups, Cyclic Groups – Subgroups - Cosets and Lagrange's Theorem, Semigroup and Monoid. Homeomorphism and Isomorphism. Rings, Integral Domains and Fields.

Unit V [14 T]: Graph Theory – Introduction, Directed Graph, Undirected Graph, Connected and Disconnected Graphs, Bipartite Graph, Complete Bipartite Graph, Isomorphic Graphs, Subgraph. Paths and Circuits. Shortest Paths in Weighted Graphs - Dijkstra's Algorithm. Eulerian Paths and Circuits, Hamiltonian Paths and Circuits. Trees - Spanning Trees and Cut-Sets, Minimum Spanning Trees - Kruskal's Algorithm, Prim's Algorithm.

References:

1. C Liu and D. Mohapatra, *Elements of Discrete Mathematics - A Computer Oriented Approach*, TMH, ISBN: 1259006395.

2. Alan Doerr and Kenneth Levassur, *Applied Discrete Structure for Computer Science*, Galgotia Publications Pvt. Ltd, ISBN: 9780574217554.
3. J. K. Sharma, *Discrete Mathematics*, Macmillan Publishers India Limited, ISBN: 1403924759.
4. J. P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Application to Computer Science*, McGraw-Hill Companies, ASIN: B001FPXR5Y.

FIRST SEMESTER				
Course code	**CSS1C02**			
Name of the course	**ADVANCED DATA STRUCTURES**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
1.2	**CORE**	**4 (3:0:2)**	**3**	**5** (Internal 1+ External 4)

Course : **CSS1C02 – ADVANCED DATA STRUCTURES**
Credits : 4 (3:0:2)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand basic and advanced data structures dealing with algorithm development	8	U	C	PO1	PSO2
CO2	Apply search and sort techniques concord with real-time computational problems	6	Ap	P	PO1	PSO2
CO3	Analyse advanced data structures dealing with algorithm development *viz.* stacks, queues, lists, trees and graphs	12	Ap	P	PO1	PSO2
CO4	Develop algorithmic approaches in real time computational environment	8	Ap	P	PO1	PSO2
CO5	Calculate the performance of algorithm using time and space complexity	5	U	C	PO1	PSO2

CO6	Evaluate the role of Hashing and Hash tables	10	Ap	P	PO1	PSO2
CO7	Analyse non-linear data structure tree	12	An	P	PO1	PSO2
CO8	Understand representation, operations and traversal mechanisms to implement the concept of a graph.	11	Ap	P	PO1	PSO2

Course Outline

Unit I [8 T] : Data structure - definition - types & operations, characteristics of data structures - Abstract Data Type (ADT) – algorithms - concepts - definition - objectives of algorithms - quality of an algorithm - space complexity and time complexity of an algorithm.

Unit II[18 T]: Counting Techniques: Basic counting techniques - permutations and combinations, asymptotic behaviour of functions. Linear data structures - Arrays - records - representation - data structure operations - traversing, inserting and deleting - sorting and searching - sorting algorithms - linear search & binary search - complexity. Linked lists - operations and implementations, - Stack - operations and its implementations (both array and linked list) - Applications - parsing arithmetic expressions, conversion and evaluating expressions. Recursion - characteristics of recursion, types of recursion applications of recursion in algorithms - comparison of recursive and non-recursive algorithms. Queue - operations and its implementations (both array and linked list) - circular queue - dequeue - priority queues, recursive lists, heterogeneous lists, deterministic skip lists, doubly linked lists and circular lists sparse matrix- representation.

Unit III[18 T]: Non-linear Data Structures - trees - terminology - tree traversals algorithms - Binary trees - threaded binary trees - binary search trees - traversals and operations on BST heap Tree - balanced trees - M-way trees - B and B+ trees, Red Black Tree, Digital Search Tree, Tries, Treaps, Huffman algorithm for extended binary tree - operations and their implementation. Graphs - representation of graphs – operations - traversals and their implementation.

Unit IV[12 T]: Hashing - overview of hashing - hash tables - hash functions and their computations open addressing - linear probing - quadratic probing - double hashing

algorithms and their implementations - rehashing - extendable hashing - separate chaining - hashing efficiency - heaps - overview of heaps - implementation and operations.

Unit V[16 T]: Heap structures - Min-Max heaps - Deaps - leftist heaps - binomial heaps - Fibonacci heaps -binary heaps - skew heaps - pairing heaps - applications - amortized analysis an unrelated puzzle - Binomial queues - skew heaps - Fibonacci heaps - Splay trees.

References:

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, *Data Structures and Algorithms*, Addison-Wesley, ISBN: 978-0201000238.
2. Horowitz E and Sahni S, *Fundamentals of Data Structures*, Computer Science Press, ISBN: 9780716780427.
3. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, *Fundamentals of Data Structures in C*, Silicon Press, ISBN: 0929306406.
4. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach With C*, Thomson Brooks/Cole Publications, Course Technology, ISBN: 9780534390808.
5. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, *Data Structure using C*, Prentice- Hall, ISBN: 9780131997462.
6. Robert Kruse, Tondo C L and Bruce Leung, *Data Structures & Program Design in C*, Pearson India, 2nd Edition, ISBN: 9788177584233.
7. U. A. Deshpande and O. G. Kakde, *Data Structures & Algorithms*, ISTE Learning Materials Centre, New Delhi, ISBN: 9788188057054.
8. Thomas H Cormen, Charles E Leiserson, and Ronald L Rivest, *Introduction to Algorithms*, 3rd Edition, Prentice Hall of India Private Limited, New Delhi, ISBN: 978-0262033848.
9. Seymour Lipschutz, *Data Structures With C*, 1st Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 0070701989.
10. Jean-Paul Tremblay, Paul G. Sorenson, P. G. Sorenson, *Introduction to Data Structures with Applications*, 2nd Edition, Mcgraw-Hill College, ISBN: 0070651574.

FIRST SEMESTER				
Course code	**CSS1C03**			
Name of the course	**Theory of Computation**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
1.3	**CORE**	4 (4:0:0)	**4**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand basic concepts in the theory of computation	6	U	F	PO1	PSO1
CO2	Understand types of formal languages viz. Type 0, Type 1, Type 2 and Type 3 and its machine equivalence	8	U	F	PO1	PSO1
CO3	Construct automation and grammar for all formal languages	8	U	F	PO1	PSO1
CO4	Differentiate strings using formal language class	6	Ap	F	PO1	PSO1
CO5	Understand real time applications using ‘types of grammar’	10	U	F	PO1	PSO1
CO6	Develop mathematical view towards general computation.	12	U	C	PO1	PSO1
CO7	Understand machines hierarchy with respect to the capabilities using Chomsky hierarchy.	16	U	C	PO1	PSO1
CO8	Classify NP and P problems	6	U	C	PO1	PSO1

Course Outline

Unit I [14 T]: Preliminaries - Introduction to formal proof and inductive proofs - The central concepts of Automata Theory - Alphabets, Strings, .Languages - Introduction to automata and grammar -Deterministic and Non-deterministic Finite Automata - Equivalence of Deterministic and Nondeterministic Finite Automata - Finite Automata with Epsilon Transitions - Equivalence of NFA with and without epsilon moves.

Unit II [16 T]: Regular Expressions, Finite Automata and Regular Expressions, Properties of Regular Languages - Pumping lemma and proof for existence of non-regular languages, Closure properties, homomorphism, substitution - Decision Properties - Equivalence and Myhill Nerode and DFA state minimization - Regular Grammar.

Unit III [16 T]: Context Free Languages - Equivalence of CFG and PDA - Normal forms (CNF and GNF) - Closure properties of CFL's - DCFL's and their properties - Decision procedures - CYK algorithm - Pumping lemma and proof for existence of non-context - free languages. Context sensitive languages: Equivalence of LBA and Context Sensitive Grammar (CSG).

Unit IV [14 T]: Turing machines - TM computations - Equivalence of standard TM with multi tape and non deterministic TM's - Turing acceptable, Turing decidable and Turing enumerable language classes - Equivalence of type 0 grammars with TM's - Church thesis - Chomsky hierarchy - Closure properties of recursive and recursively enumerable languages.

Unit V [10 T]: Computability and Decidability - halting problem - reductions - post correspondence problem. Computational complexity - Time and space bounded simulations. Classes P and NP - NP completeness - Cook's theorem.

References:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, *Introduction to Automata Theory*, Languages of Computation, 3rd Edition, Prentice Hall, ISBN: 0321455363.
2. Linz P, *An Introduction to Formal Languages and Automata*, Narosa Publishing House Pvt. Ltd., New Delhi, ISBN: 9788173197819.
3. Michael Sipser, *Introduction to Theory of Computation*, Cengage Learning India Private Limited, Indian Edition, ISBN: 8131505138.
4. H.R. Lewis and C.H. Papadimitriou, *Elements of Theory of Computation*, 2nd Edition, Prentice Hall, ISBN: 0132624788.
5. J. E. Savage, *Models of Computation*, *Exploring the Power of Computing*, Addison Wesley, 1998, Available at http://cs.brown.edu/~jes/book/.
6. Martin J.C, *Introduction to Languages and Theory of Computation*, Tata McGraw

Hill, 3rd Edition, ISBN: 9780070660489.

FIRST SEMESTER				
Course code	**CSS1C04**			
Name of the course	**The art of programming methodology**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
1.4	**CORE**	4 (2: 0: 2)	4	**5** (Internal 1+External 4)

7.

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Illustrate various notions of flowchart and algorithm.	6	Ap	P	PO1	PSO2
CO2	Design flowchart and algorithm for a given problem.	6	Ap	P	PO1	PSO2
CO3	Determine the data representation formats for a specific problem domain.	10	An	C	PO1	PSO2
CO4	Analyze user defined data types *viz.* Structures and Union.	8	U	F	PO1	PSO2
CO5	Evaluate the merits and demerits of various programming constructs to choose an appropriate problem.	14	U	C	PO1	PSO2
CO6	Implement the basic operations in file handling.	13	An	P	PO1	PSO2
CO7	Implement the concept of dynamic memory allocation.	9	U	C	PO1	PSO2

C08	Construct a program by evaluating the computational requirements.	6	U	C	PO1	PSO2

Course Outline

Unit I [22 T]: Part A: Problem Solving - Flow Chart for Structured Programming - Program Charts System Charts - Variables, data names, programming statements - Flow Chart Symbols - Terminal Symbols - I/O - Comments - Connectors - Process - Decision - Loops
- Flow Charts of Fundamental Algorithms (mentioned in Part B). Part B: Algorithm Design - Problem Solving Aspect - Top down Design - Formal Conventions Writing Algorithms - Fundamental Algorithms (Discuss the Design of Algorithms only). Part C: Program, Characteristics of a good program - Modular Approach - Programming style - Documentation and Program Maintenance - Compilers and Interpreters - Running and Debugging Programs - Syntax Errors - Run-Time Errors - Logical Errors - Concept of Structured Programming.

Unit II [12 T]: Introduction to C Programming - overview and importance of C - C Program Structure and Simple programs - Creation and Compilation of C Programs under Linux and Windows Platforms. Elements of C Language and Program constructs - structure of C program - character set, tokens, keywords, identifier - Data types, constants, symbolic constants, variables, declaration, data input and output, assignment statements. Operators in C - arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, special operators, precedence of operators - arithmetic expressions - evaluation of expressions, type conversion in expressions - precedence and associativity - mathematical functions - I/O operations.

Unit III [12 T]: Decision making - if statement, if else statement, nesting of if else and else if ladder, switch statement, break statement, continue statement, goto statement, return statement. looping - while, do-while, and for loops, nesting of loops, skipping & breaking loops. Arrays - single dimension arrays - accessing array elements - initializing an array, two dimensional & multi-dimensional arrays - memory representation - strings - processing of strings - string manipulation functions.

Unit IV [15 T]: The Concept of modularization - defining function - types of functions - User defined functions - function prototype and definition - arguments - passing parameters - call by reference - call by value - returning - nesting of functions and

recursion - passing arrays & strings to function - returning multiple values - recursion - scope and life time of variables storage class specifiers - automatic, extern, static storage, register storage. Structures & Union definition, giving values to members, structure initialization, comparison of structure variables, arrays of structures, arrays within structures, structures within arrays, structures and functions, Unions, bit-fields.

Unit V [11 T]: Pointer - pointer operator - pointer expression - declaration of pointer - initializing pointer - de-referencing - pointer to pointer, constant pointer, array of pointers, pointer to function. Files - file handling - defining & opening a file - closing a file - Input/output operations on files - error handling, random access to files, command line arguments - dynamic memory allocation - linked lists (concepts only) - preprocessor directives: macro substitution directives - simple macros - macros with arguments - nesting of macros, compiler control directives.

References:

1. Martin M. Lipschutz and Seymour Lipschutz, *Schaum's Outline of Theory and Problems of Data Processing*, ISBN: 9780070379831 (Unit I Part A).
2. Anil Bikas Chaudhuri, *The Art Of Programming Through Flowcharts & Algorithms*, Laxmi Publications, New Delhi (Unit I Part A).
3. Jean Paul Trembley and Pual G Sorenson, *An Introduction to Data Structures with Applications*, Tata McGraw Hill (Unit I Part B).
4. R G Dromey, *How to Solve by Computer*, Pearson Education, 5th Edition, ISBN: 0134340019 (Unit I Part B).
5. J.B Dixit, *Computer Fundamentals and Programming in C*, Firewall Media, ISBN: 8170088828. (Unit I Part C).
6. Dennie Van Tassel, Program Style, *Design, Efficiency, Debugging, and Testing*, PHI, ISBN: 0137299478 (Unit I Part C).
7. E Balagruswamy, *Programming in ANSI C*, TMH, 5th Edition, ISBN: 0070681821.
8. Kamthane, *Programming in C*, 2nd Edition, Pearson India, ISBN: 8131760316.
9. Brian W. Kernighan and Dennis M. Ritchie, *C Programming Language*, PHI, ISBN: 0131103628.
10. Kanetkar, *Let Us C*, BPB Publications, 8th Edition, ISBN:1934015253.

FIRST SEMESTER				
Course code	**CSS1C05**			
Name of the course	**Computer Organization and Architecture**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
1.5	**CORE**	4 (4: 0: 0)	**4**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand number system concepts.	6	U	C	PO1	PSO1
CO2	Design sequential circuit and combinational circuit.	10	U	C	PO1	PSO1
CO3	Understand the functional architecture of a computer system.	10	U	C	PO1	PSO1
CO4	Understand principles of I/O through viable mechanism specifically for secondary storage organisation.	8	U	C	PO1	PSO1
CO5	Evaluate the impact of memory elements on computer performance.	7	U	F	PO1	PSO1
CO6	Memorize computations with functional units of processor.	10	R	C	PO1	PSO1
CO7	Compare standards and guidelines towards selecting the appropriate microprocessor and microcontroller.	9	An	F	PO1	PSO1
CO8	Construct assembly language program.	12	U	C	PO1	PSO1

Course Outline

Unit I [16 T]: Number systems and Conversions, Boolean Algebra - Truth Tables - Logic gates and Map simplification - flip-flops - design of combinational and sequential circuits - examples of digital circuits - adders, multiplexers, decoders, counters, shift registers - register transfer language and micro operations - data representation - data types, sign and magnitude, complements, fixed-point representation, floating-point representation, other binary codes, error detection codes.

Unit II[12 T]: Basic computer organization - machine instructions - classification, function, addresses, size, addressing modes - instruction cycle - instruction sequencing. Fundamental concepts - registers, register transfers, performing arithmetic or logic operations, memory read and write, execution of a complete instruction, branch instruction, single bus, two bus, three bus organization, a complete processor - Control unit - hardwired control, micro programmed control, micro instructions-types.

Unit III [14 T]: Arithmetic & Logic Unit - addition of positive numbers - fast adders - signed addition and subtraction - addition/subtraction logic unit - multiplication of positive numbers - array multiplier, sequential multiplier - signed number multiplication - multiplication using Booth's algorithm - fast multiplication - bit pair recording of multiplication, division-restoring and non-restoring algorithms, floating point numbers and operations.

Unit IV [12 T]: Main Memory - memory hierarchy - main memory - RAM, ROM - memory cells
- cell organization - working - performance considerations - cache memory - virtual memory - memory management requirements - secondary storage - memory interleaving. Input / Output Organization - Accessing I/O ,d&Vices - programmed I/O, interrupt I/O - interrupts - interrupt processing - hardware interrupts - programmable interrupt controller - vectored interrupts - interrupt nesting - daisy chaining - direct memory access (DMA) - DMA operations & DMA Controller, Introduction to I/O interfaces, I/O channels, IO Processors.

Unit V [18T]: Architecture - General 8-bit microprocessor and its architecture - 8085 - Functional block diagram - architecture functions of different sections - architecture of 8086 CPU. Instruction Sets - Instruction format - addressing modes - instruction set of 8085 CPU Instruction cycle - timing diagrams - different machine cycles - fetch and execute operations estimation of execution time - estimation of execution time. Intel 8051 Micro controller - Architecture - basic instructions - basic assembly language programs peripherals: interrupts, timers, parallel port, serial port.

References:

1. V Carl Hamacher, Zvonko Vranesic and Safwat Zaky, *Computer Organization*, Mc-

Graw Hill International Edition, 5th Edition, ISBN: 9780071122184.

2. Morris Mano, *Digital Logic and Computer Design*, Prentice Hall of India, ISBN: 0876924178.
3. M Morris Mano, *Computer System Architecture*, Prentice Hall, 3rd Edition. ISBN: 0131755633.
4. William Stallings, *Computer Organization and Architecture*, 9th Edition,Prentice Hall, ISBN: 013293633X.
5. Andrew S Tanenbaum, *Structured Computer Organization*, Prentice Hall, 6th Edition, ISBN: 0132916525.
6. Floyd Thomas L, *Digital Fundamentals*, Pearson Education, 10th Edition, Prentice Hall, ISBN: 0132359235.
7. Albert Paul Malvino, Donald P Leach, *Digital Principles and Applications*, McGraw Hill, 4th Edition, ISBN: 0070398836.
8. Thomas C Bartee, *Digital Computer Fundamentals*, McGraw Hill, 6th Edition, ASIN: B004H0SL5K.
9. Ramesh. S. Gaonkar, *Microprocessor Architecture*, Programming, and Applications with the 8085, 6th Edition, Wiley Eastern Ltd, New Delhi, ISBN: 9788187972884.
10. Mohamed Rafiquzzaman, *Introduction to Microprocessors and Microcomputer Based System Design*, 2nd Edition, CRC Press, ISBN: 9780849344756.
11. Muhammad Ali Mazidi and *et al.*, *The 8051 Microcontroller and Embedded Systems*, Pearson Education Asia, 5th Indian Reprint, ISBN: 013119402X.

FIRST SEMESTER				
Course code	**CSS1L01**			
Name of the course	**Practical I**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
1.6	**CORE**	2 (0: 0: 4)	**4**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Construct programs relating to the theory portions covered in CSS1C04 The Art of Programming Methodology	36	Ap	P	PO1	PSO2
CO2	Construct programs relating to the theory portions covered in CSS1C02 Advanced Data Structures	36	Ap	P	PO1	PSO2

Course Outline

Unit I: C Programming

1. Simple C Programs like area of a circle, checking whether a given number is odd or even.
2. Implementation of programs using Loops (pyramid printing, factorial computation, number reversing, checking for Armstrong numbers, finding first N or Nth Prime numbers etc).
3. Use of 1D and 2D Arrays (searching, sorting and vector operations, matrix addition, matrix multiplication).
4. String Manipulations.
5. Structures and Unions (like addition of two complex numbers, student record creation and manipulation etc).
6. Writing functions.
7. Implementation of recursion (compute factorial, reverse a string *etc*).
8. Command line arguments.
9. Pointers - simple programs to learn concept of pointers, array operation using pointers etc.
10. File operations – file and structures.

Unit 2: Data Structures and Algorithms

1. Implementation of stacks using arrays.
2. Implementation of queues, circular queue using arrays.
3. Implementation of sequential search and binary searchtechniques.
4. Implementation of linked lists and operations (add, insert, delete, search) on linked lists.
5. Implementation of stacks using linked list.
6. Implementation of queues using linked list.
7. Implementation of doubly linked list.
8. Implementation of circular linked list.
9. Implementation of binary tree and traversals.
10. Implementation of Binary search trees and perform the operations on BST.
11. Implementation of various sorting algorithms.
12. Conversion of an infix expression to the postfix form using stacks.
13. Evaluation of a postfix expression.
14. Implementation of graphs and graph traversals.
15. Implementation of heap tree and operations.

FIRST SEMESTER				
Course code	**CSS1A01**			
Name of the course	**Introduction to Research (Ability Enhancement Audit Course)**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
1.7	**Audit**	4 (4: 0: 0)	**0**	**5** (Internal 5+ External 0)

CO	CO Statement	Cognitive Level(CL)	Knowledge Category (KC)
CO1	Understand research terminology.	U	C
CO2	Understand ethical principles of research.	U	C
CO3	Identify the components of a literature review process.	U	C
CO4	Critically analyse published research.	An	P
CO5	Introduce research methods in the field of computer Science.	C	M

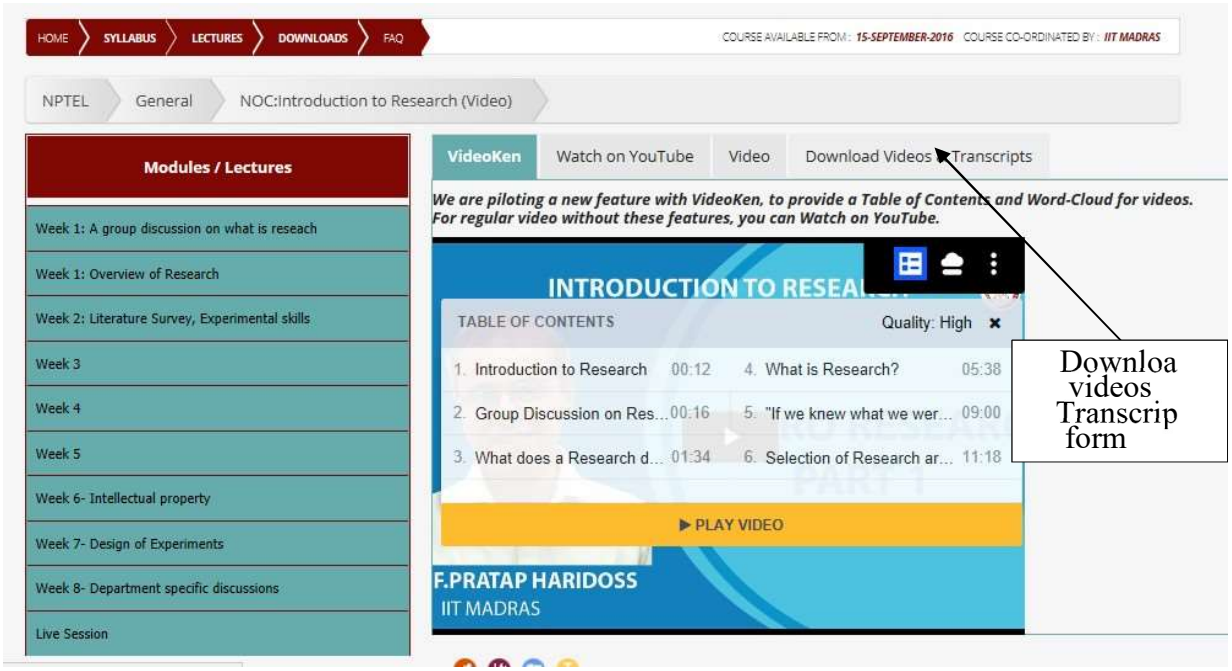
Course Evaluation & Course Credit

The Ability Enhancement Audit Course has 4 credits which will not be counted for evaluating the overall SGPA & CGPA. The department shall conduct examination of 2 Hrs duration with a minimum of 20 weightage before the conclusion of first semester classes. Students have to obtain only minimum pass requirements in this Audit Course.

Course Delivery Mode

This course is an Ability Enhancement Audit Course. The course content is not delivered

in the classrooms. Instead, the students need to do self study or can enrol themselves for the online course offered at NPTEL. The online course is available at https://nptel.ac.in/courses/121106007/. Students can either view the video module online or can download the video lessons and transcripts to view or read them offline.



Course Outline

The students are encouraged to cover the following modules of the course *Introduction to Research* from NPTEL:

- Week1: Overview of Research
- Week2: Overview of Literature Survey: Literature Survey using Web of Science, Literature Survey using Scopus, Writing Up, Tutorial on using BibTeX with LaTeX to add references to a document, Tutorial on using Microsoft Word with Bibliographic Sources, Tutorial on using Microsoft Word with endnote entries
- Week3: Data Analysis
- Week4: How to make Technical presentation – Technical Writing
- Week 6: Intellectual property
- Week8: Research in Computer Science & Engineering

References:

1. Video Lessons and Transcripts available (including in the regional language) at https://nptel.ac.in/courses/nptel_download.php?subjectid=121106007

SEMESTER II

SECOND SEMESTER				
Course code	**CSS2C06**			
Name of the course	**DESIGN AND ANALYSIS OF ALGORITHMS**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
2.1	**CORE**	**4 (4:0:0)**	**4**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand algorithm design and model of computation	8	U	C	PO1	PSO2
CO2	Analyze time and space complexity of algorithms while solving recurrences	8	An	P	PO1	PSO2
CO3	Argue the correctness of algorithms using inductive proofs and invariants	8	An	P	PO1	PSO2
CO4	Describe the divide-and-conquer, Brute Force and Branch-and-Bound techniques to explain when an algorithmic design situation calls for it.	11	An	P	PO1	PSO2
CO5	Analyse the complexity of Greedy approach and Dynamic Programming	10	An	P	PO1	PSO2
CO6	Describe classes P, NP, and NP-Complete.	8	R	C	PO1	PSO2

C07	Familiar with certain problem of NP-Complete	7	R	C	PO1	PSO2
C08	Analyze parallel algorithms and techniques to deal with hard problems.	12	R	C	PO1	PSO2

Course Outline

Unit I [12 T]: Algorithm Design: Introduction, Steps in developing algorithm, Methods of specifying an algorithm, Decisions prior to designing: based on the capabilities of the device, based on the nature of solutions, based on the most suitable data structures. Model of Computation: RAM model and PRAM model. Important Problem Types (Introductory concepts): Sorting, Searching, String processing, Graph problems, Combinatorial problems, Geometric problems and Numerical problems.

Unit II [15 T]: Basic Technique for Design of Efficient Algorithm: Brute Force approach (String matching), Divide-and-Conquer approach (Merge sort), Branch-and-Bound technique (Knapsack problem). Greedy approach (Kruskal's algorithm and Prim's Algorithm), Dynamic Programming (Longest Common Subsequence), Backtracking (Sum of subsets problem).

Unit III [18 T]: Algorithm Analysis: Importance of algorithm analysis, Time and Space Complexity. Growth of Functions: Asymptotic notations, Cost estimation based on key operations- Big Oh, Big Omega, Little Oh, Little Omega and Theta notations, Big Oh Ratio Theorem, Big Theta Ratio Theorem, Big Omega Ratio Theorem. Analyzing Algorithm Control Structures, Solving Recurrences: Iteration Method, Substitution Method, The Recursion Tree Method, Master's Theorem, Problem solving using Master's Theorem Case 1, Case 2 and Case 3. Analysis of Strassen's algorithm for matrix multiplication, Analysis of Merge sort.

Unit IV [12 T]: Complexity - Complexity Classes: P, NP, NP Hard and NP Complete problems. NP Completeness reductions for Travelling Salesman Problem and Hamiltonian Cycle. P versus NP problem.

Unit V [15 T]: Analysing Parallel Algorithms: Time Complexity, Cost, Number of Processors, Space Complexity, Speed up, Efficiency, Scalability, Amdahl's Law. Parallel merging and sorting, Euler tour technique, Parallel prefix computation, Deterministic symmetry breaking.

References:

1. Thomas H Cormen, Charles E Leiserson, and Ronald L Rivest, *Introduction to Algorithms*, 3rd Edition, Prentice Hall of India Private Limited, New Delhi, ISBN: 9780262033848 (Unit I, II, III and IV).
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, *The Design and Analysis of Computer Algorithms*, 1st Edition. Addison Wesley, ISBN: 0534915728 (Unit I, II, III and IV).
3. Pallaw, V K, *Design and Analysis of Algorithms*, Asian Books Private Ltd, 2012, ISBN: 8184121687 (Unit I, II, III and IV).
4. Sanjay Razdan, *Fundamentals of Parallel Computing*, Narosa Publishing House, 2014, ISBN: 9788184873481 (Unit V).
5. Pandey H M, *Design and Analysis of Algorithms*, University Science Press, 2013, ISBN: 9788131803349 (Unit I, II, III and IV).
6. Upadhyay N, *Design and Analysis of Algorithms*, SK Kataria & Sons, 2008 (Unit I, II, III and IV).
7. U. Manber, *Introduction to Algorithms: A Creative Approach*, Addison Wesley, ISBN: 9780201003277 (Unit I, II, III and IV).
8. Gilles Brassard and Paul Bratley, *Fundamentals of Algorithmics*, Prentice-Hall of India, ISBN: 0133350681 (Unit I, II, III and IV).
9. Goodman S E and Hedetniemi, *Introduction to the Design and Analysis of Algorithms*, Mcgraw Hill, ISBN: 0070237530 (Unit I, II, III and IV).
10. Horowitz E and Sahni S, *Fundamentals of Computer Algorithms*, Galgotia Publications Pvt. Ltd, ISBN: 8175152575 (Unit I, II, III and IV).
11. Oded Goldreich, P, *NP and NP - Completeness*, Cambridge University Press, 2011. ISBN: 0521122546 (Unit V).
12. Donald Knuth, *The Art of Computer Programming, Fundamental Algorithms*, Volume 1, Addison Wesley, 1997, ISBN: 8177587544 (Unit I).
13. Sanjeev Arora and Boaz Borak, *Computational Complexity - A Modern Approach*, Cambridge University Press; 2009, ISBN: 0521424267 (Unit III).
14. Daniel Hills W and Bruce M Boghosian, *Parallel Scientific Computation*, Science, 13 August 1993, Vol. 261 (5123), pp.856-863 (Unit V).

SECOND SEMESTER				
Course code	CSS2C07			
Name of the course	**OPERATING SYSTEM CONCEPTS**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
2.2	**CORE**	**4 (3:0:2)**	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Describe major responsibilities of a contemporary operating system	6	U	C	PO1	PSO2
CO2	Understand the most fundamental subsystems of an OS and the functions that each subsystem is responsible of	6	U	C	PO1	PSO2
CO3	Analyse the concept of a process, thread, mutual exclusion and Deadlock.	8	An	P	PO1	PSO2
CO4	Understand various scheduling algorithms to choose the most suitable one for a given application scenario	12	U	C	PO1	PSO2
CO5	Understand the concept of IPC	6	E	P	PO1	PSO2

CO6	Analyse the concepts of memory management and associated techniques.	10	An	P	PO1	PSO2
CO7	Evaluate the performance of memory allocation and replacement techniques.	12	E	C	PO1	PSO2
CO8	Familiarize client/server computing, IOS and Android.	12	An	P	PO1	PSO2

Course Outline:

Unit I [15 T]: Operating System Overview - Objectives and functions - Evolution of Operating System - Major Achievements - Process Description and Control - Process, Creation & Termination of Processes, Five State Model, Suspended Process, Process Description, Process Control - Modes of Execution, Process Creation, Process and Mode Switching. Threads - Processes Vs Threads, Multithreading, Thread States, Types of Threads, Multi Core and Multithreading. Case Study - Unix SVR4 Process Management, Linux Process and Thread Management.

Unit II [18 T]: Concurrency - Principles, Race Condition, Operating System Concerns, Process Interaction, Completion for Resources, Cooperation by Sharing. Mutual Exclusion - Requirements, Hardware Support, Semaphores, Producer Consumer Problem, Monitors, Message Passing, Readers/Writers Problem. Deadlock - Principles, Prevention, Avoidance, Detection, Recovery, Dining Philosophers Problem. Case Study: Unix Concurrency Mechanisms.

Unit III [18 T]: Memory Management, Address binding, Logical Vs Physical address space, Dynamic Loading, Dynamic Linking and Shared Libraries, Overlays, Swapping, Contiguous Memory allocation, Paging, Segmentation, Virtual memory, Demand paging, Page replacement, Thrashing. Case Study: Windows Memory Management.

Unit IV [20 T]: Uniprocessor Scheduling - types, scheduling algorithms - criteria, nonpreemptive, preemptive. Comparative study of scheduling algorithms - FCFS, SJF, Priority, RR, Multilevel, Feedback Queue. Multiprocessor Scheduling - Classification, Granularity, Design Issues, Process Scheduling, Thread Scheduling. Real Time Scheduling - Background, Characteristics of Real Time OS, Scheduling, Deadline Scheduling, Rate Monotonic Scheduling, Priority Inversion. Case study: Linux Scheduling.

Unit V [16 T]: Client/Server Computing - Definition, Applications, Classes, Three-Tier Client/Server Architecture, Middleware. Service-Oriented Architecture- Distributed Message Passing - Remote Procedure Calls - Clusters. Mobile Operating Systems - Characteristics - Comparative Study of the Features of iOS and Android.

References

1. William Stallings, *Operating System- Internals and Design Principles*, 7th Edition, Pearson, ISBN: 9780273751502.
2. Abraham Silberschatz, Peter B. Galvin and, Greg Gagne, *Operating System Concepts*, 9th Edition, John Wiley & SonsTISBN: 9781118063330.
3. Ann Mclver McHoes and Ida M. Flynn, *Understanding Operating Systems*, 6th Edition, Cengage Learning, 2010, ISBN: 9781439079201.
4. Mukesh Singhal and Niranjan G. Shivaratri, *Advanced Concepts in Operating Systems - Distributed, Database, and Multiprocessor Operating Systems*, Tata McGraw-Hill Education Private Limited, ISBN: 9780070575721.

SECOND SEMESTER				
Course code	**CSS2C08**			
Name of the course	**COMPUTER NETWORKS**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
2.3	**CORE**	**4 (2:0:2)**	**2**	**5** (Internal 1+ External 4)

5.

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Study the basic taxonomy and terminology of Computer Networking and enumerate the layers of OSI model and TCP/IP model.	10	R	C	PO1	PSO2

CO2	Remember the concepts of data communication at physical layer	8	R	C	PO1	PSO2
CO3	Compare ISO - OSI model with TCP/IP model.	6	An	C	PO1	PSO2
CO4	Identify protocols at Application layer	12	An	F	PO1	PSO2
CO5	Analyze transport layer protocols and congestion control algorithms.	8	An	F	PO1	PSO2
CO6	Analyze various routing algorithms and protocols at network layer.	6	An	P	PO1	PSO2
CO7	Understand different networking protocols at data link layer.	10	U	F	PO1	PSO2
CO8	Analyze different network security methods	12	An	C	PO1	PSO2

Course Outline:

Unit I [14 T] Introduction to Computer networks - introduction - topology - categories of networks Internetwork - Internet - network modes- layered model - OSI and TCP/IP Models Transmission media - Wired and unwired media. Computer networks and Internet - the network edge - the network core - network access - delay and loss - protocol layers and services - history of computer networking and Internet.

Unit II [12 T]: Application layer protocols – principles – the web and HTTP – FTP – Email in Internet – DNS. Socket programming – building a Web server - content distribution.

Unit III [13 T]: Transport layer services – introduction – relationship between Transport and Network layer – UDP – reliable data transfer – TCP - congestion control - Network layer services – routing – IP - routing in Internet - router - IPV6 - multicast routing – mobility.

Unit IV [10 T]: Link layer services - error detection and correction - multiple access protocols – LAN address – ARP – Ethernet – hubs – bridges – switches - wireless links – PPP - ATM.

Unit V [12 T]: Security in Networks – Principles of Cryptography – Authentication – Integrity – Key Distribution and Certification – Firewalls – Attacks and Counter Measures.

References:

1. J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach Featuring Internet*, 6th Edition, Perason Education, ISBN: 0132856204.
2. Behrouz Forouzan, *Data Communications and Networking*, 4th Edition, McGraw-Hill Reprint, ISBN: 0073250325.
3. Peterson L.L. and Davie B .S., *Computer Networks, A Systems Approach*, 5th Edition, Morgan Kaufmann, ISBN: 9780123850591.
4. Keshav, *An Engineering Approach to Computer Networking*, Pearson Education Asia, ISBN: 97898123598652000.
5. Andrew S. Tanenbaum, *Computer Networks*, 5th Edition, PHI, ISBN: 9788131787571.
6. Herbert Scheldt, *Java Complete Reference*, 7th Edition, McGraw-Hill Osborne Media, ISBN: 9780072263855.

SECOND SEMESTER				
Course code	**CSS2C09**			
Name of the course	**Computational Intelligence**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
2.4	**Core**	4 (4:0 :0)	**4**	**5 (Internal 1+ External 4)**

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the basics of Artificial Intelligence and its application.	4	U	F	PO1	PSO1
CO2	Formalize the problem as a state space or graph	3	Ap	P	PO1	PSO1
CO3	Apply search and game based techniques to solve state space problem assigned with heuristics.	18	U	P	PO1	PSO1
CO4	Understand basic issues of knowledge representation and represent viz. rules, logical reasoning and ISA relationship.	18	An	P	PO1	PSO1
CO5	Introduce Planning system and components in AI	5	U	F	PO1	PSO1
CO6	Familiarize on expert system and its lifecycle in AI	7	U	F	PO1	PSO1

CO7	Compare various machine learning methods.	4	U	P	PO1	PSO1
CO8	Understand basics of genetic algorithm and ANN.	4	U	P	PO1	PSO1
CO9	Comprehend advanced machine learning techniques such as fuzzy logic and genetic algorithms	6	C	F	PO1	PSO1
C10	Introduce Rational Intelligent Agent and types of Agents designed for problem solving	3	U	C	PO1	PSO1

Course Outline

Unit I:[10 T]

Introduction - Artificial Intelligence - problems, scope and applications, problem space and search - production system- characteristics – artificial intelligent agents, structures and strategies for state space search, strategies for space search, using state space to represent reasoning with the predicate calculus.

Unit II: [15 T]

Search technique**:** depth first search, breadth first search. Heuristics Search: control and implementation of state space search, generate and test, hill climbing, Best-first search, problem reduction, constraint satisfaction, means- ends analysis, heuristic in games, complexity issues.

Unit III: [18 T]

Knowledge representation issues, representation and mappings, representing simple facts in logic, representing instances and ISA relationships, computable functions and predicates, first order predicate calculus, inference rules, clause form, resolution, unification. natural deduction, knowledge representation using rules, Slot and filler structures: semantic nets, frames, conceptual dependency, scripts, logic programming, forward versus backward reasoning, symbolic reasoning under uncertainty- non-monotonic reasoning.

Unit IV: [18 T]

Game playing - the mini-max search procedure, adding alpha-beta cut-offs, additional refinement, iterative deepening, planning system and its components, understanding, understanding as constrained satisfaction. Definition and characteristics of expert system, representing and using domain knowledge, expert system shells. Knowledge engineering,

knowledge acquisition, expert system life cycle & expert system tools, MYCIN & DENDRAL examples of expert system.

Unit V: [11 T]

Machine learning - rote learning, learning by taking advice, learning in problem solving, learning from examples, explanation based learning, analogy, formal learning theory, connectionist models - hopfield networks, learning in neural networks, back propagation, the genetic algorithm, classifier systems and genetic programming, artificial life and society based learning.

References:

1. Elaine Rich, Kevin Knight and Shivshankar B. Nair, *Artificial Intelligence*, 3rd Edition, Tata - McGraw Hill, New Delhi, ISBN: 0070087709.
2. V S Janakiraman, K Sarukesi and P Gopalakrishnan, *Foundations of Artificial Intelligence and Expert System*, Macmillan India Limited, ISBN: 0333926250.
3. Stuart Russell and Peter Norvg, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Prentice Hall, ISBN: 0136042597.'
4. G. F. Luger and W.A Stubblefield, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving*, Addison-Wesley, 6th Edition, ISBN: 9780321545893.
5. P. H. Winston, *Artificial Intelligence*, Addison-Wesley, 3rd Edition, ISBN: 0201533774.
6. Nils J. Nilsson, Artificial Intelligence, A New Synthesis, 1st Edition, Morgan Kaufmann Publishers, Inc, ISBN: 1558604677.

SECOND SEMESTER				
Course code	**CSS2C10**			
Name of the course	**Principles of Software Engineering**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
2.5	**CORE**	**4 (4:0:0)**	**4**	**5 (Internal 1+ External 4)**

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand principles and practices of software engineering	10	U	C	PO1	PSO4
CO2	Identify software models for different nature of projects	10	AN	F	PO1	PSO4
CO3	Familiarize tools for software design process.	10	U	C	PO1	PSO4
CO4	Understand the concepts of process planning and scheduling	8	U	F	PO1	PSO4
CO5	Identify the risk associated with projects.	8	U	C	PO1	PSO4
CO6	Develop strategies for testing.	10	AN	F	PO1	PSO4
CO7	Understand processes on product survey.	6	U	C	PO1	PSO4
CO8	Familiarize the methods of report writing.	10	U	C	PO1	PSO4

Course Outline

Unit I [15 T]: Introduction – problem domain - software engineering challenges – approaches software process and development models – agile models – SDLC - software process.

Unit II [20 T]: Software requirements analysis & specification - feasibility study - types of feasibility – software requirements - problem analysis – requirement specification – functional specification – metrics. Software design – outcome – cohesion and coupling – layered arrangement of modules – approaches to software design - structured analysis – DFD extending DFD technique for applying to real-time systems – structured design – detailed design - object oriented modelling – use case model – class diagram – interaction diagram - activity diagram - data diagram – state chart diagram - ER diagram.

Unit III [35 T]: User Interface (UI) design – characteristics – basic concepts – types – fundamentals of component-based GUI Development – UI design methodology – process planning – cost estimation – project scheduling – configuration management – risk management - software coding – review – documentation – software testing - software testing basics - steps involved in test plan - software testing strategies.

Unit IV [10 T]: Managing project – time management – setting aims and objectives – techniques for generating ideas – literature survey – types of information sources – writing literature survey.

Unit V [10 T]: Project story preparation – key deliverables – communicating with experts – forms of communication – presenting ideas – common problems faced by a research scholar – report writing.

References:

1. Pankaj Jalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa Publishing House, ISBN: 9788173197024.
2. Rajib Mall, *Fundamentals of Software Engineering*, 3rd Edition, PHI Learning Pvt Ltd, ISBN: 9788120338197.
3. Rohit Khurana, *Software Engineering: Principles and Practices*, 2nd Edition, Vikas Publishing House Pvt Ltd, ISBN: 8125939466.
4. Andy Hunt, *Your Research Hunt, How to Manage it*, Routledge, ISBN: 0415344085.
5. Michael Jay Polonsky, David S. Waller, *Designing and Managing a Research Project: A Business Student's Guide*, Sage, ISBN: 1412977754.

6. Richard Bullock, Maureen Daly Goggin and Francine Weinberg, *The Norton Field Guide to Writing (with Readings and Handbook)*, 3rd Edition, W. W. Norton & Company, ISBN: 0393919595.
7. Kavadia Garg, Agrawal and Agrawal, *An introduction to Research Methodology*, Rbsa Publishers ISBN: 8176111651.

SECOND SEMESTER				
Course code	**CSS2L02**			
Name of the course	**Practical I**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
2.6	**CORE**	**(4: 0: 0)**	**4**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Construct programs relating to the theory portions covered in CSS2C07 *Operating System Concepts*	36	Ap	C	PO1	PSO2
CO2	Construct programs relating to the theory portions covered in CSS2C08 *Computer Networks*	36	Ap	P	PO1	PSO2

Course Outline

Unit I: Computer Networks

1. Design a LAN with a given set of requirements. The design should include topology, hardware and software requirements like cable, connectors, hubs/switches/bridges, interface cards along with a budget for the LAN. (Faculty in charge should give the requirements to the students)*.
2. Establish a LAN that consists of at least one server and two clients*.
3. Study of network utilities in Linux/Windows (hostname, ping, ifconfig, ipconfig, netstat, nslookup, telnet, traceroute, finger, telnet, tracert, arp, ftp etc)*.
4. Implementation of TCP Client.
5. Implementation of TCP Server.
6. Write a program to check the Date and Time in TCP Date Time Client.
7. Write a program to check the Date and Time in TCP Date Time Server.
8. Implementation of UDP client and server.
9. Write a program to transfer Files using UDP.
10. Implementation of transferring files using FTP.
11. Write a program to simulate the sliding window protocol.
12. Study of Network Simulators (NS2/Glomosim)*.

**These questions are NOT meant for examination purpose. However Viva questions can be asked based on these experiments.*

Unit II: Operating System Concepts

1. Write programs using the following system calls: fork(), execl() and wait().
2. Write File System Calls to write, append and display.
3. To accept the burst time for a set of processes for FCFS scheduling and create chart consisting of the burst time, turnaround time and wait time of each process.
4. To accept the burst time for a set of processes for SJF scheduling and create chart consisting of the burst time, turnaround time and wait time of each process.
5. To accept the burst time and priority for a set of processes for Priority scheduling and create chart consisting of the burst time, priority, turnaround time and wait time of each process.
6. To create n Fibonacci numbers and prepare a list of prime numbers amongst them (use pipe for IPC).
7. To demonstrate IPC using shared memory.
8. To allocate memory requirements for processes using best fit allocation- Accept n processes with their memory requirements and *n* holes with their sizes. Perform memory allocation using Best Fit algorithm. Display a chart consisting of the process and the allocated hole.
9. To accept n processes with their memory requirements and n holes with their sizes. Perform memory allocation using First Fit algorithm. Display a chart consisting of the process and the allocated hole.

10. To demonstrate the process of contiguous allocation of memory blocks to store files of varying sizes.
11. To implement Producer Consumer problem using semaphores.

Course : **CSS2A02**
Credit : 4 (4: 0: 0)

SECOND SEMESTER				
Course code	**CSS2A02**			
Name of the course	**Term Paper (Professional Competency Audit Course)**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
2.7	**Audit**	**(4: 0: 0)**	**0**	**5 (5+0)**

CO	CO Statement
CO1	Understand the techniques of literature survey.
CO2	Understand the process of presenting the research work through seminars and technical reports.

Course Delivery Mode

Students be given choice to opt for the supervisor according to his/her area of interest. The Department council will finally decide and distribute the students among the faculty members by accommodating the choice and interest of the students, as far as possible. The faculty in charge must give proper directions and guidance to the students in carrying out the literature review effectively and systematically.

Course Evaluation & Course Credit

The Professional Competency Audit Course has 4 credits which will not be counted for evaluating the overall SGPA & CGPA. The Department shall conduct the final evaluation of the course based on the following criteria and have to upload the results through the Academic Management System.

Component	Weightage

Publication of the Review Paper in a UGC Listed, Peer Reviewed or other peer reviewed refereed Journals	20% (Maximum weightage be given to UGC listed Journal and weightage be reduced in other cases)
Presentation in an International/ National/ Regional Conference	20% (Maximum weightage be given to International Conferences with Proceeding having ISBN and weightage be reduced in other cases)
Quality of the Technical Report	40%
Quality and Effectiveness of the Report Presentation	20%

Students have to obtain only minimum pass requirements in this Audit Course.

References:

Articles from ACM/IEEE/INFLIBNET Journals/Conference Proceedings and/or equivalent documents, standard textbooks and web based material, approved by the supervisor.

SEMESTER III

THIRD SEMESTER				
Course code	**CSS3C01**			
Name of the course	**Advanced Database Management System**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.1	**Core**	**4 (3:0:1)**	**4**	**5 (1+4)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Recall the basic concepts in database management system	14	R	C	PO1	PSO2
CO2	Understand the relational database design (normalization)	14	U	F	PO1	PSO2
CO3	Recall and memorize structured query language , PL/SQL	14	Ap	P	PO1	PSO2
CO4	Understand transaction , concurrency control in database	15	U	C	PO1	PSO2
CO5	Understand the concepts in object oriented database management system	15	U	C	PO1	PSO2

Course Outline

Unit I [12 T]: Introduction - purpose of database systems, views of data - data abstraction, instances and schemas, data independence, data models - hierarchical data model, network data model, relational data model, ER d&tg9,mg9lei. Database languages - DDL, DML, transaction management, storage management, database administrator,

database users, overall system structure. Relational data model - relational model concepts, keys, integrity constraints - domain constraints, key constraints, entity integrity constraints, referential integrity constraints. ER data model - basic concepts, constraints, keys, design issues, entity relationship diagram, weak entity sets, extended ER features, design of an ER database schema, reduction of an ER schema to tables. Relational algebra and calculus - relational algebra - selection and projection, set operations, renaming, joins, division. Relational calculus - tuple relational calculus, domain relational calculus. Expressive power of algebra and calculus.

Unit II[12 T]: Relational database design - anomalies in a database - functional dependency - lossless join and dependency- preserving decomposition - normalization - normal forms - first, second and third normal form - Boyce Codd normal form - multivalued, dependency - fourth normal form - join dependency - project join normal form - domain key normal form.

Unit III [12 T]: Relational database query languages - basics of QBE and SQL. Data definition in SQL data types, creation, insertion, viewing, updation, deletion of tables, mo difying the structure of the tables, renaming, dropping of tables. Data constraints - I/O constraints, primary key, foreign key, unique key constraints, ALTER TABLE command database manipulation in SQL - computations done on table data - SELECT command, logical operators, range searching, pattern matching, grouping data from tables in SQL, GROUP BY, HAVING clauses. Joins - joining multiple tables, joining a table to it. DELETE - UPDATE. Views - creation, renaming the column of a view, destroys view. Program with SQL - data types Using SET and SELECT commands, procedural flow, IF, IF /ELSE, WHILE, GOTO, global variables. Security - locks, types of locks, levels of locks. Cursors - working with cursors, error handling, developing stored procedures, CREATE, A LTER and DROP, passing and returning data to stored procedures, using stored procedures within queries, building user defined functions, creating and calling a scalar function, implementing triggers, creating triggers, multiple trigger interaction (Use MySQL as the RDBMS).

Unit IV [12 T]: Transaction management, concurrency control and query processing - concept,
definition and states of transactions, ACID properties - concurrency control, serializability - conflict serializability, view serializability, recoverability-recoverable schedules, non- cascading schedules, strict schedules. Concurrency control schemes - locking- two phase locking, deadlock, granularity, timestamp ordering protocol. Basics of query processing.

Unit V [12 T]: Object Oriented Database Management Systems (OODBMS) - concepts, need for OODBMS, composite objects, issues in OODBMSs, advantages and disadvantages of OODBMS. Distributed databases - motivation - distributed database concepts, types of distribution, architecture of distributed databases, the design of

distributed databases, distributed transactions, commit protocols for distributed databases.

Reference

1. Elmasri and Navathe, *Fundamentals of Database Systems*, 5th Edition, Pearson, ISBN: 9788131758984.
2. Abraham Silbersehatz, Henry F. Korth and S.Sudarshan, *Database System Concepts*, 6th Edition, Tata McGraw-Hill, ISBN: 0071325220.
3. CJ Date, *An Introduction to Database Systems*, 8th Edition, Addison Wesley, ISBN: 0321197844.
4. Ramakrishnan and Gehrke, *Database Management Systems*, 3rd Edition, McGraw - Hill Education, ISBN: 9339213114.
5. Alexis Leon and Mathews Leon, *Database Management Systems*, 1st Edition, Vikas Publishers, ISBN: 8182092221.
6. Vikram Vaswani, *MySQL The complete Reference*, 1st Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 0070586845.
7. Joel Murach, *Murach's Mysql*, Mike Murach & Associates Inc, ISBN: 9350237695.
8. Paul DuBois, *MySQL Cookbook*, 2nd Edition, O'Reilly Media, ISBN: 8184042809.

THIRD SEMESTER				
Course code	**CSS3C12**			
Name of the course	**Object Oriented Programming Concepts**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.2	**Core**	4 (2:0: 3)	**5**	**5 (1 Internal+ 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand object oriented programming concepts and formulate Java programs that include basic constructs	14	U	C	PO1	PSO2
CO2	Develop java program using packages and interfaces.	14	Ap	P	PO1	PSO2
CO3	Understand exception handling, multithreaded applications, synchronizations and I/O	15	U	C	PO1	PSO2
CO4	Understand socket programming, JDBC architecture and connectivity	14	U	C	PO1	PSO2
CO5	Develop GUI and applets for web based applications and Familiarize object oriented modeling and design patterns in UML.	15	Ap	P	PO1	PSO2

Course Outline

Unit I [14 T]: Introduction to OOPS - basic principles of object orientation (objects ,

attributes and methods, encapsulation and information hiding, state retention, object identity, messages, class hierarchy, inheritance, polymorphism, genericity) - introduction to Java history, versioning, the Java Virtual Machine, byte code, features of Java, language components - primitive data types, comments, keywords, literals, variables scope & declarations, control structures - FOR, IF, WHILE, DO WHILE, SWITCH, BREAK, CONTINUE statements - operators - casts and conversions - arrays.

Unit II [14 T]: Object - oriented programming – classes - class fundamentals - declaring objects - new operator – methods – parameter passing – constructors - parameterized constructors - this keyword – finalize method. Overloading methods and constructors, access controls, static and final, nested and inner classes. Inheritance - extends, member access and inheritance, super keyword, polymorphism, method overriding, dynamic method dispatch, abstract classes, packages and interfaces.

Unit III [15 T]: Exceptions, threads & IO in Java - The file and standard streams, stream classes and interfaces, using byte streams and character streams, threads - threads vs. processes, creating threads, runnable interface, thread class, inter thread communication, synchronization. Exceptions - basic of Java exception handling, hierarchy, developing user defined exception classes.

Unit IV [14 T]: Applets, AWT & Swing - applet class, types of applet, skeleton, applet tag, passing parameters, event handling, delegation event model, event classes, listeners, AWT classes and window fundamentals, frames, working with fonts, graphics and colors, AWT controls, layouts and menus, dialogue boxes. Swings - Japplets, icon, labels, buttons, textbox, combo box, tables and panes.

Unit V[15 T]: Database and sockets - JDBC - introduction, architecture, drivers, connections, statements, resultset and meta data (Use MySQL as the RDBMS). Sockets: introduction to networking, InetAddress, url, socket, server sockets, datagrams.

Introduction to Unified Modelling Language (UML), UML diagrams, class diagrams, object interaction diagrams, state and activity diagrams, component diagrams, deployment diagrams. Introduction to analysis - object oriented system analysis, design and implementations.

References

1. Herbert Scheldt, *Java Complete Reference*, 8th Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 1259002462.
2. E Balaguruswamy, *Programming in Java: A Primer*, 4th Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 007014169X.
3. Kathy Sierra, *Head First Java*, 2nd Edition, Shroff Publishers and Distributors Pvt Ltd, ISBN: 8173666024.
4. David Flanagan, Jim Farley, William Crawford and Kris Magnusson, *Java Enterprise*

in a Nutshell: A Desktop Quick Reference, 3rd Edition, O'Reilly Media, ISBN: 596101422.

5. Grady Booch, James Rumbaugh and Ivar Jacobson, *The Unified Modeling Language User Guide*, 2nd Edition, Pearson, ISBN: 8131715825.

THIRD SEMESTER				
Course code	**CSS3C12**			
Name of the course	**Principles of Compilers**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.3	**Core**	4 (4:0:0)	**4**	**5** (1+4)

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the process of translating a high-level language to an executable code.	14	U	C	PO1	PSO2
CO2	Familiarize the function and complexity of modern compilers.	14	U	P	PO1	PSO2
CO3	Understand the machine dependent code	14	U	C	PO1	PSO2
CO4	Apply flow graph for the intermediate codes.	15	Ap	P	PO1	PSO2
CO5	Apply optimization techniques to have a better code for code generation	15	Ap	P	PO1	PSO2

Course Outline

Unit I [12 T]: Introduction to compiling - definition of compiler, translator, interpreter, analysis of the source program, the phases of a compiler, compiler construction tools- applications of compiler technology – programming language basics - lexical analysis –

role of lexical analyser
– input buffering - specification of tokens – recognition of tokens using finite automata - regular expressions and finite automata - from NFA to DFA - Regular Expression to an NFA - Design of a lexical analyser generator.

Unit II[12 T]: Syntax analysis – role of parser – error handling and recovery – definitions of parsing, top-down parsing and bottom-up parsing - context free grammars – derivations - parse tree – ambiguity – associativity and precedence of operators - writing a grammar – top- down parsing – recursive descent parsing - FIRST and FOLLOW – LL (1) Grammars – recursive predictive parsing - bottom up parsing – reductions – handle pruning – shift reduce parsing - operator precedence parsing, simple LR parsing.

Unit III [12 T]: Intermediate code generation – DAG – three address code – addresses and instructions – quadruples – triples – Static Simple Assignment form – types and declarations
– type expressions - type equivalences – declarations – type checking – rules – type conversion – function and operator overloading – type inference and polymorphic functions – control flow – boolean expressions – short circuit code – flow-control statements – control-flow translation for boolean expressions – BREAK CONTINUE and GOTO statements.

Unit IV [12 T]: Run time environments – storage optimization – static Vs dynamic allocation – stack allocation of space - activation trees and records – calling sequences – access to non local data on the stack – data access without nested procedures – issues with nested procedures – heap management – the memory manager – the memory hierarchy – locality in programs – reducing fragmentation - manual deallocation requests.

Unit V [12 T]: Code generation – issues in the design of a code generator – the target language – a simple target machine model – the program and instruction costs – address in the target code – static allocation – stack allocation – run-time address for names – basic blocks and flow graphs – representation of flow graphs. Code optimization - the principal sources of optimization – data flow analysis – abstraction – data flow analysis schema – data flow schemas on basic blocks – reaching definitions – live variable analysis – available expressions. Region based analysis – regions – region hierarchies for reducible flow graphs – overview of a region based analysis.

References:

1. V Aho A, Ravi Sethi, D Ullman J, *Compilers Principles*, Techniques and Tools, 2nd Edition, Pearson Education Singapore Pte Ltd, ISBN: 8131721019.
2. K. V. N. Sunitha, *Compiler Construction*, Pearson, ISBN:9789332500297.
3. W Appel and Andrew, *Modern Compiler Implementation in C*, 1st

Edition,Cambridge University Press, ISBN: 817596071X.

4. Allen I Holub, *Compiler Design in C*, 1st Edition, PHI Learning Pvt Ltd, ISBN: 812030778X.
5. Tremblay and Sorenson, *The Theory and Practice of Compiler Writing*, 1st Edition, BSP Books Pvt Ltd, ISBN: 8178000776.
6. Torben Ægidius Mogensen, *Basics of Compiler Design*, Department of Computer Science, University of Copenhagen (Online Edition).

THIRD SEMESTER				
Course code	**CSS3L03**			
Name of the course	**PRACTICAL III**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.4	**Core**	2 (0:0:4)	**4**	**5** (1+4)

Course: CSS3L03 –
Credit :

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	P0	PSO
CO1	Construct programs relating to the theory portions covered in CSS3C11 *Advanced Database Management System*	36	Ap	P	PO1	PSO1
CO2	Construct programs relating to the theory portions covered in CSS3C12 *Object Oriented Programming Concepts*	36	Ap	P	PO1	PSO1

Course Outline

Unit I: Advanced Database ManagementSystem

1. Creating database tables and using data types (create table, modify table, drop table).
2. Data Manipulation (adding data with INSERT, modify data with UPDATE, deleting records with DELETE).
3. Implementing the Constraints (NULL and NOT NULL, primary key and foreign key constraint, unique, check and default constraint).
4. Retrieving Data Using SELECT (simple SELECT, WHERE, IN, BETWEEN, ORDERED BY, DISTINCT and GROUP BY).
5. Aggregate Functions (AVG, COUNT, MAX, MIN, SUM).
6. String functions.
7. Date and Time Functions.

8. Use of union, intersection, set difference.
9. Implement Nested Queries & JOIN operation.
10. Performing different operations on a view.
11. Stored Procedure Programming - Simple Procedures - decision making - Loops - Error handlers - Cursors - Functions - Triggers - Calling Stored Procedure from Triggers.

Unit II: Object Oriented Programming Concepts

1. Simple Java programs like computing formulas expressions.
2. Programs involving loops and decisions like generating Fibonacci, prime, strange series.
3. Programs involving arrays.
4. Programs involving class and objects.
5. Illustrate method overloading.
6. Illustrate single level inheritance.
7. Illustrate multiple inheritances using interface.
8. String sorting, pattern matching etc.
9. Illustrate threads and thread priorities.
10. Illustrate the use of Packages.
11. Exception handling (user-defined).
12. Abstract class.
13. Method overriding.
14. Illustrate usage of Applets like moving ball, face etc.
15. Create an AWT application for a simple calculator.
16. Frame application to illustrate the window events.
17. Frame application to illustrate mouse and keyboard event handling.
18. Swing applications.
19. Create a JDBC application to add the details of a student into a table (Use MySQL as the RDBMS).
20. Socket Programming.

THIRD SEMESTER				
Course code	CSS3E01a			
Name of the course	**Computer Graphics**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.5a	**Elective**	4 (4:0:0)	**4**	**5 (1+4)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the working of different display devices.	14	U	C	PO1	PSO2
CO2	Understand the fundamentals of computer graphics	14	U	F	PO1	PSO2
CO3	Interpret line drawing algorithms and 2D transformations	14	E	C	PO1	PSO2
CO4	Understand the viewport transformations, different clipping algorithms	15	U	C	PO1	PSO2
CO5	Analyze the working of OpenGL Programming	15	An	P	PO1	PSO3

Course Outline

Unit I: Introduction – Application of computer graphics, Video Display Devices- refresh CRT, raster and random scan display, color CRT, flat panel, LCD, LED, DVST. Raster - Scan Systems-video controller, display processor, Random-Scan Systems.

Unit II: 2D Graphics: Line drawing algorithms – DDA, Bresenham's – Midpoint Circle drawing algorithm –Filling-Scan line polygon fill algorithm, boundary fill algorithm, floodfill algorithm, 2D Transformations-translation, rotation, scaling, shearing and reflection, composite transformations. 2D Viewing –the viewing pipeline, viewing coordinate reference frame, window-to- viewport coordinate transformation. Clipping-point clipping, Cohen Sutherland line clipping, Sutherland Hodgeman polygon clipping,

text clipping.

Unit III: 3D Graphics: 3D Transformations- translation, rotation, scaling, shearing and reflection,3D Viewing-viewing pipeline, viewing coordinates, projections- parallel & perspective projections.

Unit IV: 3D object representation - wireframe model, curve representation, surfaces, spline representation, bezier curves, cubic spline. Visible surface detection methods-classification, back-face detection, Z-buffer algorithm.

Unit V: Discrete Techniques and OpenGL programming - Texture mapping, Bit and Pixel operations, Compositing, Sampling and Aliasing Techniques. Introduction to OpenGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL - GL, GLU & GLUT, a few examples of OpenGL programs.

References:

1. Donald Hearn and M. Pauline Baker, *Computer Graphics*, 2nd Edition, Prentice Hall, ISBN: 0135309247.
2. Donald D. Hearn, M. Pauline Baker and Warren Carithers, *Computer Graphics with Open GL*, 4th Edition, Prentice Hall, ISBN: 9780136053583.
3. Hill, *Computer Graphics using OpenGL*, 3rd Edition, Prentice Hall of India Private Ltd. New Delhi, ISBN: 8120338294.
4. Mason Woo, Jackie Neider, Tom Davis, Dave Shreiner, Dave Shriner and Tom David, *Open GL Programming Guide*, 6th Edition, Person, ISBN: 9780201604580.
5. *The Official Guide to Learning OpenGL*, Version 1.1, Available at http://www.glprogramming.com/red/.
6. Shreiner and Angel, *Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL*, 6th Edition, Pearson Education, ISBN: 0132545233.

THIRD SEMESTER				
Course code	**CSS3E01b**			
Name of the course	**Introduction to Soft Computing**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.5b	**Elective**	**4**	**4**	**5 (1 Internal+ 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Develop fundamental knowledge on soft computing theories	14	R	F	PO1	PSO1
CO2	Understand basics of computing paradigm known as genetic algorithms	14	U	C	PO1	PSO1
CO3	Remember various network paradigms and its applications	14	R	C	PO1	PSO1
CO4	Analyze the applications of fuzzy set theories to different branches	15	An	P	PO2	PSO2
CO5	Introduce EC algorithms and understand the swarm intelligence	15	U	C	PO2	PSO3

Course Outline

Unit I: Introduction - introduction to statistical ,syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case - 2-category classification - minimum error rate classification - classifiers - discriminant functions - decision surfaces – error probabilities and integrals - normal density - discriminant functions for normal density.

Unit II: Introduction to genetic algorithm, genetic operators and parameters, genetic algorithms in problem solving, theoretical foundations of genetic algorithms, implementation issues – systems.

Unit III: Neural model and network architectures, perceptron learning, supervised hebbian learning, back-propagation, associative learning, competitive networks, hopfield

network, computing with neural nets and applications of neural network.

Unit IV: Introduction to fuzzy sets, operations on fuzzy sets, fuzzy relations, fuzzy measures, applications of fuzzy set theory to different branches of science and engineering.

Unit V: Advanced topics - support vector machines, evolutionary computation (EC) - evolutionary algorithms, harmony search, swarm intelligence.

References:

1. Chuen-Tsai Sun, Eiji Mizutani and Jyh-Shing Roger Jang, *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence*, Prentice Hall India, ISBN: 8120322436.
2. M. Mitchell, *An Introduction to Genetic Algorithms*, Prentice-Hall, ISBN: 0262631857.
3. D. E. Goldberg, *Genetic Algorithms in Search, Optimization, and Machine Learning*, Addison-Wesley, ISBN: 0785342157673.
4. S. V. Kartalopoulos, *Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications*, Wiley-IEEE Press, 1st Edition, ISBN: 07803112802004.
5. S. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications*, PHI, ISBN: 9788120321861.

THIRD SEMESTER				
Course code	**CSS3E01c**			
Name of the course	**WEB TECHNOLOGY**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.5c	**Elective**	4 (4:0:0)	**4**	**5 (1+4)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Familiarize SGML features.	14	U	C	PO1	PSO2
CO2	Understand operators, identifiers, variables, arrays, control structures, functions and objects in JavaScript.	14	U	C	PO1	PSO2
CO3	Develop basic knowledge about the Apache web server.	14	Ap	P	PO1	PSO2
CO4	Develop hands on experience using PHP.	15	Ap	P	PO1	PSO2
CO5	Understand the concepts of content management systems (CMS).	15	U	C	PO1	PSO2

Course Outline

Unit I: Introduction to web programming - introduction to SGML features - HTML, XHTML, DHTML, XML - HTML Vs XML - creating XML documents - parsing an XML document writing well-formed documents - organizing elements with namespaces - defining elements in a DTD - declaring elements and attributes in a DTD. Overview of HTML basic formatting tags - heading, paragraph, underline break, bold, italic, underline, superscript, subscript, font and image. Attributes - align, color, bgcolor, font face, border, size. Navigation links using anchor tag - internal, external, mail and image links. Lists - ordered, unordered and definition, table tag, HTML form controls - form, text, password, textarea, button, checkbox, radio button, select box, hidden controls, frameset and frames. CSS.

Unit II: Client side programming – introduction – popular client side scripting languages - JavaScript - introduction, identifiers, operators, functions, event handling, classes, objects, array, math, string, window object, navigator DHTML font, text, image change, table expansion. JavaScript's object model- strengths and weaknesses of JavaScript - building and extending objects in JavaScript - events in JavaScript - event handlers - creating interactive forms – cookies - storing users choices in cookies - encoding cookies - browser objects - object hierarchy, creating browser objects, working with window, document, history & location - browser detection, Java to JavaScript communication.

Unit III: Web server – role - Apache web server – introduction – architecture – features - Apache's role in the Internet – LAMP – WAMP - installation and configuration - build and install Apache web server - verify initial configuration start, stop, and status the Apache server process. Configure Apache core modules security - basic security with Apache - host-based authentication - user-based authentication - secure sockets layer (SSL) - delivering dynamic web content - Apache's role in the dynamic web - server side includes (SSIs) - configure Apache web server to support CGI – CGI Alternative Technologies. virtual hosts, redirection, indexing – virtual hosting with Apache, virtual host configuration redirection, directory indexing. Proxy servers and firewalls - apache proxy configuring, proxy services firewalls and apache, firewall architecture models monitoring apache web server - error logs, logging http access, web server status and server information, user tracking - proxy caching.

Unit IV: Server side programming – server side scripts – PHP – designing dynamic web pages using PHP - defining PHP variables – variable types – operators – control flow constructs in PHP – passing form data between pages - establishing connection with MySQL database – managing database.

Unit V: Overview of content management system - coding for reusability (header.php) – user management - article publishing - additional CMS features – Web site development using Joomla!.

References:

1. Thomas A. Powell, *The Complete Reference HTML*, 3rd Edition, McGraw-Hill/Osborne Media, ISBN: 0072129514.
2. Thomas A. Powell, *Web Design: The Complete Reference*, 2nd Sub-Edition, McGraw- Hill/Osborne Media, ISBN: 0072119772
3. Robert W. Sebesta, *Programming with World Wide Web*, 7th Edition, Addison-Wesley, ISBN: 9780132665810.

1. Xue Bai, Michael Ekedahl, Joyce Farrell, Don Gosselin, Diane Zak, Bill Morrissey, Michael V. Ekedahl, Peter Macintyre and Shashi Kaparthi, *The Web Warrior*

Guide to Web programming, Thomson Learning, ISBN: 9780619064587.

4. Chris Bates, *Web Programming: Building Internet Applications*, 3rd Edition, Wiley Academic Catalog, ISBN: 9780470017753.
5. Paul J. Deitel, Harvey M. Deitel, Harvey Deitel, Paul Deitel and Abbey Deitel, *Internet and World Wide Web: How to Program*, 5th Edition, Prentice Hall, ISBN: 9780132151009.
6. R. Allen Wyke and Richard Wagner, *JavaScript Unleashed*, 3rd Edition, SAMS, ISBN: 9780672317637.
7. Richard Bowen Ken Coar, Ken A Coar and Matthew Marlowe, *Apache Server Unleashed*, SAMS, ISBN: 0672318083.
8. Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz and Michael K Glass, Beginning PHP5, *Apache, and MySQL Web Development*, Wrox, ISBN: 0764579665.
9. Jennifer Marriott and Elin Waring, *The Official Joomla! Book*, Addison-Wesley Professional, ISBN: 978-0321821546.
10. Ron Severdia and Kenneth Crowder, *Using Joomla: Building Powerful and Efficient Web Sites*, 1st Edition, O'Reilly Media, ISBN: 9780596804947.

THIRD SEMESTER				
Course code	**CSS3E01d**			
Name of the course	**BIOINFORMATICS**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.5d	**Elective**	**4**	**4**	**5 (1 Internal + 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand basic concepts of Bioinformatics and its significance with respect to Biological data	14	U	C	PO1	PSO2
CO2	Identify the methods to manage the different types of Biological data.	14	E	F	PO1	PSO2
CO3	Understand the types of data found at NCBI and EBI resources.	14	U	P	PO1	PSO2
CO4	Analyze various Biological databases on nucleic acids and protein.	15	An	P	PO1	PSO2
CO5	Identify the major steps in pair wise and multiple sequence alignment.	15	E	C	PO1	PSO2

Course Outline

Unit I: Bioinformatics - introduction to - nature and scope of computational biology and Bioinformatics. Cells - prokaryotes and eukaryotes - DNA double helix - central dogma - RNA, Amino acids, Proteins - string representations. A glossary of Bioinformatics terms - file format for bio-molecular sequences, sequence alignment, phylogeny, gene finding, microarray analysis, homology and evolutionary relationships.

Unit II: Basic algorithms in Computational Biology - exhaustive search methods and their applications in Computational Biology - string matching algorithms. Motif finding - tandem repeats - concept of dynamic programming - graph algorithms - clustering

algorithms.

Unit III: Sequence alignment - pair-wise sequence alignment, need of scoring schemes - penalizing gaps, scoring matrices for amino acid sequence alignment, PAM probability matrix and log odds matrix, BLOSUM, Dot-plot visualization, Needleman- Wunsch algorithm- effect of scoring schemes - evalues - BLAST and FASTA, Smith - Waterman algorithm for local alignment.

Unit IV: Multiple sequence alignment - sequence alignment using dynamic programming, Ndimensional dynamic programming. Tools for MSA - muscle and T-Coffee. Phylogenetic algorithms - evaluation of phylogenetic trees, significance.

Unit V: Introduction to the major resources - NCBI, EBI and ExPASy - nucleic acid sequence databases - GenBank, EMBL, DDBJ – Protein sequence databases – SWISS- PROT, TrEMBL, PIR_PSD - genome databases at NCBI, EBI, TIGR, SANGER – procedures to access these databases and to make use of the tools available.

References:

1. Mount D, *Bioinformatics; Sequence & Genome Analysis*, 2nd Edition, Cold spring Harbor Press, ISBN: 978-087969712.
2. Dan Gusfield, *Algorithms on Strings Trees and Sequences*, 1st Edition, Cambridge University Press, ISBN: 0521585198.
3. Pevzner P A, *Computational Molecular Biology: An Algorithmic Approach*, MIT Press, Cambridge, MA, ISBN: ISBN: 9780262161978.
4. Jeremy J. Ramsden, *Bioinformatics: An Introduction*, Springer, ISBN: 9789401570961.
5. Sushmita M and Tinku A, *Data Mining: Multimedia, Soft Computing and Bioinformatics*, Wiley-Interscience, ISBN: 9780471460541.
6. Richard M. Karp, *Mathematical Challenges from Genomics and Molecular Biology*, Notices of the American Mathematical Society, vol. 49, no. 5, pp. 544553.
7. Glyn Moody, *Digital Code of Life: How Bioinformatics is Revolutionizing Science, Medicine and Business*, ISBN: 9780471327882.
8. Tao Jiang, Ying Xu and Michael Q. Zhang, *Current Topics in Computational Molecular Biology Edible OH Processing*, 1st Edition, Ane Books Pvt Ltd, ISBN: 9788180520525.
9. Andrzej K. Konopka and M. James C. Crabbe, *Compact Handbook of Computational Biology*, 1st Edition, CRC Press, ISBN: 9780824709822.
10. Richard E. Bellman, *Dynamic Programming*, Princeton University Press, ISBN: 9780691146683.

11. Needleman S B and Wunsch C D, A General Method Applicable to the Search for Similarities in the Amino Acid Sequence of Two Proteins, *J. Mol. Biol*., 48 (1970) 443-453.
12. Smith T F and Waterman M S, Identification of Common Molecular Subsequences, *J. Mol. Bio*. 147 (1981) 195-197.
13. Watson J D and Crick F H C, A Structure for Deoxyribose Nucleic Acid, *Nature*, 171 (1953) 737-738.
14. Pevzner P A and Waterman M S, Open Combinatorial Problems in Computational Molecular Biology, *Proc. Third Israel Symp. Theo. Comp. Syst*. IEEE Computer Society Press, (1995) 158 - 173.

THIRD SEMESTER				
Course code	**CSS3E01e**			
Name of the course	**Computer Optimization Techniques**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.5e	**Elective**	**4**	**4**	**(1 Internal + 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Formulate a real-world problem into a mathematical problem.	14	Ap	P	PO1 PO2	PSO1
CO2	Apply specialized linear programming methods like transportation, assignment and network problems.	14	Ap	P	PO1 PO2	PSO1
CO3	Understand the theoretical knowledge of different linear programming methods and iterations.	14	An	F	PO1 PO2	PSO1
CO4	Understand integer linear programming and algorithms to solve it.	15	U	F	PO1 PO2	PSO1
CO5	Develop the basic knowledge of dynamic programming and nonlinear Programming	15	R	C	PO1 PO2	PSO1

Course Outline

Unit I: Linear programming and sensitivity analysis - two variable LP model, graphical and algebraic LP solutions, some LP applications, the simplex method and sensitivity analysis, primal-dual relationships and economic interpretation, dual simplex and generalized simplex algorithms and post-optimal analysis.

Unit II: Transportation and Network models - The transportation models and algorithm, the assignment and trans-shipment models, minimum spanning tree algorithm, shortest-route problem, maximum flow and min-cost models, critical path method and algorithms

for matching.

Unit III: Advanced linear programming and applications - simplex method fundamentals, revised simplex method and computational considerations, bounded variables algorithm, duality, parametric linear programming, goal programming formulations and algorithms.

Unit IV: Integer linear programming - illustrative applications, integer programming algorithms, unimodularity and cutting-plane methods, travelling salesperson problem.

Unit V: Dynamic programming (DP) and its application - recursive nature of computations in DP, forward and backward recursion, selected DP applications, problem of dimensionality, branch and bound method and dynamic programming, some deterministic inventory models. Nonlinear programming - convex programming problems, unconstrained problems and algorithms, constrained problems and algorithms.

References:

1. H. A. Taha, *Operations Research: An Introduction*, 9th Edition, Pearson Prentice Hall, ISBN: 013255593X.
2. C. H. Papadimitriou, K. Steiglitz, *Combinatorial Optimization: Algorithms and Complexity*, Dover Publications, ISBN: 9780486402581.

THIRD SEMESTER				
Course code	**CSS3E01f**			
Name of the course	**Numerical & Statistical Methods**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.5f	**Elective**	**4**	**4**	**(1 Internal + 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Recognize the error in the number generated	14	An	C	PO1 PO2	PSO1
CO2	Apply different methods of interpolation for prediction	14	Ap	P	PO1 PO2	PSO1
CO3	Understand the concepts of solving integrals numerically.	14	U	F	PO1 PO2	PSO1
CO4	Learn different definitions of probability and its properties.	15	R	F	PO1 PO2	PSO1
CO5	Solve specialized linear programming problem like the transportation and assignment problems.	15	Ap	P	PO1 PO2	PSO1

Course Outline

Unit I: Approximation and errors in computing - introduction, significant digits - inherent errors - numerical error - modelling errors - blunders - absolute and relative errors - conditioning and stability. Roots of non-linear equations - introduction - iterative methods
- bisection - false position - Newton - Raphson's, Secant and Bairstow's methods.

Unit II: Introduction solution of linear equations - Gauss elimination - Gauss-Jordan method Jacobi Iteration method - Gauss-Seidal methods. Interpolation - linear interpolation Newton's forward backward & divided difference interpolation methods - Lagrange's method.

Unit III: Integration - trapezoidal rule, Simpson’s 1/3, & 3/8 rules. Differential equations: Heunn’s polygon, Range-Kutta fourth order, Milne-Simpson, Adams-Bashforth and Adams- Moulton methods.

Unit IV: Classical definition of probability – statistical definition of probability – axiomatic approach to probability – addition and multiplication theorem on probability - compound and conditional probability – independence of events – Bayes theorem random variables – discrete and continues – pmf, pdf and distribution functions.

Unit V: Introduction linear programming - mathematical formulation - graphical method of solution - simplex method - duality - dual simplex - transportation - assignment problems.

References

1. E. Balagurusamy, *Numerical Methods*, 1st Edition, Tata McGraw Hill Education Private Limited, ISBN: 0074633112.
2. S.G. Gupta and V.K. Kapoor, *Fundamentals of Mathematical Statistics*, 11th Edition, Sultan Chand & Sons , ISBN: 9788180545283.
3. V.Rajaraman, *Computer Oriented Numerical Methods*, 3rd Edition, Prentice Hall Of India, ISBN: 81203078601993.
4. Satyendra Mittal and C. P. Sethi, *Linear Programming*, Pragati Prakashan.

THIRD SEMESTER				
Course code	**CSS3E02a**			
Name of the course	**Pattern Recognition**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.6a	**Elective**	**4**	**4**	**(1 Internal + 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the basic concept of a pattern and pattern recognition algorithms.	14	U	F	PO1	PSO1
CO2	Recognize the principles of Bayesian parameter estimation	14	R	F	PO1	PSO1
CO3	Analyze variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.	14	An	C	PO1	PSO3
CO4	Apply methods for pre-processing, feature extraction, and feature Selection to multivariate data.	15	Ap	P	PO2	PSO3
CO5	Understand supervised and unsupervised classification methods to detect and characterize patterns in real-world data.	15	U	C	PO2	PSO3

Course Outline

Unit I: Introduction - introduction to statistical - syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case 2 - category classification - minimum error rate classification - classifiers - discriminant functions - decision surfaces – error probabilities and integrals - normal density - discriminant functions for normal density..

Unit II: Parameter estimation and supervised learning - maximum likelihood estimation - the Bayes classifier - learning the mean of a normal density - general Bayesian learning

nonparametric technique - density estimation - parzen windows - k-nearest neighbour estimation - estimation of posterior probabilities - nearest-neighbour rule - k-nearest neighbour rule.

Unit III: Linear discriminant functions - linear discriminant functions and decision surfaces - generalized linear discriminant functions - 2-category linearly separable case – non- separable behaviour - linear programming algorithms, support vector machines - multilayer neural networks - feed forward operation and classification, back propagation algorithm, error surface, back propagation as feature mapping.

Unit IV: Syntactic methods - stochastic search - Boltzmann learning - Nonmetric methods - decision trees - CART - other tree methods, grammatical methods, grammatical inference.

Unit V: Unsupervised learning and clustering - mixture densities and identifiability, maximum likelihood estimates, applications to normal mixtures, unsupervised Bayesian learning, data description and clustering.

References:

1. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, CBS Publishers & Distributors, 2nd Edition, ISBN: 9788126511167.
2. Gonzalez R.C. and Thomson M.G., Syntactic Pattern Recognition: An Introduction, 1st Edition, Addison-Wesley, ISBN: 0201029316.
3. Fu K. S., Syntactic Pattern Recognition and Applications, Prentice Hall, ISBN: 0138801207.
4. Rajjan Shinghal, Pattern Recognition: Techniques and Applications, 1st Edition, Oxford University Press India, ISBN: 0195676858.

THIRD SEMESTER				
Course code	**CSS3E02b**			
Name of the course				
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.6b	**Elective**	**4**	**4**	**5 (1 internal + 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the fundamental concepts of wireless and mobile networks.	14	U	C	PO1	PSO2
CO2	Identify wireless application Protocols to develop mobile content development.	14	E	C	PO1	PSO2
CO3	Analyze various programming methodologies in wireless mobile environment.	14	An	P	PO1	PSO2
CO4	Understand security aspects of wireless networks.	15	U	C	PO1	PSO2
CO5	Apply knowledge of TCP/IP extensions for mobile and wireless networking	15	Ap	P	PO1	PSO2

Course Outline

Unit I: Introduction - applications - brief history of wireless communication – open research problems – wireless transmission – frequencies for radio transmission – signals – antennas – signal propagation – multiplexing – modulation – spread spectrum – cellular systems – medium access control – motivation – SDMA – FDMA – TDMA – CDMA – comparison.

Unit II: Different generations of Wireless Cellular Networks - 1G, 2G, 2.5G, 3G, 4G. Telecommunication systems – GSM – DECT – TETRA – UMTS – IMT-2000. Wireless LAN – Infrared Vs Radio transmission – Infrastructure Vs Adhoc networks – IEEE

802.11
– HIPERLAN – Bluetooth.

Unit III: Mobile network layer - Mobile IP - Dynamic Host Configuration Protocol - Routing - DSDV - DSR - Alternative Metrics. Transport and application layers - traditional TCP classical TCP improvements - WAP, WAP 2.0.

Unit IV: Wireless network security - IEEE 80211i security - Wireless Transport Layer Security sessions and connections - protocol architecture - WAP end-to-end security.

Unit V: Java for wireless devices - setting up the development environment - basic data types, libraries (CLDC, MIDP) - UI controls - displayable and display image - events and event handling - list and choice - text box - alerts - persistent storage - record stores - records
- record enumeration - network MIDlets - the connection framework - connection interface - connection using HTTP - datagram connection.

References:

1. Jochen Schiller, *Mobile Communications*, Pearson Education, 2nd Edition, ISBN: 8131724263.
2. Raj Kamal, *Mobile Computing*, 2nd Edition Oxford Univ Press, ISBN: 0198068913.
3. William Stallings, *Network Security Essentials Applications and Standards*, 4th Edition, Pearson India, ISBN: 8131761754.
4. Yu Feng and Jun Zhu, *Wireless Java Programming with J2ME*, 1st Edition, Sams, ISBN: 0672321351.
5. Dreamtech Software Team, *Wireless Programming with J2ME*: Cracking the Code, Wiley, ISBN: 0764548859. C,
6. William Stallings, *Wireless Communications and Networks*, 2nd Edition, Pearson India, ISBN: 8131720934.
7. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff and Thomas Schaeck, *Pervasive Computing Technology and Architecture of Mobile Internet Applications*, 14th Edition, Pearson Education, ISBN: 8177582801.
8. Nishit Narang and Sumit Kasera, *2G Mobile Networks: GSM and HSCSD*, Tata McGraw Hill Education, ISBN: 0070621063.
9. Hasan Ahmed, Roopa Yavagal and Asoke K Talukder, *Mobile Computing: Technology, Applications and Service Creation*, 2nd Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 0070144575.

THIRD SEMESTER				
Course code	**CSS3E02c**			
Name of the course	CRYPTOGRAPHY AND NETWORK SECURITY			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.6c	**Elective**	**4**	**4**	**5 (1 Internal + 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the fundamentals of Cryptography	14	U	F	PO1	PSO1
CO2	Familiarize Data integrity, Authentication, Digital Signatures.	14	U	F	PO1	PSO1
CO3	Analyze various network security applications, IPSec, Firewall, IDS, Web security, Email security, and malicious software.	14	An	P	PO1	PSO3
CO4	Familiarize standard algorithms used to provide confidentiality, integrity and authenticity.	15	R	P	PO2	PSO1
CO5	Design security applications in the field of Information technology	15	Ap	M	PO2	PSO3

Course Outline

Unit I: Computer security concepts – challenges – security attacks – security services – security mechanisms – a model for network security. Cryptography – symmetric encryption principles – cryptography – cryptanalysis – Feistal Cipher structure. symmetric block encryption algorithms - DES – Triple DES – AES – random and pseudorandom numbers – stream cipher and RC4 – cipher block modes of operation.

Unit II: Message authentication – approaches – MAC – one way Hash function – secure Hash functions – Message Authentication Codes. Public key cryptography principles – algorithms – digital Signatures.

Unit III: Network security applications - symmetric key distributions using symmetric encryption - Kerberos version 4 - key distributions using asymmetric encryption - X.509

certificates - public key infrastructure - federated identity management.

Unit IV: Transport level security - web security considerations - secure socket layer and transport layer security - SSL architecture - SSL record protocol - change cipher spec protocol
- handshake protocol. Transport layer security - HTTPS - SSH. IP Security - overview - policy - encapsulating security payload - combining security associations - internet key exchange.

Unit V: Intruders - intruders, intrusion detection, password management. Malicious software - types, viruses, countermeasures, worms, DDoS. Firewalls - need - characteristics, types, firewall basing, location and configuration - DMZ networks, VPN - distributed firewalls.

References:

1. William Stallings, Network Security Essentials Applications and Standards, 4th Edition, Pearson India, ISBN: 8131761754.
2. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson India, ISBN: 9332518777.
3. Atul Kahate, Cryptography and Network Security, 3rd Edition, Tata McGraw- Hill Publishing, ISBN: 9789332900929.
4. Eric Maiwald, Fundamental of Network Security, 1st Edition, Tata McGraw - Hill Education, 0071070931.
5. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security: Private Communication in Public WorJd, 2nd Edition, PHI Learning Pvt Ltd, ISBN: 8120322134.

THIRD SEMESTER				
Course code	**CSS3E02d**			
Name of the course	ADVANCED WEB TECHNOLOGY			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.6d	**Elective**	**4**	**4**	**5 (1 Internal + 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the concepts of Web 2.0	14	U	F	PO1	PSO1
CO2	Understand the concepts of web services and web service architecture.	14	U	C	PO1	PSO1
CO3	Analyze various server side programming using Python.	14	An	P	PO1	PSO3
CO4	Analyze various server side programming using Python.	15	An	P	PO2	PSO1
CO5	Develop the ability to Python SQLite integration.	15	Ap	P	PO2	PSO3

Course Outline

Unit I: Web 2.0 - definition, characteristics, key features, client side technologies (Ajax and JavaScript frameworks - YUI library, Dojo toolkit, MooTools, jQuery, Ext JS and prototype JavaScript framework), server side technologies (Ruby, Perl, Python, Enterprise Java J2EE and Microsoft.NET Framework), concepts (Rich Internet Application — Web-Oriented Architecture — Social Web), SLATES.

Unit II: Fundamentals of Web Services - Definition, Components, benefits, behavioural characteristics. Web services architecture - web service roles, web service protocol stack, service transport. Web services components - XML-RPC, SOAP, WSDL, UDDI. web services security (notions) - confidentiality (XML-RPC and SOAP run on top of HTTP) - support for Secure Sockets Layer (SSL) for HTTP - encrypted communication via SSL, authentication (HTTP's built-in support for Basic and Digest authentication - SOAP

security extensions - Digital Signature - SOAP - DSIG - SAML).

Unit III: Introduction to Python - installation - Python interpreter - usage and customization - editor setup - variables, expressions and statements - functions. Strings - lists - list comprehensions - stacks - queues - tuples - sequences - sets - dictionaries - sets - modules, I/O and exception handling - modules - search path - compiled modules - standard modules - packages - input and output functions - files - read and write - exception - handling and raising - user defined exceptions.

Unit IV: Server side programming using Python - server side scripting - CGI - role of Web server – Apache web server – Python server side script – developing Python Server Side Pages (PSP) – capturing form data – validation – processing data – exchange of data between form and server.

Unit V: Python-SQLite integration - features of SQLite data types, introduction to SQL commands - SELECT, DELETE, UPDATE, INSERT. Python functions for SQLite operations - database connection, database and table creation, selection, query, fetching results - insertion and deletion of data using Python - displaying data from SQLite in webpage. Case study - server MVC design pattern - Django.

References

1. James Governor, Web 2.0 Architectures: What Entrepreneurs & Information Architects Need to Know, 1st Edition, Shroff Publisher & Distributors, ISBN: 8184047355.
2. S. V. Subrahmanya and B. V. Kumar, Web Services: An Introduction, 2nd Edition, Tata Mc-graw Hill Publishing Co. Ltd, ISBN: 1259002764.
3. Web 2.0, http://en.wikipedia.org/wiki/Web_2.0
4. Web Services, http://www.tutorialspoint.com/webservices/
5. Ron Schmelzer, Michael Qualls, Sam Hunting, David Houlding, Madhu Siddalingaiah, Jason Bloomberg, Travis Vandersypen, Chad Darby and Diane Kennedy, XML and Web Services Unleashed, Sams, ISBN: 0672323419.
6. Sandeep Chatterjee, James Webber, Developing Enterprise Web Services: An Architect's Guide, 1st Edition, Pearson India, ISBN: 8131713172.
7. The Python Tutorial, http://docs.python.org/3.3/tutorial/
8. Allen Downey, Jeffrey Elkner and Chris Meyers, How to Think Like a Computer Scientist: Learning with Python, Createspace, 2009, ISBN: 1441419071. Online Version: http://openbookproject.net/thinkcs/python/english3e/
9. Python Documentation. A vailable at http://www.python.org/doc/
10. Swarooph CH, A Byte of Python. Available at http://swaroopch.com/ notes/python/

11. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson Education, ISBN: 8131711889.

THIRD SEMESTER				
Course code	**CSS3E02e**			
Name of the course	**VIRTUALISATION AND CLOUD COMPUTING**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.6e	**Elective**	**4**	**4**	**5 (1 Internal+ 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the basics of cloud computing and virtualization	14	U	F	PO1	PSO1
CO2	Identify cloud infrastructure and the key application features delivered on virtual infrastructures	14	U	F	PO1	PSO1
CO3	Analyze programming model and programming paradigms	14	An	F	PO1	PSO3
CO4	Understand the security and security challenges in cloud	15	U	F	PO2	PSO1
CO5	Understand mapping applications and Hadoop	15	Ap	P	PO2	PSO3

Course Outline

Unit I: Introduction - evolution of cloud computing - system models for distributed and cloud computing - NIST cloud computing reference architecture - Infrastructure as a Service (IaaS) - resource virtualization - Platform as a Service (PaaS) - cloud platform & management
- Software as a Service (SaaS) - available serviceproviders.

Unit II: Virtualization - basics of virtualization - types of virtualization - implementation levels of virtualization - virtualization structures - tools and mechanisms - virtualization of CPU, memory, I/O devices - desktop virtualization - server virtualization - Linux KVM, Xen, Qemu, LXC, OpenVZ.

Unit III: Cloud infrastructure - FOSS cloud software environments - Eucalyptus, Open Nebula, OpenStack - OpenStack architecture - compute, object storage, image service,

identity, dashboard, networking, block storage, metering, basic cloud orchestration and service definition.

Unit IV: Programming model - parallel and distributed programming paradigms – Mapreduce, twister and iterative Mapreduce – mapping applications - programming support
– Apache Hadoop – HDFS, Hadoop I/O, Hadoop configuration, MapReduce on Hadoop.

Unit V: Security in the cloud - security overview – cloud security challenges – software-as- aservice security – security governance – risk management – security monitoring – security architecture design – data security – application security – virtual machine security – Qubes
– desktop security through Virtualization.

References:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing (From Parallel Processing to the Internet of Things), Elsevier Science, ISBN: 9780128002049.
2. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management, and Security, 1st Edition, CRC Press, ISBN: 1439806802.
3. Toby Velte, Robert Elsenpeter and Anthony Velte, Cloud Computing, A Practical Approach, TMH, ISBN: 9780071626958.
4. George Reese, Cloud Application Architectures, 1st Edition, Shroff/O'Reilly, ISBN: 8184047142.
5. Ravi Nair and Jim Smith, Virtual Machines: Versatile Platforms for Systems and Processes, 1st Edition, Elsevier Science / Morgan Kaufmann, ISBN: 9780080525402/ 1558609105.
6. Katarina Stanoevska - Slabeva, Thomas Wozniak, Santi Ristol, Grid and Cloud Computing - A Business Perspective on Technology and Applications, Springer, ISBN: 3642051928.
7. Open stack Operations Guide, http://docs.openstack.org/ops/.
8. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, ISBN: 9780596551360.

THIRD SEMESTER				
Course code	**CSS3E02f**			
Name of the course	**DATA WAREHOUSING AND DATA MINING**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total marks (Int+Ext)**
3.6f	**Elective**	**4**	**4**	**5 (1 Internal+ 4 External)**

CO	CO Statement	Hrs	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Identify the scope and necessity of Data Mining and Warehousing for the society	14	R	C	PO1	PSO1
CO2	Understand data quality and methods and techniques for preprocessing of data.	14	U	F	PO1	PSO1
CO3	Analyze the patterns that can be discovered by classification and clustering.	14	An	F	PO1	PSO1
CO4	Understand data mining techniques clustering and association rule mining	15	U	F	PO1	PSO1
CO5	Identify complex data types with respect to spatial and web mining.	15	R	C	PO1	PSO1

Course Outline

Unit I: Data warehouse - definition - operational database systems Vs data warehouses - multidimensional model - from- tables and spreadsheets to Data Cubes - schemas for multidimensional databases - measures - concept hierarchies - OLAP operations in the multidimensional data model - data warehouse architecture.

Unit II: Data mining - introduction - definition - data mining functionalities - major issues in data mining - data pre-processing - data cleaning - data integration and transformation - data reduction - data discretization and concept hierarchy generation. Association rule mining - efficient and scalable frequent item set mining methods -

mining various kinds of association rules - association mining to correlation analysis - constraint- based association mining.

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 - associative classification - lazy learners - other classification methods - prediction - accuracy and error measures - evaluating the accuracy of a classifier or predictor - ensemble methods - model section.

Unit IV: Cluster analysis - types of data in cluster analysis - a categorization of major clustering methods - partitioning methods - hierarchical methods - density-based methods - grid-based methods - model-based clustering methods - clustering high dimensional data - constraint-based cluster analysis - outlier analysis.

Unit V: Graph mining - mining object, spatial, multimedia, text and web data - multidimensional analysis and descriptive mining of complex data objects - spatial data mining - multimedia data mining - text mining - mining the World Wide Web.

References:

1. Jain Pei, Jiawei Han and Micheline Kamber, *Data Mining Concepts and Techniques*, 3rd Edition, Elsevier, ISBN: 9380931913.
2. Alex Berson and Stephen J. Smith, *Data Warehousing, Data Mining & OLAP*, Computing Mcgraw-Hill, ISBN: 0070062722.
3. K.P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data mining Theory and Practice*, 1st Edition, Prentice Hall of India, ISBNy.8120328973.
4. G. K. Gupta, *Introduction to Data Mining with Case Studies*, 3rd Edition, PHI Learning Pvt. Ltd, ISBN: 8120350022.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, 1st Edition, Pearson India, ISBN: 93325186

SEMESTER IV

FOURTH SEMESTER				
Course code	**CSS4P01**			
Name of the course	**PROJECT WORK**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.1	**CORE**	**8(7:0:8)**	**15**	**5** (Internal 1+ External 4)

CO	CO Statement	Hours	Cognitive Level (CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand programming language concepts and software engineering principles to develop a medium sized software projects for industry or propose any new model for the selected field of research	270	An	M	PO3	PSO4

Course Outcome :

- Understand process of software development life cycle.
- Develop a quality software solution by following the software engineering principles and practices. Students are also encouraged to take up a research oriented work to formulate a research problem and produce results based on its implementation/simulation/experimental analysis.

Course Outline

Major project work is to be done individually by each student, under the guidance of a faculty member of the concerned department.

Guide has to constantly monitor the works done by the student, imparting him/her the necessary inputs for the successful completion of the project work. Students can either take up a real-life application oriented project work or research and development project. The student can formulate a project problem with the help of her/his guide and submit the project proposal of the same. Approval of the project proposal is mandatory. If approved, the student can commence working on it, and complete it.

Guidelines for Submission of Report

The distinguishing mark of a dissertation is an original contribution to knowledge. The dissertation is a formal document whose sole purpose is to prove that you have made an original contribution to knowledge. Failure to prove that you have made such a contribution generally leads to failure.

It is a test of the student's ability to undertake and complete a sustained piece of independent research and analysis / application development, and to write up the work in a coherent form according to the rules and conventions of the academic community. The role of the supervisor too is very crucial in this context.

A satisfactory dissertation should not only be adequate in its methodology, in its analysis and in its argument, and adequately demonstrate its author's familiarity with the relevant literature; it should also be written in correct, coherent language, in an appropriate style, correctly following the conventions of citation. It should, moreover, have a logical and visible structure and development that should at all times assist the reader understands the arguments being presented. The layout and physical appearance of the dissertation should also conform to university standards. The dissertation is to be prepared in TEX format (either Latex or a suitable Windows TEX variant). The format of the report is included in Appendix A. Students are also encouraged to present their work in IT fest/conference/workshop/journal with the assistance and guidance of the supervisor. This should pave as a good start for the student in the art of publishing/presenting his/her work to the outside world. Due weightage is accommodated for publications out of the project work in the final evaluation.

FOURTH SEMESTER				
Course code	**CSS4E03a**			
Name of the course	**DATA COMPRESSION**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2a	**ELECTIVE**	**3 (5:0:0)**	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the importantance of data compression	8	U	C	PO1	PSO3
CO2	Familiarise the basic techniques of compression	8	U	C	PO1	PSO3
CO3	Familiarise the basic concepts of Information Theory	8	U	C	PO1	PSO3
CO4	Analyze compression techniques for strings and images.	12	An	P	PO1	PSO3
CO5	Apply different transforms for compression.	12	Ap	P	PO1	PSO3
CO6	Understand video file formats , audio file formats and the compression techniques used in them	14	U	C	PO1	PSO3
CO7	Analyze various compression algorithms for audio file formats	14	U	C	PO1	PSO3

CO8	Analyze various compression algorithms for video file formats.	14	U	C	PO1	PSO3

Course Outline

Unit I [18 T]: Basic Techniques - Intuitive Compression, Run-Length Encoding, RLE Text Compression, RLE Image Compression, Move-to-Front Coding, Scalar Quantization, Recursive Range Reduction. Statistical Methods - Information Theory Concepts, Variable-Size Codes, prefix Codes, Shannon-Fano Coding, Huffman Coding, Adaptive Huffman Coding

Unit II [18 T] : Dictionary methods - string compression, LZ77 sliding window, MZW, GIF images. Image compression - approaches to image compression, intuitive methods and image transform, test images, JPEG, progressive image compression, vector quantization.

Unit III [18 T]: Wavelet methods - Fourier transform, frequency domain, Fourier image compression, CWT and inverse CWT, Haar transform, filter bank, DWT, JPEG 2000. Video compression - analogue video, composite and component video, digital video, video compression, MPEG.

Unit IV [18 T]: Audio compression - sound, digital audio, human auditory system, MPEG-1 audio layer. Fractal based compression - IFS. Comparison of compression algorithms. Implementation of compression algorithms.

References

1. David Solomon, *Data Compression: The Complete Reference*, 4th Edition, Springer, ISBN: 8184898002.
2. Stephen Welstead, *Fractal and Wavelet Image Compression Techniques*, Lap Lambert Academic Publishing, ISBN: 384651845X.
3. Khalid Sayood, *Introduction to Data compression*, 4th Edition, Elsevier India Pvt. Ltd, ISBN: 8131234088.

FOURTH SEMESTER				
Course code	**CSS4E03b**			
Name of the course	**PERVASIVE COMPUTING**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2b	**ELECTIVE**	**3 (3:0:2)**	**5**	**5** (Internal 1+ External 4)

4.

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand pervasive computing devices and interfaces.	12	U	C	PO1	PSO3
CO2	Understand the application examples of pervasive computing	6	U	C	PO1	PSO3
CO3	Familiarize the role of XML in pervasive computing.	12	An	P	PO1	PSO3
CO4	Familiarize the role of WAP architecture and security.	12	An	P	PO1	PSO3
CO5	Understand the role of speech based applications in pervasive computing.	12	U	C	PO1	PSO3
CO6	Familiarize different voice standards.	12	F	F	PO1	PSO3

CO7	Understand the Model-View-Controller pattern	12	An	P	PO1	PSO3
CO8	Analyze pervasive web application architecture.	12	U	C	PO1	PSO3

Course Outline

Unit I [15 T]: Introduction to pervasive computing - past, present, future - the pervasive computing market, m-Business, challenges and future of pervasive computing. Application examples of pervasive computing: retail, airline check-in and booking, sales force automation, healthcare, tracking, car information systems, Email access via WAP and voice.

Unit II [18 T]: Device technology for pervasive computing - hardware, human-machine interfaces, biometrics, operating systems, Java for pervasive devices, outlook. Device connectivity - protocols, security, device management.

Unit III [17 T]:: Web application concepts for pervasive computing - history, WWW architecture, protocols, trans-coding, client authentication via the Internet for pervasive computing. WAP and beyond - introduction, components of the WAP architecture, WAP infrastructure, WAP security issues, Wireless Markup Language, WAP push, products, i-Mode, outlook.

Unit IV [20 T]:: Web voice technology - basics of speech recognition, voice standards, speech applications, speech and pervasive computing, security personal digital assistants - history, device categories, personal digital assistant operating systems, device characteristics, software components, standards, mobile applications and personal digital assistant browsers. Server side programming (Java) for pervasive computing - Java 2 Enterprise Edition (Overview), servlets, Enterprise Java Beans, Java Server Pages, Extensible Markup Language, Web Services, Model-View-Controller pattern.

Unit V [20 T]:: Pervasive web application architecture - background, scalability & availability - development of pervasive computing web applications, pervasive application architecture - example pervasive application - introduction, user interface overview, architecture, implementation. Access from PCs - smart-card authentication via the Internet, ordering goods. Access via WAP - WAP functionality, implementation - access from personal digital assistants - extending the example application to personal digital assistants, implementation for synchronized devices, implementation for intermittently connected devices, implementation for connected devices - access via voice: extending the example application to voice access, implementation.

References:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec and Klaus Rindtorff, *Pervasive Computing: Technology and Architecture of Mobile Internet Applications*, 14th Edition, Pearson Education, ISBN: 8177582801.
2. Stefen Poslad, *Ubiquitous Computing: Smart Devices, Environments and Interactions*, Wiley India Pvt Ltd, ISBN: 8126527331.
3. Guruduth S. Banavar, Norman H. Cohen and Chandra Narayanaswami, Pervasive Computing: *An Application-Based Approach*, Wiley-Blackwell, ISBN: 0471777404.
4. Frank Adelstein, S K S Gupta, G G Richard and L Schwiebert, *Fundamentals of Mobile and Pervasive Computing*, Tata McGraw-Hill, New Delhi, ISBN: 0070603642.
5. Genco and S. Sorce, *Pervasive Systems and Ubiquitous Computing*, 1st Edition, WIT Press, ISBN: 1845644824.
6. Somprakash Bandyopadhyay, Amitava Mukherjee and Debashis Saha, *Networking Infrastructure for Pervasive Computing Enabling Technologies and Systems*, 1st Edition, ISBN: 8184898037.

FOURTH SEMESTER				
Course code	CSS4E03c			
Name of the course	**System Security**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2c	**ELECTIVE**	3(5:0:0)	**4**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive level (CL)	KC	PO	PSO
CO1	Identify computer and network security threats.	10	U	F	PO1	PSO2
CO2	Identify the motive, nature and scope of cyber crime.	6	U	C	PO1	PSO2
CO3	Understand the importance of Security in Information System	12	U	C	PO1	PSO2
CO4	Understand important elements of security - Program Security and Operating system security,	14	U	C	PO1	PSO2
CO5	Develop a security model to prevent, detect and mitigate the attacks.	8	Ap	P	PO1	PSO2
CO6	Delineate various types of security policies	10	An	P	PO1	PSO2
CO7	Understand important elements of Database security	14	U	C	PO1	PSO2

CO8	Understand important elements of Administering Security Policy	16	U	F	PO1	PSO2

Course Outline

Unit I [14 T]: Notion of different types of securities - information security - computer security - security goals, relation between security, confidentiality, integrity, availability and authorization, vulnerabilities - principles of adequate protection. Notions of operating security, database security, program security, network security attacks - threats, vulnerabilities and controls. The kind of problems - interception, interruption, modification, fabrication. Computer criminals - amateurs, crackers, career criminals. Methods of defence
- control, hardware controls, software controls, effectiveness of controls.

Unit II [16 T]: Program security - secure programs - fixing faults, unexpected behaviour, types of

flaws. Non-malicious program errors - buffer overflows, incomplete mediation. Viruses and other malicious code - kinds of malicious code, how viruses attach, how viruses gain control, prevention, control example - the brain virus, the internet worm, web bugs. Targeted malicious code - trapdoors, Salami attack. Controls against program threats - development controls, peer reviews, hazard analysis.

Unit III [16 T]: Operating system security - protected objects and methods of protection - memory address protection - fence, relocation, base/bounds registers, tagged architecture, segmentation, paging. Control of access to general objects - directory, access control list. File protection mechanism - basics forms of protection, single permissions. Authentication - authentication basics, password, authentication process challenge - response, biometrics. Trusted operating systems - security policies for operating systems, models of security - requirement of security systems, multilevel security, access security, limitations of security systems. Trusted operating system design - elements, security features, assurance, system flaws and assurance methods.

Unit IV [14 T]: Database Security - security requirements - integrity of database, confidentiality and availability, reliability and integrity, sensitive data, interface, multilevel database, proposals for multilevel security.

Unit V [12 T]: Administrating security - security planning - contents of a security planning, team members, commitment to a security plan, business continuity plans. Risk analysis - the nature of risk, steps of risk analysis. Arguments for and against risk analysis, organizational security policies - purpose and goals of organizational security. Audience, characteristics of a good security policy. Nature of security policies - data

sensitivity policy, government agency IT security policy. Physical security - natural disaster, human vandals, interception of sensitive information.

References

1. C. P. Pfleeger and S. L. Pfleeger, Security in Computing, 4th Edition, Pearson India, ISBN: 9788131727256.
2. Matt Bishop, Computer Security: Art & Science, 1st Edition, Pearson, ISBN: 0201440997.
3. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson India, ISBN: 9332518777.
4. Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, 4th Edition, Ceneage Learning India Pvt Ltd, ISBN: 8131516458.

FOURTH SEMESTER				
Course code	**CSS4E03d**			
Name of the course	**MOLECULAR SIMULATION AND MODELLING**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2d	**ELECTIVE**	**3 (5:0:0)**	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand different molecular modelling methods.	18	U	C	PO1	PSO3
CO2	Familiarize concept, principles of mathematical modeling and discrete system simulation.	18	An	P	PO1	PSO3
CO3	Analyse different mapping techniques and Microarray technology	18	An	P	PO1	PSO3
CO4	Analyse different prediction strategies of Structural Modelling.	18	An	P	PO1	PSO3
CO5	Familiarize scientific literature in the basic operations and steps in molecular visualization	18	An	C	PO1	PSO3

Course Outline

Unit I [12 T]: Overview of molecular modelling - molecular modelling methods - semi-empirical method and empirical method. Model Type - static, dynamic and probabilistic models. Models of growth and decay

Unit II [15 T]: System modelling - concept, principles of mathematical modelling, static physical model, stochastic activities, continuous and discrete simulation. Discrete system simulation

- probability concepts in simulation, random number generations and their testing, stochastic variable generation. Model execution - event driven versus time driven.

Unit III [22 T]: Computational gene mapping - genetic mapping, gene expression, gene prediction methods, gene prediction tools, mutational analysis, introduction to restriction mapping and map assembly, mapping with restriction fragment fingerprints, Lander - Waterman statistics. Software Packages for Phylogenetic Analysis - PHYLogeny Inference Package (Phylip), Phylogenetic Analysis using Parsimony (PAUP) and Phylogenetic Analysis by Maximum Likelihood (PAML). Microarray technology - techniques for microarray data analysis - microarray databases. Scatter Plots, Principal Component A nalysis, Cluster Analysis, Applications of Microarray Technology.

Unit IV [21 T]: Structural Modelling: Protein structure prediction - Prediction of protein secondary structure from the amino acid sequences. Prediction of three dimensional protei n structure. Protein structure classification: Two major classification schemes - CATH and SCOP. Protein structure prediction: Steps involved in homology modeling. Protein- Protein Interactions: Prediction methods for Protein- Protein interactions. Protein- protein interaction Databases. Computer Assisted Drug Design (CADD): Protein based drug design cycle, drug discovery pipeline. Docking Simulations: Rigid docking and Flexible docking.

Unit V [20 T]:: Molecular Visualization: Visualization of protein structure, Methods of studying proteins, Proteomics databases, Protein family databases, PDB file format. Software tools for 3D molecular graphic visualization: Rasmol - basic operations and steps in Rasmol to visualize the molecule, advantages of Rasmol, advantages of Swiss-PdbViewer.

References:

1. Stephen Misener and Stephen A. Krawetz, Bioinformatics: Methods and Protocols, 1st Edition, Humana Press, iSBN: 1617371564.
2. Geoffrey Gordan, System SimuS&nr 2nd Edition,' PHI, ISBN: 9788120301405.
3. Tamar Schlick, Molecular Modeling and Simulation: An Interdisciplinary Guide, 2nd Edition, Springer, ISBN: 14w1426902.

4. Narsingh Dev, System Modelling with Digital Computer, PHI, ISBN: 0138817898.
5. Andrew Leach, Molecular Modelling: Principles and Applications, Prentice Hall. 2nd Edition, ISBN: 81317286092001.
6. Prakash S Lohar, Bioinformatics, MJP publishers, Chennai, ISBN: 9788180940668.
7. H-D Holtje, Molecular Modeling - Basic Principles and Applications, 3rd Edition, Wiley-VCH, ISBN-13: 9783527315680.
8. Alan Hinchliffe, Molecular Modelling for Beginners, 2nd Edition, John Wiley and Sons Ltd, ISBN: 9780470513149.
9. N Cohen, Guidebook on Molecular Modeling in Drug Design, 1st Edition, ISBN :9780121782450
10. Masatoshi Nei and Sudhir Kumar, Molecular Evolution and Phylogenetics, Oxford University Press, ISBN: 0195135857.
11. Asheesh Shanker, Vinay Sharma and Ashok Munjal, A Textbook of Bioinformatics, 1st Edition, Rastogi Publications, New Delhi, ISBN: 9788171339174.
12. Des Higgins (Ed), Willie Taylor (Ed), Bioinformatics: Sequence, Structure and Databanks - A Practical Approach, 3rd Edition, New Delhi Oxford University Press, ISBN: 0195667530.

FOURTH SEMESTER				
Course code	**CSS4E03e**			
Name of the course	**FUNDAMENTALS OF BIG DATA**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2e	**CORE**	**3 (5:0:0)**	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the basic concepts of big data and databases available in real-time	18	U	C	PO1	PSO3
CO2	Familiarize data analytics using a tool - R.	18	An	P	PO1	PSO3
CO3	Understand NOSQL databases and implement basic functions	18	U	C	PO1	PSO3
CO4	Familiarize HADOOP	18	U	C	PO1	PSO3
CO5	Understand the elementary concepts of mapreduce.	18	U	C	PO1	PSO3

Course Outline

Unit I [18 T]: Introduction to Big Data – definition & importance of Big Data - four dimensions

of Big Data - volume, velocity, variety, veracity – importance of big data – structured data, unstructured data - the role of a CMS in big data management - integrating data

types into a big data environment - distributed computing and Big Data. Big Data stack – layer 0,1 and 2 – Big Data management – operational databases – relational databases – non relational databases – NoSQL - key-value pair databases – document databases - columnar databases - graph databases - spatial databases.

Unit II [18 T]: Big Data analysis - basic analytics - operationalized analytics - modifying business intelligence products to handle Big Data - Big Data analytics examples - Analytics solutions
- text analytics - exploring unstructured data - understanding text analytics analysis and extraction techniques - the extracted information - text analytics tools for Big Data - custom applications for Big Data analysis - R Environment - Google Prediction API - Characteristics of a Big Data Analysis Framework.

Unit III [18 T]: NoSQL databases - types - Advantages over Relational Databases - MongoDB - introduction - MongoDB philosophy - the data model - designing the database - collections
- documents - data types - the _id Field - indexes - viewing available databases and collections - opening a database - inserting data - querying for data - retrieving documents - aggregation commands - grouping results - conditional operators - specifying an array of matches - applying criteria for search - $slice - $size - $exists - $type - $elemMatch - $not (meta-operator) - update() - save() - $inc - $set - $unset - $push - $pushAll - $addToSet - removing elements from an array atomic operations - modifying and returning a document atomically - renaming a collection - removing data - referencing a database - implementing index-related functions - min() and max().

Unit IV [18 T]: Hadoop - history - components - HDFS - MapReduce Basics - origins of MapReduce map function - reduce function - putting them together - Hadoop common components - application development in Hadoop - Pig and Pig Latin - Load - Transform - Dump and Store - Hive - Jaql - getting our data into Hadoop - basic copy data - Flume - Zookeeper ^ HBase -Oozie - Ltycene - Avro.

Unit V [18 T]: Understanding MapReduce - key/value pairs - the Hadoop Java API for MapReduce - the Mapper class - the Reducer class - the Driver class - writing simple MapReduce programs - Hadoop-provided mapper and reducer implementations - Hadoop- specific data types - the Writable and WritableComparable interfaces - wrapper classes - Input/output - InputFormat and RecordReader - OutputFormat and RecordWriter. Implementing WordCount using streaming - analyzing a large dataset - summarizing the UFO data - summarizing the shape data - a relational view on data with Hive - creating a table for the UFO data - inserting the UFO data - redefining the table with the correct column separator - creating a table from an existing file - SQL views.

References

1. Hurwitz, Alan Nugent, Fern Halper and Marcia Kaufman, *Big Data for Dummies*,

ISBN: 9781118504222.

2. Eelco Plugge, Peter Membrey and Tim Hawkins, *The Definitive Guide to MongoDB*: *The NoSQL Database for Cloud and Desktop Computing*, 1st Edition, Apress, ISBN: 9781430230519.
3. Chris Elaton, Derk Deroos, Tom Deutsch, George Lapis and Pual Zikopoulos, *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, 1st Edition, ISBN: B006UWBBO6.
4. Garry Turkington, *Hadoop Beginner's Guide*, Packt Publishing Ltd, ISBN: 1849517304.

FOURTH SEMESTER				
Course code	**CSS4E03f**			
Name of the course	**WEB ENGINEERING**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2f	**ELECTIVE**	3 (5:0:0)	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the basics and evolution of Web Engineering	12	U	C	PO1	PSO3
CO2	Understand requirement engineering activities for web applications	12	U	C	PO1	PSO3
CO3	Familiarize web application architecture	10	An	P	PO1	PSO3
CO4	Demonstrate design principles in Web applications	14	Ap	P	PO1	PSO3
CO5	Understand modeling concepts in web engineering	10	U	C	PO1	PSO3
CO6	design and develop website using current Web technologies and model	12	Ap	P	PO1	PSO3
CO7	Apply testing principles on web applications	12	Ap	P	PO1	PSO3

CO8	Familiarize risks and change management to assure quality in web projects.	8	U	C	PO1	PSO3

Course Outline

Unit I [12 T]: Web Engineering (WE) – introduction – motivation – categories & characteristics of web applications – product related, usage related and development related – evolution of WE.

Unit II [14 T]: Requirements Engineering (RE) for web applications - introduction - fundamentals - sources of requirements - RE activities - RE specifications in WE - RE principles for web applications - adapting RE methods for web applications development - requirement types, notations, tools.

Unit III [18 T]: Web application architecture - introduction - fundamentals - definition of architecture - developing and characterising architectures - components of a generic web application architecture - layered architecture - database centric architecture - architecture for web document management - architecture for multimedia data.

Unit IV [24 T]: Modelling web applications - introduction - modelling specifics in WE - levels – aspects phases of customizations - modelling requirements - hypertext modelling - hypertext structure modelling concepts - access modelling concepts. Web application design - web design from an evolutionary perspective - information design - software design merging information design & software design - problems and restrictions in integrated web design - a proposed structural approach - presentation design - presentation of nodes and meshes - device independent development - approaches - interaction design - user interaction - user interface organization - navigation design - deigning a link representation - designing link internals - navigation and orientation - structural dialog for complex activities - interplay with technology and architecture - functional design.

Unit V [22 T]: Testing web applications - introduction - fundamentals - terminology - quality characteristics - test objectives - test levels - role of tester - test specifics in we - test approaches
- conventional, agile - test schemes - three test dimensions - applying the scheme to web applications - test methods and techniques - link testing - browser testing - usability testing
- load, stress and continues testing - testing security - test- driven development. Web project development - scope - refining frame work activities - building a WebE team - risk management - making schedule - managing quality, change - project tracking.

References

1. Gerti Kappel, Birgit Proll, Siegried Reich and Werner Retschitzegger, *Web Engineering: The Discipline of Systematic Development of Web Applications*, John Wiley and Sons Ltd, ISBN: 9780470064894.
2. Roger S Pressman and David Lowe, Web Engineering: A Practitioner's Approach, 1st Edition, Tata Macgraw Hill Publications, ISBN: 9780073523293.
3. Leon Shklar and Rich Rosen, *Web Application Architecture: Principles, Protocols and Practices*, 2nd Edition, Wiley, ISBN: 047051860X.
4. Guy W Leeky-Thompson, *Just Enough Web Programming with XHTML, PHP, and MySQL,* 1st Edition, Cenagage Learning, ISBN: 159863481X.
5. Anders Moller and Michael Schwartzbach, *An Introduction to XML and Web Technologies*, 1st Edition, Pearson Education, New Delhi, 2009.
6. Chrits Bates, *Web Programming: Building Internet Applications*, 3rd Edition, Wiley India Edition, ISBN: 8126512903. MySQL, 1st Edition, Cenagage Learning, ISBN: 159863481X.

FOURTH SEMESTER				
Course code	**CSS4E04a**			
Name of the course	**Digital Image Processing**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2a	**Elective**	3(5:0:0)	**5**	**5 (Internal 1+ External 4)**

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand application of digital image processing.	8	U	F	PO3	PSO4
CO2	Explore image processing fundamentals.	6	U	P	PO3	PSO4
CO3	Familiarize with image sampling and quantization.	6	U	P	PO3	PSO4
CO4	Understand image transformation techniques viz. Fourier transform, walsh Hadamard, DCT, and Hotelling transform.	16	An	P	PO3	PSO4
CO5	Understand image enhancement techniques - histogram processing and various image filters viz.laplacian filter, smoothing and sharpening filters, spatial filters, and homomorphic filters.	16	U	F	PO3	PSO4
CO6	Familiarize various noise models and filter techniques.	10	Ap	F	PO3	PSO4
CO7	Understand concept of segmentation in images.	14	Ap	P	PO3	PSO4

CO8	Understand lossy and lossless compression techniques.	14	U	P	PO3	PSO4

Course Outline

Unit I [16 T]: Introduction - digital image representation - fundamental steps in image processing
- elements of digital image processing systems - digital image fundamentals - elements of visual perception - a simple image model - sampling and quantization - basic relationship between pixels - image geometry.

Unit II [16 T]: Image transforms - introduction to Fourier transform - discrete Fourier transform (DFT) - properties DFT- other separable image transforms - Walsh, Hadamard and Discrete Cosine transforms. Hotelling transform.

Unit III [16 T]: Image enhancement - basic grey level transformation - histogram equalization - image subtraction - image averaging - spatial filtering - smoothing, sharpening filters Laplacian filters. Enhancement in the frequency domain - frequency domain filters smoothing, sharpening filters - homomorphic filtering.

Unit IV [16 T]: Image restoration - model of Image degradation/restoration process - noise models inverse filtering - least mean square filtering - constrained least mean square filtering. Edge detection - thresholding - region based segmentation - boundary representation.

Unit V [16 T]: Image compression - fundamental concepts of image compression - compression models - information theoretic perspective. Lossless compression - Huffman coding - arithmetic coding - bit plane coding - run length coding. Lossy compression - transform coding - image compression standards.

References

1. Richard E Woods and Rafael C Gonzalez, *Digital Image Processing*, 3rd Edition, Pearson Education Singapore Pte Ltd, ISBN: 8131726959.
2. B. Chanda and D.D. Majumder, *Digital Image Processing and Analysis*, 2nd Edition, PHI Learning Pvt Ltd, ISBN: 8120343255.
3. A.K. Jain, *Fundamentals of Digital Image Processing*, 2nd Edition, PHI Learning Pvt Ltd, ISBN: 8120309294.
4. W.K. Pratt, *Digital Image Processing: PIKS Scientific Inside*, 4th Edition, John Wiley, ISBN: 0471767778.
5. Milan Sonka, Vaclav Hlavac and Roger Boyle, *Image Processing Analysis and*

Machine Vision, 3rd Edition, Ceneage Learning India Pvt Ltd, ISBN: 8131518833.

FOURTH SEMESTER				
Course code	**CSS4E04b**			
Name of the course	**Advanced Topics In Database Design**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2b	**ELECTIVE**	**3 (4:0:0)**		**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the concepts of extended entity relationship model and object model.	14	U	C	PO1	PSO2
CO2	Design and implement an Object-Oriented database schema for a given problem-domain	12	C	C	PO1	PSO2
CO3	Familiarize RDBMS, OODBMS and ORDBMS.	12	U	C	PO1	PSO2
CO4	Populate and query a database using SQL DML/DDL commands.	12	U	C	PO1	PSO2
CO5	Understand parallel and distributed databases.	12	U	C	PO1	PSO2
CO6	Understand the client server architecture.	8	U	C	PO1	PSO2

CO7	Develop XML applications with object database.	12	C	C	PO1	PSO2
CO8	Understand the data models *viz.* active, temporal, spatial, deductive, mobile databases and geographic information systems.	8	U	C	PO1	PSO2

Course Outline

Unit I [10T]: The Extended Entity Relationship model and object model - The ER model revisited, motivation for complex data types, user defined abstract data types and structured types, subclasses, super classes, inheritance, specialization and generalization, constraints and characteristics of specialization and generalization, relationship types of degree higher than two.

Unit II [12 T]: Object-Oriented databases - overview of object-oriented concepts, object identity, object structure, and type constructors, encapsulation of operations, methods, and persistence, type hierarchies and inheritance, type extents and queries, complex objects, database schema design for OODBMS, OQL, persistent programming languages, OODBMS architecture and storage issues, transactions and concurrency control, example of ODBMS.

Unit III [14 T]: Object relational and extended relational databases - database design for an ORDBMS - nested relations and collections, storage and access methods, query processing and optimization, an overview of SQL3, implementation issues for extended type - systems comparison of RDBMS, OODBMS and ORDBMS.

Unit IV [18 T]: Parallel and distributed databases and client-server architecture - architectures for parallel databases, parallel query evaluation, parallelizing individual operations, sorting, joins, distributed database concepts, data fragmentation, replication and allocation techniques for distributed database design, query processing in distributed databases, concurrency control and recovery in distributed databases. An overview of client-server architecture.

Unit V [18 T]: Object databases on the web and semi structured data - web interfaces to the web, overview of XML - structure of XML data, document schema, querying XML data - storage of XML data, XML applications - the semi structured data model, implementation issues, indexes for text data. Enhanced data models for advanced applications - active database concepts, temporal database concepts, spatial databases concepts and architecture, deductive databases and query processing, mobile databases, geographic information systems.

References:

1. Elmasri and Navathe, *Database Systems - Models, Languages, Design and Application Programming*, 6th Edition, Pearson India, ISBN: 8131792471.
2. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd Edition, McGraw - Hill Education, ISBN: 9339213114.
3. Korth, Silberchatz and Sudarshan, *Database System Concepts*, 6th Edition, McGraw- Hill Education India Pvt. Ltd, ISBN: 9332901384.
4. Alexis Leon and Mathews Leon, *Database Management System*, 1st Edition, Vikas Publishers, ISBN: 8182092221. L»r
5. Peter Rob and Coronet, *Database Systems, Design, Implementation and Management*, 5th Revised Edition, Course Technology, ISBN: 061906269X.
6. C J Date, *Introduction to Database Systems*, 8th Edition, Addison-Wesley, ISBN: 0321197844. CSS4E01c | Software Development for Portable Devices

FOURTH SEMESTER				
Course code	**CSS4E04c**			
Name of the course	**Software Development for Portable Devices**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2c	**ELECTIVE**	**3 (5:0:0)**	**5**	**5 (Internal 1+ External 4)**

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Introduce mobile web application development	8	U	C	PO1	PSO3
CO2	Apply HTML 5 tags and attributes .	15	Ap	P	PO1	PSO3
CO3	Use jQuery events and event handling methods.	15	Ap	P	PO1	PSO3
CO4	Exemplify mobile application development using android.	15	U	F	PO1	PSO3
CO5	Illustrate mobile database application using SQLite and content provider	10	U	C	PO1	PSO2

CO6	Implement mobile application using audio and video, location based, and network connectivity services.	15	U	C	PO1	PSO2

Course Outline

Unit I [23 T]: Introduction to Mobile Web (HTML 5) - Semantic Elements - Structural Elements

- Basic formatting tags - heading, paragraph, underline break, bold, italic, underline, superscript, subscript, font and image. Different attributes like align, color, bgcolor, font face, border, size. Navigation Links using anchor tag - internal, external, mail and image links. Lists - ordered, unordered and definition, table tag, HTML5 form controls - form, input types - color, date, datetime, datetime-local, email, month, number, range, search, tel, time, url, week, text, password, textarea, button, checkbox, radio button, select box, hidden controls, calendar, date, time, email, url, search. Datalist, keygen, output - Introduction to CSS3.

Unit II[15 T] jQuery - introduction - Adding jQuery to web pages - downloading - accessing from CDNs - jQuery syntax - jQuery selectors - event methods - ready(), click(), dblclick(), mouseenter(), mouseleave(), mousedown(), mouseup(), hover(), foucs(), blur() - effects - hide, show, fading, sliding, animation - callback functions - chaining - methods for changing and manipulating HTML elements and attributes - adding new elements/content - append(), prepend(), after(), before() - removing elements - remove(), empty() - manipulating CSS3 - dimensions of elements and browser window - traversing - ancestors, descendants, siblings.

Unit III [15 T]: Introduction to Android and smart phones, Android architecture & virtual machine, mobile technology terminologies, setting up the environment, setting up emulators, Android fundamentals - activities and applications activity life cycles, activity stacks, activity states. Introduction to manifest, resources & R.java, assets, values - strings.xml

- form widgets, views, layouts & drawable resources - XML layouts, linear layouts, relative layouts, table layouts, A ndroid widgets, UI XML specifications events, bundles & intents - explicit intents implicit intents event broadcasting with intents event reception with broadcast receivers, adapters and data binding.

Unit IV [10 T]: Files, content providers and databases - saving and loading files, SQLite databases

- Android database design - exposing access to a data source through a content provider content provider registration native content providers, Android Debug Bridge (adb) tool,

Linkify.

Unit V [15 T]: Adapters and widgets, notifications, custom components threads running on UI thread, Worker thread handlers & runnable asyntask (in detail), playing audio and video, recording audio and video, using the camera to take and process pictures. Networking & location based services - live folders, using sdcards – reading and writing, XML parsing - JSON parsing - including external libraries in applications, Map-based activities, Maps via intent and Map activity GPS, location based services configuration, geocoding, accessing phone services (Call, SMS, MMS), network connectivity services, using Wifi & Bluetooth action bar tabs and custom views on action bars.

References:

1. Terry Felke-Morris, *Web Development & Design Foundations with HTML5*, 7th Edition, Addison-Wesley, ISBN: 0133571785.
2. *Html5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery*, Kogent Learning Solutions Inc, ISBN: 9350040956.
3. Kessler, *Programming HTML 5Applications*, OReilly Media, ISBN: 9350235904.
4. Robin Nixon, *Html5 For IOS and Android: Beginner Guide*, 1st Edition, McGraw-Hill Education India Pvt .Ltd, ISBN: 101259003078.
5. Lauren Darcey and Shane Conder, *Android Wireless Application Development: Android Essentials* (Volume 1), 3rd Edition, Pearson Education, ISBN: 9332518882.
6. Zigurd Mednieks, Rick Rogers, Lombardo John and Blake Meike, *Android Application Development*, 1st Edition, O'Reilly Meida,
7. Reto Meier, *Professional Android 2 Application Development*, 1st Edition, Wiley India Pvt Ltd, ISBN: 8126525894.

FOURTH SEMESTER				
Course code	**CSS4E04d**			
Name of the course	**Storage Area Networks**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2d	**ELECTIVE4**	**3 (5:0:0)**	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Familiarize the concepts of storage area network.	8	U	C	PO1	PSO3
CO2	Familiarize the topologies used in storage area network.	10	U	C	PO1	PSO3
CO3	Understand the configuration and technology of storage area network	10	U	C	PO1	PSO3
CO4	Understand the challenges in software management.	10	U	C	PO1	PSO3
CO5	Understand the network architecture of storage network.	10	U	C	PO1	PSO3

CO6	Implement strategies of backup software in storage area network.	12	Ap	P	PO1	PSO3
CO7	Familiarize the management of storage area network.	15	U	C	PO1	PSO3
CO8	Understand the concepts of designing and building of SAN.	12	U	C	PO1	PSO3

Course Outline

Unit I [18 T]: Basic networking concepts and topologies - OSI reference model, common network devices, network topologies, MAC standards - need for storage networks – storage devices - techniques evolution - benefits of SANs - SAN components and building blocks - fibre channel basics - fibre channel topologies, fibre channel layers, classes of service SAN topologies.

Unit 2 [20 T] : SAN fundamentals - SAN operating systems software and hardware types of SAN technology - technology and configuration, high scalability and flexibility standards - storage management challenges - networked storage implementation challenges - storage subsystems for video services.

Unit III [22 T: Storage networking architecture storage in storage networking - challenges, cost and performance - Network in storage networking - fibre channel, emerging SAN interconnect technologies - basic software, advanced software, backup software implementation strategies.

Unit IV [15 T]: Storage network management in-band management out-of-band management - SNMPHTTP - TELNET storage network management issues - storage resource management - storage management, storage, systems and enterprise management integration.

Unit V [12 T]: Designing and building a SAN - design considerations - business requirements - physical layout, placement, storage, pooling, data availability, connectivity, scalability, migration, manageability, fault tolerance and resilience - prevention of congestion - routability - backup and restoration - SAN security & iSCSI technology - basic security guidelines - implementing SAN security - backup and restoration in iSCSI technology - future of SANS.

References

1. Meeta Gupta, *Storage Area Network Fundamentals*, Cisco Press, ISBN:

158705065X.

2. John R. Vacca, *The Essential Guide to Storage Area Networks*, 1st Edition, Prentice Hall, ISBN: 0130935751.
3. Richard Barker and Paul Massiglia, *Storage Area Network Essentials*: *A Complete Guide to Understanding and Implementing SANs*, Wiley India Pvt Ltd, ISBN: 8126518588.
4. Tom Clark, *Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs*, 2nd Edition, Addison Wesley Professional, ISBN: 0321136500.
5. Robert Spalding, *Storage Networks: The Complete Reference*, 1st Edition, Tata McGraw-Hill Education, ISBN: 0070532923.
6. Christopher Poelke and Alex-Nikitin, *Storage Area Networks for Dummies*, 2nd Edition, ISBN: 9780470385135. '
7. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka and Nils Haustein, *Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE*, Wiley India Pvt Ltd, ISBN: 8126518324.

FOURTH SEMESTER				
Course code	**CSS4E04e**			
Name of the course	**SEMANTIC WEB**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2e	**ELECTIVE**	**3 (5:0:0)**	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the set of activities that concern the ontology development	18	U	C	PO1	PSO3
CO2	Familiarize languages for semantic web and ontologies	18	An	P	PO1	PSO3
CO3	Understand ontology-learning for semantic web	18	U	C	PO1	PSO3
CO4	Introduce ontology management and familiarize to work with tools	18	R	C	PO1	PSO3
CO5	Applications and security concepts of web services and semantic web services.	18	An	C	PO1	PSO3

Course Outline

Unit I [18 T]: Components - types - ontological commitments - ontological categories - philosophical background - knowledge representation ontologies – top level ontologies - linguistic ontologies - domain ontologies - semantic web - need - foundation - layers - architecture.

Unit II[18 T]: Languages for semantic web and ontologies - web documents in XML – RDF – schema – web resource description using RDF - RDF properties – topic maps and RDF – overview – syntax structure – semantics – pragmatics - traditional ontology languages – LOOM - OKBC – OCML - Flogic Ontology Markup Languages – SHOE – OIL – AML
– OIL – OWL.

Unit III[18 T]: Ontology learning for semantic web - taxonomy for ontology learning - layered approach - phases of ontology learning - importing and processing ontologies and documents
- ontology learning algorithms - evaluation.

Unit IV [18 T]: Ontology management and tools - overview - need for management - development process - target ontology - ontology mapping - skills management system - ontological class - constraints - issues. Evolution - development of tools and tool suites - ontology merge tools - ontology based annotation tools.

Unit V [18 T]: Applications - web services - semantic web services - security issues - current trends.

References

1. Asuncion Gomez-Perez, Oscar Corcho and Mariano Fernandez-Lopez, *Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web*, 1st Edition, Springer, ISBN: 1849968845.
2. Grigoris Antoniou and Frank van Harmelen, *A Semantic Web Primer*, The MIT Press, ISBN: 0262012103.
3. Liyand, *Introduction to the Semantic Web and Semantic Web Services*, Chapman, ISBN: 1584889330.
4. Alexander Maedche, *Ontology Learning for the Semantic Web*, Springer, 2002nd Edition, ISBN: 0792376560.
5. John Davies, Dieter Fensel and Frank Van Harmelen, *Towards the Semantic Web: Ontology-Driven Knowledge Management*, 1st Edition, Wiley, ISBN: 0470848677.
6. Dieter Fensel, Wolfgang Wahlster, Henry Lieberman and James Hendler, *Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential*, The MIT Press, ISBN: 9780262562126.

FOURTH SEMESTER				
Course code	**CSS4E04f**			
Name of the course	**ADVANCED JAVA PROGRAMMING**			
Course No	**Course Category Core/Compli/ Elective**	**Number of Credits**	**Number of hours of Lectures/week**	**Total Weightage (Int+Ext)**
4.2f	**ELECTIVE**	3 (5:0:0)	**5**	**5** (Internal 1+ External 4)

CO	CO Statement	Hrs	Cognitive Level(CL)	Knowledge Category (KC)	PO	PSO
CO1	Understand the basics of RMI	15	U	C	PO1	PSO3
CO2	Understand and Analyze Servlets	15	U	C	PO1	PSO3
CO3	Familiarize JNDI and EJB architecture	18	An	P	PO1	PSO3
CO4	Demonstrate JSP concepts and familiarize JSP technology	23	An	P	PO1	PSO3
CO5	Familiarize Hibernate and ORM	19	An	C	PO1	PSO3

Course Outline

Unit I [15 T]: RMI & Servlets - introduction, architecture, defining remote objects, creating stubs and skeletons, serializable classes, accessing remote objects, factory classes, dynamically loaded classes, RMI activation, registering remote objects.

Unit II[15 T]: Servlets, generic servlet, servlets that access request headers, develop servlets that manipulate response headers, HTTP servlets, forms, HTTP protocols -

configuring Tomcat Server, servlet context, servlet context listener, servelet chaining.

Unit III [18 T]: JNDI & EJB - architecture, context initial context class, objects in a context, binding objects, accessing directory services, attributes and attribute interface modifying directory entities, creating directories entities. EJB roles, architecture, container, implementing a basic EJB object, implementing session beans, implementing entity bean, deploying an enterprise bean object.

Unit IV[23 T]: Java Server Pages (JSP) - developing JSP pages, technology, syntax using scripting elements, syntax using the courier page directive, create and use JSP error pages, building reusable web presentation, components, JSP technology syntax using the include directive, JSP technology syntax using the jsp:include standard action, developing JSP Pages using custom tags, problem with JSP technology scriptlet code, given an existing custom tag library, develop a JSP page using the library, developing a simple custom tag, structure and
execution of a custom tag in a JSP page, tag handler class for a simple empty custom tag, custom tag that includes its body in the contour of the HTTP response, tag library description for a simple, empty custom tag.

Unit V[19 T]: Hibernate - ORM overview - Hibernate overview, environment, configuration, sessions, persistent class - mapping files - mapping types - examples - O/R mappings - annotations - Hibernate Query Language - Hibernate criteria - queries - Hibernate Native SQL, caching, batch processing, interceptors.

References

1. Jason Hunter and William Crawford, *Java Servlet Programming*, 2nd Edition, O'Reilly Media, ISBN: 0596000405.
2. Karl Moss, *Java Servlets*, McGraw-Hill, ISBN: 0074637398.
3. Barry Burd, *JSP: JavaServerPages*, IDG Books, ISBN: 0764535358.
4. Prashant Sridharan, *Javabeans Developer's Resource*, ISBN: 0138873089.
5. Chuck Cavaness, *Programming Jakarta Struts*, 2nd Edition, O'Reilly Media, ISBN: 0596006519.
6. Madhusudhan Konda, *Just Hibernate: A Lightweight Introduction to the Hibernate Framework*, Oreilly Meida, ISBN: 9781449334376.

APPENDIX A : Guidelines for Project Report & Layout

Cover Page & First Page

<<TITLE>>

A PROJECT REPORT

SUBMITTED BY

<<NAME OF THE STUDENT>>

FOR THE AWARD OF THE
DEGREE OF MASTER OF SCIENCE (M.SC.) IN
COMPUTER SCIENCE
(UNIVERSITY OF CALICUT)

<<COLLEGE EMBLEM>>

<<NAME OF THE DEPARTMENT>>

<<NAME OF THE INSTITUTION>>
(AFFILIATED TO THE UNIVERSITY OF CALICUT)
<<ADDRESS>>

MONTH YEAR

Acknowledgemet

ACKNOWLEDGEMENT

I would like to thank ……..

Date: Name of the Student

Declaration by the Student

DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person or material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

Date: Signature:

Name

: Reg.

No.:

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Certificate from Guide & HoD

CERTIFICATE

This is to certify that the project report entitled <<TITLE HERE>> submitted by <<Name of the Student>> (Register Number: << Reg, No>>) to University of Calicut for the award of the degree of Master of Science (M.Sc.) in Computer Science is a bonafide record of the project work carried out by him/her under my supervision and guidance. The content of the report, in full or parts have not been submitted to any other Institute or University for the award of any other degree or diploma.

Signature
<<Name Project Guide>>
<<Designation>>

Signature
<<Name of the HOD>>
<<Designation>>

Place:

Date:

PROJECT EVALUATION REPORT OF THE EXAMINERS

Certified that the candidate was examined by us in the Project Viva Voce Examination held on ..... and his/her Register Number is .....

Examiners:

1.

2.

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Contents

CONTENTS

Page *iv*

Abstract

ABSTRACT

The abstract is a very brief summary of the report's contents. It should be about half a page long. Somebody unfamiliar with your project should have a good idea of what it's about having read the abstract alone and will know whether it will be of interest to them.

An abstract is a section at the beginning of a report, dissertation, thesis or paper summarising the contents, significant results and conclusions of said document. It allows people to rapidly ascertain the documents purpose and if the document will be useful for them to read.

The abstract is not the same as a summary in the sense you are think of. It is a standalone account of the document giving purpose of the work (objectives), method used, scope of the work, results, conclusions and recommendations.

The abstract, although it comes first logistically, always should be written at the completion of the other chapters of the project report. It needs to be written last because it is the essence of your report, drawing information from all of the other sections of the report. It explains why the experiment was performed and what conclusions were drawn from the results obtained.

A general guideline for an abstract has five sections or areas of focus: why the experiment was conducted; the problem being addressed; what methods were used to solve the problem; the major results obtained; and the overall conclusions from the experiment as a whole.

Do not be misled, however, from this list into thinking that the abstract is a long section. In fact, it should be significantly shorter than all of the others. All of this information should be summarized in a clear but succinct manner if the abstract is going to be successful. An estimated average length for all of this information is only a single paragraph. Although this may seem as though it is a short length to contain all of the required information, it is necessary because it forces you to be accurate and yet compact, two essential qualities.

There are many useful web pages such as http://writing2.richmond.edu/training/proiect/biologv/abslit.html to get few sample abstracts and the common mistakes we make when we write an abstract.

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List of Figures

LIST OF FIGURES

List of Tables

LIST OF FIGURES

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…

CHAPTER 1

INTRODUCTION

This is a general introduction about the project. Briefly summarize the relevance and background information about the proposed work. It should have the following sections.

1. About the proposed work, underlying technologies and techniques – outline briefly the technological/engineering/scientific/socioeconomic/relevance or significance of the project work being reported.
2. Project Profile – Tile, Area and Category and other relevant information.
3. About the Organization – to whom the Project Work is carried out.
4. Major Contributions of the Project Work.

CHAPTER 2

PROBLEM DEFINITION AND METHODOLOGY

This chapter is meant for giving a detailed description about the problem. This chapter includes the following subsections.

1. ProblemDefinition
2. Objectives
3. Motivation
4. Methodology
5. Scope

CHAPTER 3

REQUIREMENT ANALYSIS AND SPECIFICATION

This chapter includes the following subsections.

1. Requirement Analysis/Literature Review
2. Existing System
3. Proposed System
4. Requirement Specification
    a. Functional Requirements
    b. Non-functional Requirements
    c. Environmental Details (Hardware & Software Requirements)
5. Feasibility Study
    a. Technical Feasibility
    b. Economical Feasibility
    c. Operational Feasibility
6. Project Planning and Scheduling
    a. PERT Chart
    b. GANTT Chart
7. Software Requirement Specifications (IEEE format preferred)

CHAPTER 4

REQUIREMENT ANALYSIS AND SPECIFICATION

This chapter includes the following subsections.

1. Users of the System
2. Modularity Criteria
3. Architecture Diagrams (whichever of the following if applicable)
   a. DFD
   b. UML Diagrams
   c. Flowchart
4. User Interface Layout
5. Structure of Reports Being Created
6. Database Design
   a. List of Entities and Attributes
   b. E R Diagram
   c. Structure of Tables

CHAPTER 5

IMPLEMENTATION

This chapter is about the realisation of the concepts and ideas developed earlier. It can also describe any problems that may have arisen during implementation and how you dealt with them.

Do not attempt to describe all the code in the system, and do not include large pieces of code in this section. Instead pick out and describe just the pieces of code which, for example:

- Are especially critical to the operation of the system;
- You feel might be of particular interest to the reader for some reason;
- Illustrate a non-standard or innovative way of implementing an algorithm, data structure, etc.

You should also mention any unforeseen problems you encountered when implementing the system and how and to what extent you overcame them. Common problems are:

- Difficulties involving existing software, because of, e.g.,
    - its complexity,
    - lack of documentation;
    - lack of suitable supporting software;
    - over-ambitious project aims.

A seemingly disproportionate amount of project time can be taken up in dealing with such problems. The Implementation section gives you the opportunity to show where that time has gone.

Complete source code should be provided separately as an

appendix. This chapter includes the following subsections.

1. Brief description about the Tools/Scripts for Implementation
2. Module Hierarchy
3. Coding
4. Problems Encountered

CHAPTER 6

TESTING

This chapter includes the following subsections.

1. Test Plans
2. Unit Testing
    a. Test Items (Test Cases)
3. Integration Testing
4. System Testing
    a. Test Items (Test Cases)
5. Implementation - Changeover Plans

CHAPTER 7

CONCLUSION

The purpose of this section is to provide a summary of the whole thesis or report. In this context, it is similar to the Abstract, except that the Abstract puts roughly equal weight on all report chapters, whereas the Conclusion chapter focuses primarily on the findings, conclusions and/or recommendations of the project.

There are a couple of rules for this chapter:

- All material presented in this chapter must have appeared already in the report; no new material can be introduced in this chapter (rigid rule of technical writing).
- Usually, you would not present any figures or tables in this chapter (rule of thumb).

Conclusions section can have the following (typical) content. These contents must not be given in bulleted format.

- Re-introduce the project and the need for the work though more briefly than in the introduction.
- Reiterate the purpose and specific objectives of your project.
- Recap the approach taken similar to the road map in the introduction.
- However, in this case, you are re-capping the data, methodology and results as you go.
- Summarize the major findings and recommendations of your work.

Future Enhancements

Identify further works that can be added to make your system to meet the challenges of tomorrow. You can also include whatever requirements you could not fully due to the scarcity of time/resources.

BIBLIOGRAPHY

Ideas or contents taken from other sources should be properly cited. It is important that you give proper credit to all work that is not strictly your own, and that you do not violate copyright restrictions.

References should be listed in alphabetical order of authors' surname, and should give sufficient and accurate publication details. IEEE format is to be followed while preparing citations.

PUBLICATIONS OUT OF THE PROJECT WORK

A list of publications made or communicated out of the work done in the project is to be included here.

GENERAL INSTRUCTIONS

1. All chapters should contain an introduction and summary (summarizes the entire chapter content in one or two lines) sections.
2. Students have to take care that only chapters/sections relevant to their work are to be included in their report.
3. Instead of merely replicating the definitions for these sections from standard text books of Software Engineering, the student has to describe the information related to his/her work (For eg, Feasibility study should be about how the proposed work is technically/economically/operationally feasible).
4. Figures and tables are to be clear and legible.
5. Citations are to be provided wherever necessary.
6. Important code, screenshots, report formats and glossary of technical terms are to be attached as Appendices A, B, C and D respectively.

Model Question Paper

FIRST SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,
Computer Science
CSS1 C01: Discrete Mathematical Structures

Time: 3 Hours Maximum Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1 .a) Define symmetric difference between two sets with example.
b) What is a simple proposition and compound proposition?
2. Draw a truth table of p → q. Explain the difference between tautology and contradiction
3. a) Define powerset of a set and find the powerset of {1,2,3}.
b) Define a poset with example.
4. a) Check whether the relation R = {(a, a),(a,b),(a,c),(b,c)} is an equivalence relation.
b) What is partial order relation? Explain with an example.
5. What is bijective, injective and surjective function? Explain with example.
6. What is complemented and distributed lattice? Explain with an example
7. a) What is the difference between walk ,path and circuit in a graph? Give an example
b) Draw all possible subgraph of a complete graph K3.

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. a) Show that identity element in a group is unique.
b) Define fields with example.
9. What do you mean by Venn diagram?. Draw venn diagram of union, intersection and difference of two sets. Also explain different types of sets
10.a) Show that the given statement (p → q) ↔ (~pvq) is a tautology.
b) What is the Hasse diagram for the partial ordering {(A,B)/ACB}.
11.a) Prove that every cycle group is abelian.
b) State and prove De morgan's law on lattices.
12. Prove that in a distributive lattices if an element has complement then it is unique.
13. Explain Prim's and Kruskal's algorithm.
14. Prove that in a tree t = (v,e), |v| = |e| + 1.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. a) Does the complete graph K4 is Eulerian? Justify your answer.
b) What is PDNF and PCNF? Obtain the PDNF of (P^Q)v(~P^R)v(Q^R).
16. a) Show that (p→ ~q)^(p→ ~r)↔ ~(p^(qvr)).
b) Let A be the set of all positive integers. Let a binary relation R on A such that (a,b) is in R iff a divides b. Show that R is an partial order relation.
17.a) Let (A, ≤) be a lattice with universal upper and lower bound 1 and 0. For any element a in A, show that av1 = a, av0 = a, a^1 = a, a^0 = a.
b)State and prove Eulers theorem on graphs.
18. a) Prove that a subgraph H of G is normal iff every left cosets of H is a right cosets of H in G.
b) Explain predicate calculus.

FIRST SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,
Computer Science
CSS1 C02: Advanced Data Structures

Time: 3 Hours Maximum Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. Explain different binary tree traversal techniques in detail.
2. Explain the following sorting techniques?
(a) Quick sort (b) Selection sort
(c) Insertion sort (d) Bubble sort
3. Write the algorithm for infix to post fix. Convert to postfix form of the expression (A + B)*(C*D - E)*F / G is
4. Describe Abstract data type
5. a) What do you mean by priority queue ?
b) What do you mean by asymptotic notation? Explain.
7. Discuss the following data structure
(a) Linked lists (b) Queues
(c) Stacks (d) Deque

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. Discuss BFS and DFS algorithms with a suitable example.
9. What is a Binary Search Tree (BST)? Make a BST for the following sequence of numbers.
45, 36, 76, 23, 89, 115, 39, 41, 56, 69, 48
Traverse the tree in Preorder, Inorder and postorder?
10. The following values are to be stored in a hash table
25, 42, 96, 101, 102, 162, 197
Describe how the values are hashed by using division method of hashing with a table size of seven.
Use chaining as the method of collision resolution.
11. What is a threaded binary tree? Explain its operation with example
12. What is heap? Explain different types of heaps.
13. What is Recursion? Compare Recursive and Non Recursive algorithms. Explain with an example
14. Explain Huffman algorithm for Extended binary tree with example.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. What are circular queues? Write down routines for inserting and deleting elements from a circular queue implemented using arrays and linked lists.
16. What is B – Tree? Give the algorithm for insertion and deletion and explain with example.
17. Write short note on:
a) Red black tree
b) Digital search tree
c) Splay tree
d) Sparse matrix
e) Circular linked list
18. Derive the best, average, worst case time complexity of a quick sort.

FIRST SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS

CSS1C03 Theory of Computation

TIME: Three Hours Maximum: 30 weightage

Part A

Answer any 4 questions

Each question carries 2 weightage

1. Write a Regular Expression to denote a language L which accepts all the strings which begin or end with either 00 or 11. Define Instantaneous description (ID) in PDA.
2. What is: (a) CFL (b) Sentential form? Explain in detail
3. If S->aSb | aAb , A->bAa , A->ba .Find out the CFL
4. What is Backus-Naur Form (BNF)?
5. What is a Turing machine?
6. State Cooks theorem.
7. What is NP complete?

(4×2=8 weightage)

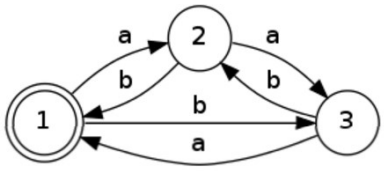
Part B

Answer any 4 questions

Each questions carries 3 weightage.

8. What are the different proof techniques used in computation?
9. Prove by the Principle of Mathematical Induction that for any natural number n,

   7n – 2n is divisible by 5.
10. Prove the closure property of regular sets?
11. State and prove Pumping lemma for regular expressions.
12. What is the significance of CYK algorithm?
13. Write the regular expression corresponding to the automata.



14. Convert the following CFG into CNF

S → S1 | S2 S1 → S1b | Ab | λ A → aAb | ab S2 → S2a | Ba | λ B → bBa | ba

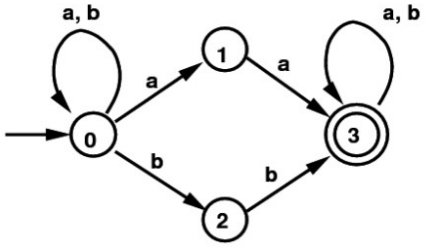
(4×3=12 weightage)

Part C

Answer any 3 questions.

Each question carry 4 weightage

15.
   a. Prove the equivalence of NFA and DFA.
   b. Construct DFA from the given NFA

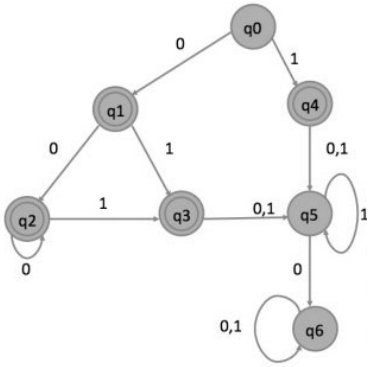


16.

a. Explain the Halting problem. Is it decidable or undecidable problem
b. What is meant by Turing acceptable, Turing decidable and Turing enumerable language classes ?

17.

a. Write the Myhill Nerode algorithm to minimise a FA.
b. Minimise the given Finite Autonomous:



18. Explain the Chomsky hierarchy. Compare the closure property of recursive grammar and recursively enumerable grammar.

(2×5=10 weightage)

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FIRST SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS
COMPUTER SCIENCE
CSS1C04: The Art of Programming Methodology

Time: 3 Hours Maximum: Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4x2=8 Weightage)

1. What is a compiler? List the difference between compiler and interpreter.
2. Explain the different types of user defined data types in C.
3. Discuss the different string handling functions in C.
4. What are the different character I/O functions?
5. Differentiate between structure and Union with suitable examples
6. Explain the term recursion with suitable example
7. Explain various input/output operations on files? Write a program to copy the contents of one file into another?

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. What are program chart and system chart? Explain the flowchart for structured programming?
9. What is the purpose of format specifiers? Explain the different format specifiers in C with example.
10. What is the difference between call by value and call by reference? Explain with suitable programs
11. Explain the scope and lifetime of storage classes in C
12. Write a program to find if a square matrix is symmetric or not with flowchart and algorithm
13. What are the advantages of using typedef in a program? Give its significance in structures with an example program.
14. a) Write a program to sort an array of elements using function?
    b) Write a recursive program to find the factorial of a number?

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. Write a function program that allow a floating point number to be raised to an integer power $y=x^n$ without using library function. Give algorithm and flowchart. Also explain the different flowchart symbols
16. Explain various decision control and looping structures available in C with suitable examples?
17. a) What is a function pointer? Write a recursive function using function pointer to find the sum of first n natural numbers?
    b) Write a program to sort a list of strings into alphabetical order using an array of pointers?
18. a) Explain with a suitable example how structures are passed to functions?
    b) Write a program to sort an array of strings using pointers.
    c) Differentiate between structures and arrays.

FIRST SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,

Computer Science

CSS1 C05: COMPUTER ORGANIZATION & ARCHITECTURE

Time: 3 Hours **Maximum: Weightage: 30**

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. a) Convert 78610 to octal and 7778 to binary.
   b) What are BCD codes?
2. What is meant by size of an instruction? Write short notes on zero address, one address, two address and three address instructions
3. Describe the different types of flags in 8085.
4. Explain the IEEE standard specification of floating point numbers? Differentiate between overflow and underflow.
5. What are micro instructions? Give the difference between hardwired control unit and micro-programmed control unit
6. What is the use of DMA controller? Explain with a neat diagram.
7. What is Interrupt Service Routine (ISR)? Discuss how interrupts are serviced.

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. List out the different types of cache memory mapping techniques.
9. a) What are timing diagrams?
   b) Perform subtraction using 2's complement a) 11012-10102 b) 110002-101012
10. What are logic gates? Discuss various types of logic gates. Also explain universal gates
11. a) Discuss signed magnitude representation using suitable examples.
    b) Explain the working of a shift register.
12. a) Write notes on I/O interface.
    b) Differentiate between programmed I/O and Interrupt I/O.
13. How data transfers between registers and memory? Explain
14. Give a short note on K-map. Simplify using K-map X=ABCD+AB(C+D)+ACD+BCD

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. Discuss sequential circuits and combinational circuits with the help of a diagram and truth table.
16. Explain different arithmetic operations on floating point numbers.
17. Explain how the ALU performs multiplication of two positive numbers with a neat diagram
18. Discuss the architecture of Intel 8051.

SECOND SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,
MODEL QUESTION PAPER
Computer Science
CSS2 C06: Design and Analysis of Algorithms

Time: 3 Hours Maximum Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. a) Write a note on Iteration Method.
   b) Define Hamiltonian circuit problem.
2. a) How NP Hard problem are different from NP Complete?
   b) What is Clique?
3. What is Time complexity Space complexity and asymptotic notations?
4. What do you mean by PRAM? Describe different PRAM models.
7. a) Write a note on Euler tour technique.
   b) What is an Optimal Solution?

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. Explain merge sort algorithm and quick sort using divide and conquer approach with example.
9. Write a short note on different algorithm design strategies.
10. Explain Huffman code and CYK algorithm using an example.
11. What are the different classes of NP-Hard and NP-Complete and their properties.
12. Using the master theorem, find the asymptotic bound for the following recurrences:
    (a) $T(n) = 3T(n/2) + n^2$
    (b) $T(n) = 2T(n/2) + n \log n$
    (c) $T(n) = 2T(n/4) + n^{0.51}$
13. Explain Knapsack Algorithm in detail.
14. Explain Strassen's Matrix Multiplication algorithm. Use Strassen's algorithm to multiply the following 2 matrices.

$$\begin{matrix} 2 & -8 \\ 5 & 4 \end{matrix} \qquad \begin{matrix} 4 & 7 \\ -3 & 9 \end{matrix}$$

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. What is meant by Minimum Cost Spanning Tree? Explain about Kruskal and Prim's Algorithm with appropriate examples for each.
16. Explain and prove Cook's theorem with example.
17. Explain in detail about Parallel prefix computation.
18. Write about Amortized Analysis.

SECOND SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,
MODEL QUESTION PAPER
Computer Science
CSS2 C07: Operating System Concepts

Time: 3 Hours Maximum: Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. Differentiate between FCFS and round robin scheduling. Give examples for each.
2. Explain process states. What is the significance of PCB? Explain each block in PCB.
3. Discuss internal fragmentation and external fragmentation. Also give the different techniques to avoid them.
4. Define virtual memory. Discuss different virtual memory schemes.
5. What do you mean by dynamic linking and static linking?
6. What is thrashing? What is Belady's anomaly? Which algorithm suffers from Belady's anomaly? Discuss the algorithm with an example.
7. State the objectives of eCos kernel.

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. Discuss the different page replacement policies.
9. a) Differentiate between process and thread.
   b) How and why the operating systems swap the processes?
10. Explain multilevel queue scheduling with reference to eCos.
11. Explain the producer-consumer problem in detail. Give its solution
12. What is the purpose of Banker's algorithm? Explain in detail.
13. Discuss the android internal memory partitions.
14. Differentiate between logical address space and physical address space.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. What is dead lock? Comment on dead lock prevention.
16. Explain different CPU scheduling algorithms.
17. Describe various layers in iOS architecture.
18. Explain paging and segmentation mechanism. Give its advantages and disadvantages.

SECOND SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,
MODEL QUESTION PAPER
Computer Science
CSS2 C08: Computer Networks

Time: 3 Hours Maximum Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. a) What is the purpose of a web server?
   b) Define multicasting and broadcasting?
2. a) What are the major principles of cryptography?
   b) Why firewall protection required?
3. Write about different types of networks?
4. Define hamming distance? How is it calculated? Explain with an example
5. What do you mean by a socket? Explain TCP/IP socket and Datagram socket.
6. a) What is the usage of hubs? How does it differ from switch?
   b) How network delays are calculated?
7. What do you mean by burst error?

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. Explain various networks topologies.
9. Short note on IPV4 and IPV6.
10. Explain the various layers of TCP/IP model.
11. a) Explain the protocol HTTP
    b) Differentiate switches and bridges.
12. Describe various error detection and error correction methods
13. Explain various FEC techniques
14. Write short note on protocols TCP and UDP.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. a) Explain various layers of ISO OSI reference model.
    b) Give the comparison between ISO OSI and TCP/IP reference model
16. a) Explain various routing techniques.
    b) Write socket programme to distribute content through networks
17. Explain various algorithms for cryptography.
18. a) Discuss different access control protocols
    b) Describe different application layer protocols

Second Semester M.Sc. Degree Examinations
M. Sc. Computer Science
CSS2C09: Computational Intelligence

Time: 3 hours **Weightage: 30**

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. Explain the relationship between the A* algorithm and the Uniform Cost Search algorithm?
2. Write algorithm to implement mean end analysis.
3. Compare the complexity of informed and uninformed search techniques
4. Compare Depth First Search and Breadth First Search technique?
5. What do you under by the term heuristic search?
6. What are the properties of knowledge representation system?
7. What are the components of a planning system?

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. What are the issues in knowledge representation?
9. Explain the concept of iterative deepening?
10. Detail on, forward reasoning and backward reasoning ?
11. Explain the operation of 'cut' and 'fail' predicates in PROLOG.
12. What is problem reduction? Explain AO* algorithm to tackle And-or graphs.
13. Explain hull climbing techniques.
14. Write note on heuristics in games.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. Explain the different types of hill climbing search techniques. Write the algorithm to implement each of the techniques.
16. Explain the concept of slot and filler structures
17. What is meant by constraint satisfiability problem? Trace the constrain satisfiability procedure solving the following crypt arithmetic problem:

    BASE+

    BALL

    GAMES

    where alphabets take values from 0-9 and nor two alphabets is assigned the same value
18. Write the procedure for resolution in predicate logic using unification algorithm. Assume the statement:
    - A like easy courses
    - Science courses are hard
    - All courses in basket weaving department are easy
    - BK301 is a basket weaving course.

    Use resolution to answer the question "what course does A like?"

SECOND SEMESTER M.Sc. C.S. DEGREE EXAMINATION

(CUCSS-PG)

CSS2C10 PRINCIPLES OF SOFTWARE ENGINEERING

Time: 3 hrs Max. Weight: 30

Part A

I Short answer questions. Answer Any 4 . 2*4=8

1. How does IEEE define software requirement?
2. Define cohesion?
3. List the techniques used for project scheduling?
4. Define the characteristics of software test?
5. Define the term time management?
6. What are the good objectives required in project management?
7. Describe the problems faced by research scholars?

Part B

II Short Essay (Answer any 4) 3*3=12

8. Explain the spiral model with the help of examples?
9. List the commonly followed elicitation techniques?
10. Explain the process of structured analysis?
11. What are the issues involved in software testing?
12. Discuss the process of code documentation briefly?
13. Write the steps for writing a literature survey?
14. What is communication? List the different forms of communication?

Part C

III Essay Questions (Answer any Two) 5*2=10

15. Software engineering can be viewed as layered technology. Explain in brief?
16. Explain the significance of E-R diagram in software engineering with the help of examples?
17. Explain the process of risk management, risk assessment and risk control
18. Explain the project management process groups with the help of a diagram?

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THIRD SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,

MODEL QUESTION PAPER

Computer Science

CSS3 C11: Advanced Database Management System

Time: 3 Hours Max. Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. a) Differentiate candidate key and primary key of a relation with suitable examples.
   b) What is data independence?
2. a) Define a weak entity, with suitable example.
   b) Differentiate database intension and extension.
3. What is functional dependency? Explain BCNF with example
4. What is Lossless and Lossy Decomposition? Explain with example.
5. Explain the different DML commands in SQL with example.
6. Why concurrency control is needed? Explain the different concurrency control mechanisms.
7. Distinguish between 4NF & 5NF.

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. Differentiate tuple relational calculus and domain relational calculus. Give examples
9. a) Explain informal guidelines that are used to measure the quality of a relation schema.
   b) What is closure? State inference rules for functional dependencies.
10. a) Explain the advantages of DBMS over file system.
    b) Discuss homogeneous DDBMS.
11. Describe stored procedures and function with example.
12. Elucidate transaction management. What is a time stamp? How does the system generate a time stamp?
13. Write short notes on cursors and triggers with example.
14. a)What are the advantages of replication transparency?
    b) Explain pattern matching mechanism in RDBMS.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. What do you mean by ER model? Explain ER diagram in detail. Give example
16. Explain 1NF, 2NF & 3NF with suitable examples.
17. Explain all constraints in SQL statement. Provide examples.
18. Write a short note on:
    (a) Concurrency control
    (b) 2PL protocol
    (c) Recovery in DBMS
    (d) Embedded SQL
    (e) OODBMS

Third M.Sc. (CSS) DEGREE EXAMINATIONS

MODEL QUESTION PAPER
COMPUTER SCIENCE
CSS3C12: Object Oriented Programming Concepts

Time: 3 Hours Maximum: Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4x2=8 Weightage)

1. Give a brief description of applet life cycle.
2. What do you mean by dynamic method dispatch in Java? Explain with an example.
3. Briefly explain UML.
4. Discuss the features of Java.
5. What is meant by adapter classes?
6. Give the different stream classes used for file handling in Java.
7. Write a Java program that implements an echo server.

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. What is a UML state diagram? Discuss the different symbols used in state diagram.
9. How does Java allow you to fully utilize the "one interface, multiple methods" aspect of polymorphism?
10. Explain how arrays are implemented in Java.
11. Discuss different types of sockets.
12. What is the purpose of LayoutManager? Discuss the different Layout Manager classes available in java.awt package.
13. Describe the features of different swing components
14. **How does Java achieve synchronization in multithreading?**

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. Describe the Java Thread Model.
16. Explain the basic principles of object orientation. Also give the significance of JVM and byte code.
17. Explain JDBC architecture.
18. Describe Delegation Event Model

Third Semester M.Sc. Degree Examination
Computer Science (Core)
CSS3C13: Principles of Compilers

Time: 3 hours **Weightage: 30**

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. Mention the applications of DAGs.
2. Define left factoring. Left factor the following grammar: S → iEtS | iEtSeS |a
3. What do you mean by Recursive Descent Parsing?
4. Define handle. What do you mean by handle pruning?
5. State error recovery in operator-Precedence Parsing.
6. Why LR parsing is attractive one?
7. What are the benefits of using machine-independent intermediate form?

Part B

Answer any 4 Questions. Each question carries 3 weightage (4 x 3=12 Weightage)

8. Define context free grammar. When will you say that two CFGs are equal?
9. Consider the following grammar:
   $S \rightarrow A$
   $A \rightarrow A+A \mid B++$
   $B \rightarrow y$
   Draw the parse tree for the input "$y + + + y + +$"
10. Why do we use regular expressions to define the lexical syntax of a language?
11. What is a syntax tree? Draw the syntax tree for the assignment statement a := b * -c + b * -c.
12. Write the static assignment form of the statement: Consider the following intermediate program in three address code

p = a – b q = p *c p = u * v q = p + q

13. Compare the various methods of implementing three address statements?
14. Explain back patching.

Part C

Answer any 2 Questions. Each question carries 5 weightage (5x 2=10 Weightage)

15.
   a. What is meant by Shot-Circuit or jumping code?
   b. Translate the conditional statement if a<b then 1 else 0 into three address code.
16. Explain the phases of a compiler.
17. Consider the following grammar:

X → YaYb | ZbZa Y → ε Z → ε

Using the definition of LL(1), explain why the grammar is or is not LL(1).

18. Consider the following grammar with terminals [,], a, b, c, +, and -:

S → [S X] | a X → ε | + S Y | Y b Y→ ε | - S X c

Parse the string parse [a+a-ac]

THIRD SEMESTER M.Sc. (CSS) DEGREE EXAMINATIONS,

Computer Science

CSS3 E01a: Computer Graphics

Time: 3 Hours Max. Weightage: 30

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. a) What is DVST?
   b) Differentiate between LCD and LED.
2. a) Explain DDA algorithm with algorithm
   b) Discuss Midpoint circle generation algorithm
3. Explain 2D transformations with example
4. Explain the different 3D transformations with examples. Also explain composite 3D transformations.
5. a) Discuss the features of OpenGL.
   b) How can you draw a triangle in OpenGL? Explain with code.
6. a) A Homogenous Co-ordinate point P(3, 2, 1) is translated in X, Y and Z direction by -2, -2 and -2 units respectively followed by successive rotation about X – axis. Find the final position of the co-ordinate.
   b) Describe wire frame model for representing 3D objects,
7. How are curves represented in Graphics? Explain different types of curves.

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. a) Write the perspective projection matrix on the view plane where Z = f and where Centre of projection is (0, 0, 0).
   b) What is projection? What are the different types of projection
9. a) Consider a triangle represented by A (0, 0), B (3, 1), C (4, 2). The triangle is rotated by 60 degrees about a point P (-1, -1). Compute the co-ordinates of the new triangle after rotation.
   b) Explain the different 3D transformations
10. a) Derive equation for reflection y = -x.
    b) What is sampling and aliasing technique?
11. a) Explain using Bresenham's algorithm to draw a line from (1, 1) to (8, 5).
    b) Discuss scanline and Boundary fill algorithm.
12. What is visible surface detection? Explain the different algorithms for visible surface detection.
13. Explain raster scan display.
14. Describe various 3-D object representations.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. What is clipping? Explain Cohen Sutherland line clipping algorithm and Sutherland Hodgeman polygon clipping algorithm with example.
16. Explain different video display devices.
17. Discuss spline representation.
18. Describe the following:
    a) Texture mapping
    b) Bit and pixel operations
    c) Sampling techniques
    d) GL, GLU & GLUT
    e) Compositing

THIRD SEMESTER MSC DEGREE EXAMINATION, NOVEMBER 2016

(CUCSS)

COMPUTER SCIENCE

CSS3E02f: Data Warehousing and Data Mining

TIME: Three Hours Maximum: 30 weightage

PART A

Answer any 4 questions

Each question carries 2 weightage

1.

a. Define OLTP.

b. What are the characteristics of data warehouse?

2.

a. Define KDD.

b. Define support and confidence in Association rule mining.

3. Explain Normalization in detail?

4.

a. Define pre-pruning.

b. Define SVM.

5. What are the layers in backpropagation?

6.

a. What is DBSCAN?

b. Define CLARA.

7.

a. Define text mining.

b. What is multimedia mining?

(2×4=8 weightage)

PART B

Answer any 6 questions

Each question carries 2 weightage each

8.

a. Differentiate between operational database and data warehouse.

b. What are operations on datacube?

9. Mention few approaches to mining Multilevel Association Rules.

10.

    a. Explain naive Bayesian classification.

    b. Explain lazy learners.

11. Explain the Classification by Back propagation.

12.

    a. Explain agglomerative clustering method.

    b. What is an outlier? Explain the types of outliers in detail.

13.

    a. Explain web mining

    b. What is Spatial Data mining? Explain the techniques used in Spatial Data mining.

14. . Explain partitioning clustering methods in detail.

(3×4=12 weightage)

PART C

Answer any 2 questions.

Each question carries 5 weightage

15. Explain various data reduction methods.

16. Explain association rule mining. Explain Apriori Algorithm with an example.

17. Explain the Classification by Decision Tree Induction.

18. Explain model evaluation and selection for classification methods.

(5×2=10 weightage)

Fourth Semester M.Sc. Degree Examination
M. Sc. Computer Science
CSS4E01a Digital Image Processing

Time: 3 hours **Weightage: 30**

Part A

Answer any 4 Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1. Define histogram.
2. What is meant by image negatives?
3. What is meant by Laplacian filter?
4. What do you mean by Point processing?
5. What is meant by Noise probability density function?
6. What is meant by least mean square filter?
7. What is segmentation?

Part B

Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8. What is inverse filtering?
9. Explain about Wiener filter used for image restoration.
10. What is meant by region growing.
11. Describe homomorphic filtering
12. Discuss in detail: (a) Power law transformation (b) Contrast stretching
13. Sketch a block diagram model for the image degradation/restoration process.
14. Explain the steps in image processing.

Part C

Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15. Explain Histogram processing
16. Explain a Model of the Image Degradation/Restoration Process.
17. Explain about the restoration filters used when the image degradation is due to noise only.
18. Discuss region based segmentation in detail.

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Fourth Semester M.Sc. Degree Examination
M. Sc. Computer Science
CSS3 E05c: System Security

Part A

I. Answer any four Questions. Each question carries 2 weightage (4 x 2=8 Weightage)

1.
   a. What is the difference between a Threat and a Vulnerability?
   b. List three important security goals
2.
   a. What is a Trapdoor?
   b. Define Digital Signature
3.
   a. What is incomplete mediation?
   b. Why does Salami attack persist?
4. What are Base/Bound Registers?
5.
   a. List the two essential systems of Kerberos.
   b. What is social engineering?
6.
   a. What is meant by Trusted System?
   b. What is Commutative Filter?
7. What do you mean by sensitivity lock?

Part B

II. Answer any 4 questions. Each question carries 3 weightage (4 x 3 = 12 Weightage)

8.
   a. What is the outcome of Footprinting? How does is it different from Scanning?
   b. Bring out the purpose of encryption in multilevel secure database management systems?
9. Explain how a Fence Register is used for relocating a user's program?
10.
   a. What is Access Control Matrix? Explain
   b. What is Chinese Wall Security policy? Explain
11. Explain any four security features employed by an ordinary operating system.
12.
   a. What are the major arguments for and against Risk analysis? Explain
13. Discuss the concept of Tracker Attacks.
14. What are the major characteristics of a good security policy?

Part C

III. Answer any 2 questions. Each question carries 5 weightage. (2 x 5 = 10 Weightage)

15.
   a. List and explain any five memory address protection mechanism in detail.
   b. Explain Bell-La Padula confidentiality model.
16.
   a. Elaborate the security features of trusted operating system.

b. Elucidate basic security requirement of database system.

17. Describe the biometric user authentication schemes.

18. Write short notes on:

a) contents of security plan b) Security policy

c) Contingency planning