M.E. (Computer Science and Engineering)

2013 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai

Approved by AICTE - Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)

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Contents

Rules and Regulations

M. E. / M. Tech. Programmes

(For the batch of students admitted in 2013-2014 and onwards)

NOTE: *The regulations hereunder are subject to amendments as may be decided by the Academic Council of the Institute from time to time. Any or all such amendments will be effective from such date and to such batches of students including those already in the middle of the programme) as may be decided by the Academic Council.*

1. Conditions for Admission

(i) Candidates for admission to the I Semester of M. E. / M. Tech. degree programme will be required to satisfy the conditions of admission thereto prescribed by the Anna University, Chennai and Government of Tamil Nadu.

(ii) Part–time candidates should satisfy conditions regarding experience, sponsorship, place of work, etc., that may be prescribed by Anna University, Chennai from time to time, in addition to satisfying requirements as in Clause 1(i).

2. Duration of the Programme

(i) **Minimum Duration:** The programme will lead to the Degree of Master of Engineering (M.E.) / Master of Technology (M. Tech.) of the Anna University, Chennai extend over a period of two years. The two academic years (Part-time three academic years) will be divided into four semesters (Part-time six Semesters) with two semesters per year.

(ii) **Maximum Duration**: The candidate shall complete all the passing requirements of the M. E. / M. Tech. degree programmes within a maximum period of 4 years / 8 semesters in case of full-time programme and 6 years / 12 semesters in case of part-time programme, these periods being reckoned from the commencement of the semester to which the candidate was first admitted.

3. Branches of Study

The following are the branches of study of M.E. / M.Tech. Programmes

M.E.

Branch I	Applied Electronics
Branch II	CAD/CAM
Branch III	Communication Systems
Branch IV	Computer Science and Engineering
Branch V	Embedded Systems
Branch VI	Engineering Design
Branch VII	Power Electronics and Drives
Branch VIII	Software Engineering
Branch IX	Structural Engineering
Branch X	VLSI Design

M. Tech.

Branch I	Biotechnology

4. Structure of Programmes

(i) **Curriculum:** The curriculum for each programme includes Courses of study and detailed syllabi. The Courses of study include theory Courses (including electives), seminar, practicals, Industrial training / Mini-project, Project Work (Phase I) and Project Work (Phase II) as prescribed by the respective Boards of Studies from time to time.

Full-time Programme: Every full-time candidate shall undergo the Courses of his/her programme given in clause 12 in various semesters as shown below:

Semester 1:	6 Theory Courses and two Practicals
Semester 2:	6 Theory Courses, one Practical and a Technical Seminar
Semester 3:	3 Theory Courses and Project Work (Phase I)
Semester 4:	Project work (Phase II).

Part-time Programme: Every part-time candidate shall undergo the Courses of his/her programme in various semesters as shown below:

Semester 1:	3 Theory Courses and one Practical
Semester 2:	3 Theory Courses and one Practical
Semester 3:	3 Theory Courses, Technical Seminar and one Practical
Semester 4:	3 Theory Courses
Semester 5:	3 Theory Courses and Project Work (Phase I)
Semester 6:	Project Work (Phase II)

(ii) **Theory Courses:** Every candidate shall undergo core theory, elective, and practical Courses including project work of his/her degree programme as given in clause 12 and six elective theory Courses. The candidate shall opt electives from the list of electives relating to his/her degree programme as given in clause 12 in consultation with the Head of the Department. However, a candidate may be permitted to take a maximum of two electives from the list of Courses of other M.E. / M.Tech. Degree programmes with specific permission from the respective Heads of the Departments.

(iii) **Project Work:** Every candidate individually shall undertake the Project Work (Phase I) during the third semester (fifth semester for part-time programme) and the Project Work (Phase II) during the fourth semester (Sixth semester for part-time programme). The Project Work (Phase II) shall be a continuation work of the Project Work (Phase I). The Project Work can be undertaken in an industrial / research organisation or in the Institute in consultation with the faculty guide and the Head of the Department. In case of Project Work at industrial / research organization, the same shall be jointly supervised by a faculty guide and an expert from the organization.

(iv) **Industrial Training / Mini Project:** Every full-time candidate shall opt to take-up either industrial training or Mini Project under the supervision of a faculty guide.

(v) **Value added / Certificate Courses:** Students can opt for any one of the Value added Courses in II and III semester. A separate certificate will be issued on successful completion of the Course.

(vi) **Special Self-Study Elective Courses:** Students can opt for any one of the special elective Courses as Self-Study in addition to the electives specified in the curriculum in II and III semesters, under the guidance of the faculty. The grades of only passed candidates will be indicated in the mark sheet, but will not be taken into account for assessing CGPA.

(vii) **Application oriented and Design Experiments**: The students are to carryout Application oriented and Design Experiments in each laboratory in consultation with the respective faculty and Head of the department.

(viii) **Mini project**: A Mini Project shall be undertaken individually or in a group of not more than 3 in consultation with the respective faculty and the Heads of the Department, in any one of the laboratories from I to III semesters.

(ix) **Credit Assignment:** Each course is normally assigned a certain number of credits with 1 credit per lecture hour per week, 1 credit for 1 or 2 hours of practical per week (2 credits for 3 hours of practical), 4 credits for theory with lab component with 3 hours of lecture and 2 hours of practical per week, 2 credits for 3 hours of seminar per week, 6 credits for the Project Phase I and 12 credits for the Project Phase II. The exact numbers of credits assigned to the different courses of various programmes are decided by the respective Boards of Studies.

(x) **Minimum Credits:** For the award of the degree, the candidate shall earn a minimum number of total credits as prescribed by the respective Board of Studies as given below:

M.E./M. Tech. Programmes	Total Credits
M.E. Applied Electronics	75
M.E. CAD / CAM	75
M.E. Communication Systems	75
M.E. Computer Science and Engineering	75
M.E. Embedded Systems	75
M.E. Engineering Design	77
M.E. Power Electronics and Drives	76
M.E. Software Engineering	76
M.E. Structural Engineering	77
M.E. VLSI Design	75
M.Tech. Biotechnology	76

5. Requirements for Completion of Study of a Semester

(i) a) Candidate will be deemed to have completed the study of any semester only if he /she has kept not less than 70% of attendance in each course and at least 80% of attendance on an average in all courses in that semester put together.

b) On medical grounds, 10% relaxation in the attendance can be allowed

(ii) his/her progress has been satisfactory, and

(iii) his/her conduct has been satisfactory

6. Assessment and Passing Requirements

(i) **Assessment:** The assessment will comprise continuous assessment and final examination, carrying marks as specified in the scheme (clause 10). Continuous assessment will be made as per the guidelines framed by the Institute from time to time. All assessments will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades and grade points will be awarded as per clause 6(v).

(ii) **Final Examinations:** Final examinations will normally be conducted during November / December and during April / May of each year. Supplementary examinations may be conducted at such times as may be decided by the Institute.

A candidate will be permitted to appear for the final examination of a semester only if he/she has completed the study of that semester satisfying the requirements given in clause 5 and registers simultaneously for the examinations of the highest semester eligible and all the Courses which he/she is in arrears of. A candidate, who is not permitted to appear at the final examination of a semester, is not permitted to proceed to the next semester. A candidate who is not permitted to appear at the final examination of any semester has to register for and redo the Courses of that semester at the next available opportunity.

(iii) **Rejoining the Programme:** A candidate who has not completed the study of any semester as per clause 5 or who is allowed to rejoin the programme after a period of discontinuance or who on his/her own request is permitted to repeat the study of any semester, may join the semester which he/she is eligible or permitted to join, only at the time of its normal commencement for a regular batch of candidates and after obtaining the approval from the Director of Technical Education and Anna University, Chennai. No candidate will however be enrolled in more than one semester

at any point of time. In the case of repeaters, the earlier continuous assessment in the repeated Courses will be disregarded.

(iv) **Industrial Training, Mini-project and Project Work:**
Every candidate shall submit reports on Industrial training / Mini-project, Project Work (Phase I) and Project Work (Phase II) on dates announced by the Institute / department through the faculty guide to the Head of the Department. If a candidate fails to submit the reports of any of these Courses not later than the specified date, he/she is deemed to have failed in it. Every candidate shall present report/papers in the seminars in each of the relevant semesters about the Industrial training / Mini-project, Project Work (Phase I) and Project Work (Phase II). The reports/papers shall be presented in the seminar before a review committee constituted by the Head of the Department. The Industrial training / Mini-project, Project Work (Phase I) and Project Work (Phase II) will be evaluated based on the presentations in the seminar, reports and viva-voce examinations. In case of the industrial training for the full-time candidates, evaluation will be carried out in the third semester.

In case of Project Work (Phase II), the viva-voce examination will be carried out by a team consisting of an internal examiner, usually the supervisor, and an external examiner, appointed by the Principal.

1. Due weight will be given for the training report from the Organisation / Industry while evaluating the report and its presentation at the seminar about the nature of the training and what the student has learnt. The student shall be required to get a grade not less than "C". The grade will be indicated in the mark sheet. This will not be taken into account for assessing CGPA.
2. The evaluation of the Mini Project will be based on the report, presentation at the seminar and viva-voce. The student shall be required to get a Grade not less than "C". The grade will be indicated in the mark sheet. This will not be taken into account for assessing CGPA.
3. Every Candidate shall pursue Project work-Phase I in third semester and Project Work – Phase II in fourth semester which is in continuation of Phase I. Project work –Phase I and Phase II will be evaluated as given below in the scheme of evaluation

A candidate is permitted to register for the Project Work (Phase II), only after passing the Project Work (Phase I). A candidate who fails in Industrial training / Mini-project, Project Work (Phase I) or Project Work (Phase II) shall register for redoing the same at the beginning of a subsequent semester.

(v) **Letter grade and grade point:** The letter grade and the grade point are awarded based on percentage of total marks secured by a candidate in an individual Course as detailed below:

Range of Percentage of Total Marks	Letter grade	Grade Point (g)
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49 or less than 50% in final examination	RA	0
Incomplete	I	
Withdrawal	W	

"RA" denotes reappearance in the course.
"I" denotes incomplete as per clause 5 (i) & (ii) and hence prevented from writing semester end examination.
"W" denotes withdrawal from the final examination

After completion of the programme earning the minimum number of credits, the Cumulative Grade Point Average (CGPA) from the semester in which the candidate has joined first to the final semester is calculated using the formula:

$$CGPA = \frac{\sum g_i * C_i}{\sum C_i}$$

Where g_i : Grade point secured corresponding to the Course

C_i : Credits allotted to the Course.

(vi) **Passing a Course:** A candidate who secures grade point 5 or more in any Course of study will be declared to have passed that Course, provided a minimum of 50% is secured in the final examination of that Course of study.
A candidate, who is absent for the final examination or withdraws from final examination or secures a letter grade RA (Grade point 0) in any Course carrying continuous assessment and final examination marks, will retain the already earned continuous assessment marks for two subsequent appearances in the examination of that Course and thereafter he/she will be solely assessed by the final examination carrying the entire marks of that Course.
A candidate, who scores a letter grade RA (Grade point 0) in any Course carrying only continuous assessment marks, will be solely examined by a final examination carrying the entire marks of that Course, the continuous assessment marks obtained earlier being disregarded.

7. Qualifying for the Award of the Degree

A candidate will be declared to have qualified for the award of the M.E. / M.Tech. Degree provided:

(i) he/she has successfully completed the Course requirements and has passed all the prescribed Courses of study of the respective programme listed in clause 12 within the duration specified in clause 2.
(ii) No disciplinary action is pending against the candidate

8. Classification of Degree

(i) **First Class with Distinction:** A candidate who qualifies for the award of degree (vide clause 7) having passed all the Courses of all the semesters at the first opportunity within four consecutive semesters (six consecutive semesters for part-time) after the commencement of his / her study and securing a CGPA of 8.5 and above shall be declared to have passed in First Class with Distinction. For this purpose the withdrawal from examination (vide clause 9) will not be construed as an opportunity for appearance in the examination.
(ii) **First Class:** A candidate who qualifies for the award of degree (vide clause 7) having passed all the Courses of all the semesters within a maximum period of six semesters for full-time and eight consecutive semesters for part-time after commencement of his /her study and securing a CGPA of 6.50 and above shall be declared to have passed in First Class.
(iii) **Second Class:** All other candidates who qualify for the award of degree (vide clause 7) shall be declared to have passed in Second Class.

9. Withdrawal from Examination

(i) A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any Course or Courses of only one semester examination during the entire duration of the degree programme. Also, only one application for withdrawal is permitted for that semester examination in which withdrawal is sought.
(ii) Withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination and if it is made prior to the commencement of the semester examinations and also recommended by the Head of the Department and the Principal.
(iii) Withdrawal shall not be construed as an opportunity for appearance in the examination for the eligibility of a candidate for First Class with Distinction.

10. Scheme of Assessment

- Students who were absent for the previous periodicals and those who wish to improve their periodical test marks shall take up an optional test consisting of two units prior to the commencement of model examination.

Scheme of Evaluation

i) Theory

Final Examination	: 50 Marks
Internal Assessment	: 50 Marks

Distribution of marks for internal assessment:

Assignment/Tutorial	: 05	
Test 1	: 10	
Test 2	: 10	
Model Exam	: 15	(Entire syllabus)
Innovative Presentation[#]	: 10	
	: 50	

[#] Innovative Presentation includes Seminar / Quiz / Group Discussion / Case Study /Soft Skill Development / Mini Project / Review of State-of-the art

ii) Technical Seminar **:** 100 Marks

Three Seminars (3 × 25)	: 75 Marks
Report	: 25 Marks

iii) Practical

Final Examination	: 50 Marks
Internal Assessment	: 50 Marks

Distribution of marks for internal assessment:

Preparation	: 5
Conduct of Experiments	: 10
Observation & Analysis of results	: 10
Record	: 10
Model Exam & Viva-voce	: 15
	: 50

iv) Project Work Phase – I & Viva Voce **Marks**

Internal

Project Identification	: 10
Literature survey + analysis	: 15
Sub Total	: 25
Approach & Progress	: 25
Total	: 50

External – Final Evaluation

Report Preparation & Presentation	: 25
Viva Voce	: 25
	: 50

v) Project Work Phase – II **Marks**

Internal

Continuation of Approach & Progress	: 50
Findings, Discussion & Conclusion	: 50
Total	: 100

External – Final Evaluation

Report Preparation & Presentation	: 50
Viva Voce	: 50
	: 100

11 . Question paper pattern for Theory Examination

Max. Marks	: 100
Time	: 3 Hours

PART A
Short Answer Questions: 15
(15 × 2 Marks) : 30 Marks
(Three Questions from each unit)

PART B
Lengthy Answer Questions: 2
(2 × 14 Marks) *(Compulsory)* : 28
(Questions may be framed from any of the five units)
Lengthy Answer Questions: 3
(3 × 14 Marks) *(Either Or Type)* : 42
(Questions may be framed from the remaining three units)

Total Marks	: 100

12. Curriculum and Syllabi

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. The graduates of Computer Science and Engineering would demonstrate an exceptional involvement and active participation in Research and Development related to Computer Science and Engineering through precise education

II. The graduates of Computer Science and Engineering would practice their careers in industry/ academia/research/ government with a strong foundation and in-depth knowledge

III. The graduates of Computer Science and Engineering would analyze, design and create products, solutions to problems with good scientific and engineering breadth

IV. The graduates of Computer Science and Engineering would demonstrate professional expertise by communicating their engineering ideas and solutions ethically to the society.

PROGRAMME OUTCOMES (POs)

Post Graduating student of Computer Science and Engineering programme will be able to

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
c) Design a system component or process to meet desired needs with realistic constraints such as economic, environmental, social, ethical, manufacturability and sustainability.
d) Define, assess, tailor the software quality practices and software processes with methodologies for appropriate application on software development projects in various domain areas.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental and societal context.
g) Recognize the necessity and ability to engage in life-long learning.
h) Acquire the knowledge of contemporary issues.
i) Use the techniques, skills and modern Engineering tools necessary for Engineering practice.
j) Pursue life-long learning through post graduate education, participation in professional activities or the acquisition of new technical proficiencies with managerial and leadership skills.

MAPPING OF PEOs AND POs

		Programme Educational Objectives	Program Outcomes
PEO:	I	Provide engineering insight to problem solving to succeed in Technical Profession through precise education and to prepare students to excel in research	a), b) and c)
PEO:	II	Strengthen foundation and depth for successful Computer Science and Engineering careers in industry, academia, research or government	d) and f)
PEO:	III	Equip with good scientific and engineering breadth so as to analyze, design and create products, solutions to problems in the area of Computer Science and Engineering	e), g) and h)
PEO:	IV	Demonstrate professional expertise by communicating their engineering ideas and solutions ethically to the society	i) and j)

Curriculum: **M. E. Computer Science and Engineering | Minimum Credits to be earned: 75 | Regulation 2013**
Approved in the VII Academic Council held on 18-05-2013

M. E. Computer Science and Engineering (Full –Time)

First Semester							
Code No.	**Courses**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
13CS11	Theoretical Foundations of Computer Science	I	a,b,c,d	3	1	0	4
13CS12	Advanced Data Structures and Algorithms	II	a,c,e,f	3	0	0	3
13CS13	Advanced Computer Architecture		a,b,e,f	3	0	0	3
13CS14	Advanced Operating System		a,c,e,f,i	3	1	0	4
13CS15	Compiler Construction and Optimization	I, II	a,c,d,e	3	1	0	4
13CS16	Object Oriented Software Engineering	II, III	a,b,c,d,j	3	1	0	4
13CS17	Data Structures and Algorithms Laboratory	I, II	a,b,e,i	0	0	3	2
13CS18	Operating Systems and Compiler Laboratory		a,b,e,i	0	0	3	2
			Total	18	4	6	26
Second Semester							
Code No.	**Courses**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
13CS21	Advanced Database Technology	II	a,b,g,f,j	3	1	0	4
13CS22	Advanced Communication Networks		a,b,c,g	3	0	0	3
13CS23	Recent Trends in Computing	III, IV	a,d,g,h,j	3	0	0	3
	Elective			3	0	0	3
	Elective			3	0	0	3
	Elective			3	0	0	3
13CS24	Database Technology Laboratory	I, II	a,b,e,i	0	0	3	2
13CS25	Technical Seminar	IV	h	0	0	2	1
			Total	18	1	5	22
Third Semester							
Code No.	**Courses**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
	Elective			3	0	0	3
	Elective			3	0	0	3
	Elective			3	0	0	3
13CS31	Project Work Phase – I and Viva Voce	I, IV	a,e,f,h,i	-			6
			Total	9	0	0	15
Fourth Semester							
Code No.	**Courses**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
13CS41	Project Work Phase – II	I, IV	a,e,f,h,i	-			12

M. E. Computer Science and Engineering (Part - Time)

Code No.	Courses	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
First Semester							
13CS11	Theoretical Foundations of Computer Science	I	a,b,c,d	3	1	0	4
13CS12	Advanced Data Structures and Algorithms	II	a,c,e,f	3	0	0	3
13CS13	Advanced Computer Architecture	II	a,b,e,f	3	0	0	3
13CS17	Data Structures and Algorithms Laboratory	I, II	a,b,e,i	0	0	3	2
			Total	9	1	3	12
Second Semester							
13CS21	Advanced Database Technology	II	a,b,g,f,j	3	1	0	4
13CS22	Advanced Communication Networks	II	a,b,c,g	3	0	0	3
13CS23	Recent Trends in Computing	III, IV	a,d,g,h,j	3	0	0	3
13CS24	Database Technology Laboratory	I, II	a,b,e,i	0	0	3	2
			Total	9	1	3	12
Third Semester							
13CS14	Advanced Operating System	II	a,c,e,f,i	3	1	0	4
13CS15	Compiler Construction and Optimization	I, II	a,c,d,e	3	1	0	4
13CS16	Object Oriented Software Engineering	II, III	a,b,c,d,j	3	1	0	4
13CS18	Operating Systems and Compiler Laboratory	I,II	a,b,e,i	0	0	3	2
			Total	9	3	3	14
Fourth Semester							
	Elective			3	0	0	3
	Elective			3	0	0	3
	Elective			3	0	0	3
13CS25	Technical Seminar	IV	h	0	0	2	1
			Total	9	0	2	10
Fifth Semester							
	Elective			3	0	0	3
	Elective			3	0	0	3
	Elective			3	0	0	3
13CS31	Project Work Phase – I and Viva Voce	I, IV	a,e,f,h,i	-			6
			Total	9	0	0	15
Sixth Semester							
13CS41	Project Work Phase – II	I, IV	a,e,f,h,i	-			12

List of Electives							
Code No.	**Courses**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
Machine Intelligence Stream							
13CS51	Agent Based Intelligent Systems	I, III	a,e,f,h	3	0	0	3
13CS52	Data Warehousing and Data Mining		a,c,e,i	3	0	0	3
13CS53	Knowledge Engineering		a,b,e,f,g	3	0	0	3
13CS54	Business Intelligence		a,c,f,i	3	0	0	3
13CS55	Soft Computing		a,g,h	3	0	0	3
13CS56	Pattern Recognition		a,c,e,i	3	0	0	3
13CS57	Natural Language Processing		a,g,h	3	0	0	3
13CS58	Semantic Web		a,b,g,i	3	0	0	3
13CS59	Digital Imaging		a,d,f,j	3	0	0	3
Network & Hardware Stream							
13CS60	Distributed Computing	I, II	a,b,e	3	0	0	3
13CS61	Security in Computing		a,e,f,i	3	0	0	3
13CS62	Mobile and Pervasive Computing	I, III	b,e,f,h,i	3	0	0	3
13CS63	Ad-Hoc and Sensor Networks		a,c,f,g	3	0	0	3
13CS64	Network Engineering and Management	I, II	a,e,i	3	0	0	3
13CS65	Performance Evaluation of Computer Systems and Networks	I, III	a,c,e,f,i	3	0	0	3
13CS66	Cloud Computing		a,b,d	3	0	0	3
13CS67	High Performance Computing		a,c,e,i	3	0	0	3
13CS68	Embedded Real Time Operating Systems		a,b,f,g	3	0	0	3
13CS69	Multimedia Systems		b,c,i	3	0	0	3
13CS70	PC Hardware & Trouble Shooting*		b,i	3	0	0	3
Software Engineering Stream							
13CS71	Software Project Management	II	d,e,i,j	3	0	0	3
13CS72	Software Quality Assurance		a,e,f,i	3	0	0	3
13CS73	Software Testing		a,d,i	3	0	0	3
13CS74	Design Patterns	I, III	b,c,d,g	3	0	0	3
13CS75	Human Computer Interaction		a,e,f	3	0	0	3
13CS76	Web Engineering		a,h,i	3	0	0	3
13CS77	Service Oriented Architecture		b,d,i	3	0	0	3
13CS78	XML and Web Services		a,c,e,i	3	0	0	3
13CS79	Component Based Technology		b,c,d,e	3	0	0	3
13CS80	Internet and Web Technology*		b,e,g,j	3	0	0	3
13CS81	Mobile Operating Systems*		a,c,e,f,i	3	0	0	3
13CS82	Research Methodology	I, IV	a,c,e	3	0	0	3
Self Study Elective							
13CS01	Grid and Cluster Computing Framework	I,III	b,e,f,h	3	0	0	3

*Open Elective

13CS11 THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE

3 1 0 4

Course Objectives (COs)

- To understand and use the terms cardinality, finite and countably infinite sets and determine which of these characteristics is associated with a given set.
- To construct simple mathematical proofs and possess the ability to verify them.
- To provide students with the understanding of various types of graphs including Eulerian graphs and Hamiltonian graphs.
- To classify various types of Grammar.

Course Learning Outcomes (CLOs)

- Check the validity of the arguments.
- Understand how to construct correct mathematical arguments.
- Check whether a particular combination of words is a valid sentence or not

Program Outcomes (POs)

a) Graduate will be skilled in propositional logic, including modeling English description with propositions and connectives and doing with truth analysis and will be conversant in predicate logic.
b) Able to solve problems using mathematical induction.
c) Able to distinguish between deterministic finite state machines and Non-deterministic finite state machines.
d) An ability to participate and succeed in competitive examinations.

Unit I

Fundamental Structures

Set theory - Relationship between sets - Operations on sets - Set identities - Principle of inclusion and exclusion – Minsets. Relations: – Binary relations - Partial orderings - Equivalence relations. Functions: – Properties of functions - Composition of functions – Inverse functions.

12 Hours

Unit II

Logic

Propositional logic – Logical connectives – Truth tables – Normal forms (conjunctive and disjunctive) - Predicate logic - Universal and existential quantifiers - Proof techniques – Direct and indirect – Proof by contradiction – Mathematical Induction.

12 Hours

Unit III

Modeling Computation and Languages

Finite state machines – Deterministic finite state machines (DFA) and Non-deterministic finite state machines (NFA) – Equivalence of DFA and NFA - Formal Languages – Classes of Grammars – Type 0-Context sensitive – Context free- Regular Grammar.

12 Hours

Unit IV

Graph Theory

Introduction to Graphs-Graph operations- Graph and Matrices – Graph Isomorphism – Connected Graphs – Euler Graphs- Hamilton paths and circuits – Shortest path problem.

12 Hours

Unit V

Queue Models

Characteristics of Queueing Models- Kendal's Notation-Single and Multi-Server Markovian queuing models – M/M/1, M/M/C (finite and infinite capacity) and (M/G/1) :(∞/GD)-Queuing applications.

12 Hours
Total: 60 Hours

References

1. Kenneth H. Rosen ,*Discrete Mathematics and its Applications,*Tata McGraw Hill Publications, New Delhi, 2011.

2. Trembly J.P. and Manohar R., *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill Publications Co. Ltd., New Delhi 2008.
3. Alan Doerr and Kenneth Levasseur, *Applied Discrete Structures for Computer Science*, Galgotia Publications Pvt.Ltd. Delhi. 2010.
4. Ralph P Girmaldi and B.V. Ramana *Discrete and Combinatorial Mathematics*: An Applied Introduction, Pearson Education Asia, Delhi, 2007.
5. H. A.Taha, *Operations Research - An Introduction*,8th Edition, Prentice Hall of India Ltd, New Delhi, 2008

13CS12 ADVANCED DATA STRUCTURES AND ALGORITHMS

3 0 0 3

Course Objectives (COs)

- To understand the implementation and use of advanced data structures.
- To learn how to analyze the space and time requirements of a given algorithm.
- To design efficient algorithms using algorithmic techniques.

Course Learning Outcomes (CLOs)

- Understand the properties of various data structures.
- Analyze different algorithm design techniques.
- Design and employ appropriate data structures for solving real time applications.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Unit I

Complexity Analysis and Elementary Data Structures

Asymptotic notations – Properties of big oh notation – Asymptotic notation with several parameters – Conditional asymptotic notation – Amortized analysis – NP Completeness - Arrays – Linked lists – Trees.

9 Hours

Unit II

Heap Structures and Amortized Analysis

Min-max heaps – D-Heaps – Leftist heaps –Binomial heaps – Fibonacci heaps – Skew heaps - Lazy binomial heaps- Amortized analysis – Binomial heaps – Skew heaps – Fibonacci heaps.

9 Hours

Unit III

Search Structures

Binary search trees – AVL trees – 2-3 trees – 2-3-4 trees – Red-black trees – B-trees – Splay trees- Hashing and collision resolution.

9 Hours

Unit IV

Greedy and Divide and Conquer

Knapsack problem- Minimum spanning trees: Prim's algorithm - Kruskal's algorithm -Tree-vertex splitting – Job sequencing with deadlines – Optimal storage on tapes - Quicksort – Strassen's matrix multiplication – Convex hull.

9 Hours

Unit V

Dynamic Programming and Backtracking

Multistage graphs – 0/1 knapsacks using dynamic programming – Flow shop scheduling – 8-queens problem – Graph coloring – Knapsack using backtracking- Hamiltonian cycles.

9 Hours

Total: 45 Hours

References

1. Mark Allen Weiss, *Data Structures and Algorithms in C++*, Pearson, 2009.
2. E. Horowitz, S. Sahni and S. Rajasekaran, *Computer Algorithms / C++*, University Press, 2007.

3. Adam Drozdex, *Data Structures and* algorithms in C++. New Delhi: Thomson learning, 2006.
4. T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, *Introduction to Algorithms*, Prentice hall of India, 2003.

13CS13 ADVANCED COMPUTER ARCHITECTURE

3 0 0 3

Course Objectives (COs)

- To introduce the fundamental techniques based on parallel processing.
- To develop the foundations for analyzing the benefits of design options in computer architecture.
- To give experience of the application of the various computing techniques.

Course Learning Outcomes (CLOs)

- Analyze the working principle of different ILP and TLP techniques.
- Demonstrate the concepts of multiprocessor architecture.
- Identify the need of cache and virtual memory.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Unit I

Pipelining and ILP

Fundamentals of computer design - Measuring and reporting performance - Instruction level parallelism and its exploitation - Concepts and challenges - Overcoming data hazards with dynamic scheduling –Dynamic branch prediction – Speculation-Multiple issue processors.

9 Hours

Unit II

Advanced Techniques for Exploiting ILP

Compiler techniques for exposing ILP - Limitations on ILP for realizable processors - Hardware versus software Speculation - Multithreading: Using ILP support to exploit Thread-level parallelism -Performance of advanced multiple issue processors-Efficiency in advanced multiple issue processors.

9 Hours

Unit III

Multiprocessors

Symmetric and distributed shared memory architectures – Cache coherence issues - Performance Issues – Synchronization issues – Models of memory consistency - Interconnection networks – Buses, crossbar-Multi-stage switches.

9 Hours

Unit IV

Memory Hierarchy

Introduction - Optimizations of cache performance - Memory technology and optimizations - Protection: Virtual memory and virtual machines-Design of memory hierarchies.

9 Hours

Unit V

Storage Systems

Advanced topics in disk storage-Definition and examples of real faults and failures-I/O performance, reliability measures and benchmarks-A Little queuing theory.

9 Hours

Total: 45 Hours

References

1. John L. Hennessey and David A. Patterson, *Computer Architecture – A quantitative approach*. Noida: Morgan Kaufmann / Elsevier, 2012.
2. William Stallings, *Computer Organization and Architecture – Designing for Performance*. New Delhi: Pearson Education, 2006.
3. David E. Culler and Jaswinder Pal Singh, *Parallel Computing Architecture: A hardware/ software approach*. Noida: Morgan Kaufmann / Elsevier, 1999.

13CS14 ADVANCED OPERATING SYSTEM

3 1 0 4

Course Objectives (COs)

- To know the components of the operating systems.
- To have thorough knowledge of process management, storage management , Input / Output and file systems.
- To have thorough knowledge of distributed operating systems concepts.

Course Learning Outcomes (CLOs)

- Analyze the requirements of operating system.
- Demonstrate the scheduling mechanisms.
- Design the algorithm for memory management techniques.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate and solve engineering problems
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Process Management

Operating system and services - Process structure and PCB - Threads – Inter process communication - CPU scheduling approaches - Process synchronization — Deadlocks.

9 Hours

Unit II

Memory Management and File Management

Memory management- Paging- Segmentation-Virtual memory- Demand paging – Page replacement algorithms- File systems – Access methods – Directory structure and implementation– File system mounting – File sharing – Protection - File System structure and implementation – Allocation methods.

9 Hours

Unit III

Distributed Operating System

Introduction-Remote procedure call – Logical clocks – Vector clocks – Distributed mutual exclusion – Non token based algorithms – Token based algorithms– Deadlock detection algorithms – Election algorithms -Byzantine agreement problem-Load distributing algorithms –Performance comparison.

9 Hours

Unit IV

Distributed Resource Management

Distributed file systems – Architecture-Design issues-Distributed shared memory-Architecture-Algorithms-Memory coherence –Coherence protocols-Design issues.

9 Hours

Unit V

Distributed File Systems

Introduction, good features of DFS- File models- File accessing models- File sharing semantics- File-Caching schemes- File replication- Fault tolerance- Atomic transactions and design principles.

9 Hours

Total: 45+15 Hours

References

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, *Operating System Concepts*. New Delhi: Addison Wesley Publishing Company, 2009
2. Mukesh Singhal, and Niranjan Shivratri, *Distributed operating system.* New Delhi: TMH, 2001
3. William Stallings, *Operating Systems Internals and Design Principles.* New Delhi: Pearson Education, 2003
4. Naji, *Linux OS.* New Delhi: Prentice Hall of India, 2003
5. C.M. Krishna, Kang G. Shin, *Real-Time Systems*, McGraw-Hill International Editions, 1997

13CS15 COMPILER CONSTRUCTION AND OPTIMIZATION

3 1 0 4

Course Objectives (COs)

- To understand, design and implement a lexical analyzer.
- To understand, design and implement a parser.
- To understand, design code generation schemes.
- To understand optimization of codes and runtime environment.

Course Learning Outcomes (CLOs)

- Design lexical and syntax analysis phases of complier.
- Demonstrate the basic notions and techniques for programming language translation
- Demonstrate the basic notions and techniques for intermediate code generation.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
d) Identify, analyze, formulate and solve engineering problems.
e) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Unit I

Introduction to Compiler and Lexical Analysis

Language processors - Structure of a compiler - Lexical analysis - Role of the lexical analyzer - Input buffering - Specification and recognition of tokens. Finite automata - Regular expression to finite automation - Optimization of DFA-Based pattern matchers - LEX

9 Hours

Unit II

Syntax Analysis

Role of a parser - Context-free grammars - Top-down parsing – Non recursive predictive parser - Bottom-up parsing - LR parsers – SLR – CLR – LALR. Introduction to language for specifying parser - YACC

9 Hours

Unit III

Intermediate Code Generation

Intermediate code generation: Intermediate languages - Declarations - Assignment statements - Boolean expressions - Case statements- Backpatching.

9 Hours

Unit IV

Code Generation

Issues in the design of a code generator - Target Language – Addresses in the target code - A Simple code generator - Register allocation and assignment

9 Hours

Unit V

Code Optimization

Basic blocks and flow graphs - Optimization of basic blocks – Peephole optimization - The principal sources of optimization - Introduction to Data flow analysis – Foundation to data flow analysis – Constant propagation - Partial redundancy elimination

9 Hours

Total: 45+15 Hours

References

1. Alfred V. Aho, Monica S. Lam , Ravi Sethi and Jeffrey D. Ullman *Compilers: Principles, Techniques and Tools* , Pearson, 2011.
2. Keith D Cooper and Linda Torczon, *Engineering a Compiler*, Elsevier Science, 2011
3. A. V. Aho, Ravi Sethi and J. D. Ullman, *Compilers: Principles, Techniques and Tools*. New Delhi: Addison- Wesley, 2005.
4. Kennath C. Louden, *Compiler Construction Principles and Practice*. New Delhi: Vikas publishing House, 2003.

13CS16 OBJECT ORIENTED SOFTWARE ENGINEERING

3 1 0 4

Course Objectives (COs)

- To understand the basic concepts of software engineering
- To realize the relationship between UML diagrams
- To design and test software project
- To manage a software project using object oriented software engineering

Course Learning Outcomes (CLOs)

- Execute the software project using software engineering methodologies
- Draw various UML diagrams and inter relate them
- Design, test and manage the software project using various tools

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
d) Define, assess and tailor software quality practices, and software processes and methodologies for appropriate application on software development projects in a variety of domain areas
j) Pursue life-long learning through post graduate education, participation in professional activities or the acquisition of new technical proficiencies with managerial and leadership skills.

Unit I

Introduction to Object Oriented Software Engineering

Software engineering concepts -Software engineering development activities - Managing software development - Introduction to UML- Modeling concepts – UML diagrams - Project organizations - Project communication concepts- Organizational activities

9 Hours

Unit II

Requirements Elicitation and Analysis

An overview of requirements elicitation – Requirements elicitation concepts - Requirements elicitation activities - Managing requirements elicitation - Analysis overview – Concepts of analysis - Activities: from use cases to objects- Managing analysis.

9 Hours

Unit III

System Design and Object Design

Decomposing the system- An overview of system design - System design concepts - System design activities - From objects to subsystems - Addressing design goals - Managing system design - Object design - Reusing pattern solutions - Reuse concepts - Solution objects – Inheritance - Design patterns - Reuse activities - Managing reuse.

9 Hours

Unit IV

Testing and Managing Changes

Testing concepts - Testing activities - Component inspection- Managing testing - Rationale management - Rationale concepts - Rationale activities - From issues to decisions - Managing rationale heuristics for communicating about rationale - Issue modeling and negotiation - Conflict resolution strategies.

9 Hours

Unit V

Configuration Management and Project Management

Configuration management concepts - Configuration management activities - Managing configuration management - Project management - Project management concepts - Classical project management activities - Agile project management activities. **9 Hours**

Total: 45+15 Hours

References

1. Bernd Bruegge, Allen H., *Object-Oriented Software Engineering: Using UML, Patterns and Java*, Pearson Education,2011
2. Timothy C. Lethbridge and Robert Laganiere, *Object -Oriented Software Engineering: Practical software development using UML and Java*, McGraw-Hill Higher Education 2013
3. Sommerville, *Software Engineering*, Pearson Education,2009
4. Roger S. *Pressman*. *Software Engineering - A Practitionar's Approach*, McGraw-Hill International Edition, 2010

13CS17 DATA STRUCTURES AND ALGORITHMS LABORATORY

0 0 3 2

Course Objectives (COs)

- To efficiently implement the different data structures in C++
- To introduce mathematical aspects and implement solutions for specific problem.
- To efficiently implement the various algorithmic design techniques.

Course Learning Outcomes (CLOs)

- Determine algorithm correctness and time efficiency.
- Analyze different algorithm design techniques.
- Implement algorithms to solve problems.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e) Identify, analyze, formulate and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

List of Experiments

1. Basic data structures using C++ templates (Stack, Queue and Linked lists)
2. Construct a binary search tree and perform various tree traversals
3. Create Min Heap and perform the operations on it
4. Implement operations on Leftist Heap
5. Perform rotations on AVL Tree
6. Implement sorting techniques

7. Create Convex hull using divide and conquer
8. Job sequencing with deadlines using greedy method
9. 0/1 Knapsack using dynamic programming
10. Graph coloring using backtracking

Mini Project

13CS18 OPERATING SYSTEMS AND COMPILER LABORATORY

0 0 3 2

Course Objectives (COs)

- Implementation of scheduling Algorithms & Memory Management Techniques
- Perform lexical analysis and use lexical analyzer generators
- Perform parsing and intermediate representation

Course Learning Outcomes (CLOs)

- Demonstrate the concepts of operating system
- Demonstrate the importance of implementing parser.
- Design of applications for generating intermediate code.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e) Identify, analyze, formulate and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

List of Experiments

Operating Systems

1. Write a programme for CPU Scheduling Algorithms
    - First Come First Serve
    - Shortest Job First Serve
    - Priority scheduling
    - Round Robin scheduling
2. Write a program for Best fit, First Fit Algorithm for Memory Management.
3. Write a program for Memory Allocation with Pages.
4. Write a program to implement Banker's algorithm.
5. Write a program for Deadlock Handling operations.

Compiler

1. Construction of NFA for a regular expression.
2. Write a program for Shift reduce parser.
3. Write a program for predictive parser.
4. Generation of intermediate code.
5. Write a program for lexical analyzer using LEX tool.

Mini Project

13CS21 ADVANCED DATABASE TECHNOLOGY

3 1 0 4

Course Objectives (COs)

- To learn the data models and to conceptualize a database system using ER diagrams.
- To know the concepts of parallel and distributed databases.
- To gain knowledge about the emerging database technologies.

Course Learning Outcomes (CLOs)

- Understand the basic database system concepts.

- Design parallel and distributed databases.
- Apply the object oriented concepts in databases.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
g) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
j) Pursue life-long learning through post graduate education, participation in professional activities, or the acquisition of new technical proficiencies, or managerial and leadership skills.

Unit I

Database System Concepts

File systems - Database systems - Database systems architecture - Data models - Relational model –Hierarchical model - Network model - Entity-Relationship model-Normalization and database design(1NF,2NF,3NF, BCNF).

9 **Hours**

Unit II

Parallel and Distributed Databases

Parallel Databases: I/O parallelism – Inter and Intra query parallelism – Inter and Intra operation parallelism – Distributed database concepts - Distributed data storage – Distributed transactions – Commit protocols – Concurrency control – Distributed query processing-Three tier client-server architecture.

9 Hours

Unit III

Object and Object Relational Databases

Concepts for object databases: Object identity – Object structure – Type constructors – Encapsulation of operations – Methods – Persistence – Type and class hierarchies – Inheritance – Complex objects – Object database standards, languages and design: ODMG model – ODL – OQL – Object relational and extended – Relational systems: Object relational features in SQL / Oracle.

9 Hours

Unit IV

Enhanced Data Models

Active database concepts and triggers – Temporal databases – Spatial databases – Multimedia databases – Deductive databases – XML databases: XML data model – DTD - XML schema - XML querying - Geographic information systems-Genome data management.

9 Hours

Unit V

Emerging Technologies

Mobile Databases: Location and handoff management - Effect of mobility on data management – Location dependent data distribution - Mobile transaction models - Concurrency control - Transaction commit protocols – Information retrieval-Web databases.

9 Hours

Total: 45+15 Hours

References

1. R. Elmasri, and S. B. Navathe, *Fundamentals of Database Systems*. New Delhi: Pearson Education/Addison Wesley, 2011.
2. Henry F. Korth, Abraham Silberschatz, and S. Sudharshan, *Database System Concepts*. New Delhi: McGraw Hill, 2006.
3. Thomas Cannolly and Carolyn Begg, *Database Systems, A Practical Approach to Design, Implementation and Management*. New Delhi: Pearson Education, 2009.
4. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*. New Delhi: McGraw Hill, 2004.

13CS22 ADVANCED COMMUNICATION NETWORKS

3 0 0 3

Course Objectives (COs)

- To study about the wired, wireless LANs and backbone networks

- To gain in-depth knowledge about the routing protocols
- To focus on **c**ongestion control and traffic management

Course Learning Outcomes (CLOs)

- Identify the type of networks and protocols for a given network scenario
- Estimate the performance and throughput of a given network
- Design a network aimed at optimum performance

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
g) Recognize necessity and ability to engage in life-long learning.

Unit I

Introduction

Requirements – Network architecture – Implementing network software – Performance - Reliable transmission – ethernet and Multiple access network (802.3) – Wireless - 802.11/Wi-Fi - Bluetooth/802.15.1 - Cell phone technologies

9 Hours

Unit II

Internetworking and End to End Protocol

Switching and bridging – Datagrams - Virtual circuit switching - Source routing - Bridges and LAN switches - Basic internetworking (IP) - Service model - Global addresses - Datagram forwarding in IP - Subnetting and classless addressing - Address translation - Host configuration - Error reporting - Virtual networks and Tunnels **–** Simple demultiplexer (UDP) - Reliable byte stream (TCP) – Remote Procedure Call (RPC).

9 Hours

Unit III

High-Speed Networks

Frame relays – Packet switching networks – Frame relay networks – ATM protocol architecture – Logical connections – ATM cells – Service categories – ATM adaptation layer – High-speed LANs – Wireless LANs.

9 Hours

Unit IV

Congestion and Traffic Management

Effects of congestion – Traffic management - Congestion control in packet - Switching networks – Frame relay congestion control – Need for flow and error control – Link control mechanisms –ARQ performance – TCP flow and congestion control – Performance of TCP over ATM – Requirements for ATM traffic and congestion control – ATM traffic - Related attributes – Traffic management framework – Traffic control.

9 Hours

Unit V

Internet Routing

Overview of graph theory and Least-cost paths – Interior routing protocols – Internet routing principles – Distance vector and Link state protocol – Exterior routing protocols: BGP and IDRP - Multicasting.

9 Hours

Total: 45 Hours

References

1. Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*, Morgan Kaufmann, 2012.
2. William Stallings, *High-Speed Networks and Internets: Performance and Quality of Service*, Pearson Education, 2010.
3. James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach*, Pearson Education, 2013.
4. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson Education, 2011.
5. Behrouz Forouzan, *Data communications and Networking*, Tata Mc Graw Hill Education, 2009

13CS23 RECENT TRENDS IN COMPUTING

3 0 0 3

Course Objectives (COs)

- To know the emerging trends in Android operating system
- To have thorough knowledge of big data analytics
- To have systematic knowledge of cloud computing

Course Learning Outcomes (CLOs)

- Familiar with the basic concepts of Android operating system
- Demonstrate the process of cloud computing
- Comprehend the importance of big data analysis

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in research
d) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability
g) Identify, analyze, formulate and solve engineering problems
h) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
j) Use the techniques, skills, and modern engineering tools necessary for engineering practice

Unit I

Android Operating System

Introduction-Getting started with Android programming- Activities, fragments, and intents - Getting to know the Android user interface-Designing your user interface with views-Displaying pictures and menus with views.

9 Hours

Unit II

Android Application Development

Design of android user interface with views-Using list views to display long list-understanding specialized fragments-Displaying pictures and menus-Data persistence.

9 Hours

Unit III

Cloud Computing

Introduction to cloud computing-Fundamentals of cloud computing -Cloud for the business- Managing the cloud resources -Advantages of highly scaled data centre - Scaling computer system -Cloud's workload strategy.

9 Hours

Unit IV

Cloud Elements

Private and hybrid clouds- Infrastructure as service - Platform as service - Software as service - Massively scaled applications and business process-Managing and securing cloud services -Governing the cloud- Virtualization and the cloud.

9 Hours

Unit V

Big Data Analytics

Introduction to big data –Importance of big data- Industry examples for big data - Big data technology- Information management- Business analytics

.

9 Hours

Total: 45 Hours

References

1. Wei-Meng Lee ,Beginning Android 4 Application Development, New Delhi: Wiley Publications 2012
2. Judith Hurwitz, *Cloud computing for dummies.* New Delhi: Wiley Publishing Inc.2010.
3. Michael Minelli, *Big Data Big Analytics*, New Delhi, John Wiley publications 2013.
4. Aravind Sethi, *Big data analytics Disruptive Technologies changing the Game,* IBM Corporation MC Press 2012.

13CS24 DATABASE TECHNOLOGY LABORATORY

0 0 3 2

Course Objectives (COs)

- To study and implement the basic SQL commands.
- To implement the database design in PL/SQL.
- To store different types of data in a database and retrieve it from a front end.

Course Learning Outcomes (CLOs)

- Understand the basic SQL commands.
- Develop procedures, functions in SQL.
- Develop packages in SQL.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e) Identify, analyze, formulate and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

List of Experiments

1. Working basic SQL commands (DDL, DML, DCL, and TCL).
2. Executing Single Row and Group functions.
3. Running SQL queries on Join and Integrity constraints.
4. Implementation of Synonyms, Sequences, Views and Indexes.
5. Design a database using first and second normal form.
6. Perform the Locks & Partitions operations.
7. Simple programs using PL/SQL blocks.
8. Apply the concepts of Exception handling in PL/SQL block.
9. Create Cursors and Triggers.
10. Use the concept of Procedures and Function in PL/SQL block.
11. Devise a Package for a banking system to maintain its customer details.
    Mini Project

13CS51 AGENT BASED INTELLIGENT SYSTEMS

3 0 0 3

Course Objectives (COs)

- To introduce the fundamental concepts of artificial intelligence
- To explore the different paradigms in knowledge representation and reasoning
- To equip students with the knowledge and skills in logic programming using Prolog
- To recognize problems that may be solved using artificial intelligence and machine learning

Course Learning Outcomes (CLOs)

- Understand the history, development and various applications of artificial intelligence
- Familiarize with propositional and predicate logic and their roles in logic programming
- Learn the knowledge representation and reasoning techniques in rule-based systems, case-based systems, and model-based systems
- Apply and integrate various artificial intelligence techniques in intelligent system development

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
h) Acquire the knowledge of contemporary issues.

Unit I

Introduction

AI Problems – Problem as a State space search – Problem characteristics - Production systems and characteristics – Issues in design of search programs – Heuristic search techniques – Hill climbing – Best-first search – Problem reduction – Constraint satisfaction.

9 Hours

Unit II

Knowledge Representation

Knowledge representation issues - Representation and mapping – Approaches, issues in knowledge Representation– frame problem - Using predicate logic - Simple facts in logic – Instance and ISA relationships – Computable functions and predicates – Resolution.

9 Hours

Unit III

Uncertainty and Reasoning

Symbolic reasoning under Uncertainty – Nonmonotonic reasoning – Logics – Implementation issues – Augumenting a problem-solver – Breadth first search – Depth first search implementation – Statistical reasoning – Probability and Baye's theorem – Rule-based system – Bayesian networks.

9 Hours

Unit IV

Planning and Game Playing

Minimax search procedure – Adding alpha-beta cutoffs – Additional refinements – Iterative deepening – Planning – Components of planning system – Goal stack planning – Nonlinear planning using constraint posting – Hierarchical planning.

9 Hours

Unit V

Advanced Topics

Natural language processing – Syntactic processing – Semantic analysis – Statistical NLP – Expert systems – Expert system shells – Knowledge acquisition – Prolog-The natural language of artificial intelligence –Introduction – Goals - Prolog terminology – Variables - Control structures - Arithmetic operators.

9 Hours

Total: 45 Hours

References

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, *Artificial Intelligence*, Tata McGraw Hill, 2010.
2. Stuart Russell and Peter Norvig, *Artificial Intelligence - A Modern Approach*, Prentice Hall India, 2010.
3. M. Tim Jones, *Artificial Intelligence: A Systems Approach*, Jones and Bartlett Publisher, 2010.
4. Winston, Patrick Henry, *Artificial Intelligence*, Addison Wesley, 2008.

13CS52 DATA WAREHOUSING AND DATA MINING

3 0 0 3

Course Objectives (COs)

- To introduce the basic concepts and techniques of data mining
- To develop the skills using recent data mining software for solving practical problems.
- To assess the strengths and weaknesses of various methods and algorithms

Course Learning Outcomes (CLOs)

- Identify the key processes of data mining, data warehousing and knowledge discovery process
- Describe the basic principles and algorithms used in practical data mining and understand their strengths and weaknesses
- Apply data mining techniques to solve problems in other disciplines in a mathematical way

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Introduction

The evolution of database system technology – Types of databases - Steps in knowledge discovery - Architecture of a data mining systems- Classification of data mining systems –Data mining task primitives - Integration of data mining systems with a database or data warehouse system.

9 Hours

Unit II

Data Preprocessing and association Rules

Data preprocessing-Data cleaning-Integration-Transformation-Reduction-Discretization- Concept hierarchies-Association rules mining : Basic concepts – Efficient and scalable frequent itemset mining methods – Mining various kinds of association rules – From association mining to correlation analysis.

9 Hours

Unit III

Classification and Clustering

Classification and prediction: Issues regarding classification and prediction-classification by decision tree induction-Bayesian classification-Classification by back propagation - Prediction - Clusters analysis: Types of data in cluster analysis- Categorization of major clustering methods- Partitioning methods : k-means and k-mediods - Hierarchical methods: Agglomerative and divisive clustering

9 Hours

Unit IV

Data Warehousing

Data warehousing components -Multi dimensional data model- Data warehouse architecture-Data warehouse implementation- -Mapping the data warehouse to multiprocessor architecture- OLAP-OLAP operations in multidimensional data model - Types of OLAP servers

9 Hours

Unit V

Applications

Data mining applications - Social impacts of data mining: Ubiquitous and invisible data mining – data mining privacy and data security - Case Studies: Mining the WWW -Text mining

9 Hours

Total: 45 Hours

References

1. Jiawei Han and Micheline Kamber, *Data Mining Concepts and Techniques*. Noida : Elsevier, 2011.
2. Alex Berson and Stephen J Smith, *Data Warehousing, Data Mining and OLAP(Data Warehousing/Data Management)*. New Delhi : Tata Mcgraw- Hill, 2004
3. Usama M. Fayyad, Gregory Piatetsky-Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, *Advances in Knowledge Discovery and Data Mining*. New Delhi: The M.I.T Press, 1996.
4. Ralph Kimball, *The Data Warehouse Life Cycle Toolkit*. New Delhi: John Wiley & Sons Inc., 1998.

13CS53 KNOWLEDGE ENGINEERING

3 0 0 3

Course Objectives (COs)

- To learn about knowledge representation schemes and reasoning
- To have a thorough understanding of action planning and its representation
- To gain skill in designing agents for the real world problems

Course Learning Outcomes (CLOs)

- Able to represent knowledge and reasoning and to use tools for knowledge acquisition
- Represent the knowledge using object oriented method
- Design, test and manage the agents for the problems

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
g) Recognize the necessity and an ability to engage in life-long learning.

Unit I

Introduction

Key concepts –Reason for knowledge representation and reasoning – Language of first order logic – Syntax, semantics pragmatics – Expressing knowledge – Levels of representation – Knowledge acquisition and sharing – Sharing ontologies – Language ontologies –Language patterns - Tools for knowledge acquisition**.**

9 Hours

Unit II

Reasoning

Proportional case – Handling variables and qualifies – Dealing with intractability – Reasoning with horn clauses - Procedural control of reasoning – Rules in production – Description logic - Vivid knowledge - Beyond vivid.

9 Hours

Unit III

Representation and Classification

Object oriented representations – Frame formalism – Structured descriptions – Meaning and entailment - Taxonomies and classification – Inheritance – Networks –Strategies for defeasible inheritance - Formal account of inheritance networks.

9 Hours

Unit IV

Defaults, Uncertainty and Expressiveness

Defaults – Introduction – Closed world reasoning – Circumscription – Default logic limitations of logic – Fuzzy logic – Non monotonic logic – Theories and world – Semiotics – Auto epistemic logic – Vagueness – Uncertainty and degrees of belief – Non categorical reasoning - Objective and subjective probability.

9 Hours

Unit V

Actions and Planning

Explanation and diagnosis – Purpose – Syntax - semantics of context – First order reasoning – Modal reasoning in context – Encapsulating objects in context – Agents – Actions – Situational calculus – Frame problem – Complex actions – Planning – Strips – Planning as reasoning - Hierarchical and conditional planning.

9 Hours

Total: 45 Hours

References

1. Ronald Brachman, Hector Levesque, *Knowledge Representation and Reasoning*, Morgan Kaufmann Series in Artificial Intelligence, 2011.

2. John F. Sowa, *Knowledge Representation: Logical, Philosophical, and Computational Foundations*, Brooks Cole, 2011.
3. Arthur B. Markman, *Knowledge Representation*. United States: Lawrence Erlbaum Associates, 1998.
4. S. Simon L. Kendal, M. Creen, *An Introduction to Knowledge Engineering*, Springer, 2007.

13CS54 BUSINESS INTELLIGENCE

3 0 0 3

Course Objectives (COs)

- To understand the basics of business intelligence framework.
- To learn the data integration and multi-dimensional data modeling.
- To build business intelligence applications using tools.

Course Learning Outcomes (CLOs)

- Apply the key issues in evaluating and selecting architecture for business intelligence appropriate to environments.
- Understand the characteristics, architectures, and development of data warehouses, data marts, and decision support Systems.
- Design data warehouse and data mart.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
f) Understand the impact of engineering solutions in a global, economic, environmental and societal context.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Introduction of Technical Architecture

Technical architecture overview - Back room architecture - Presentation server architecture - Front room architecture – Infrastructure – Metadata - Security.

9 Hours

Unit II

Dimensional Modeling

Making the case for dimensional modeling- Dimensional modeling primer- Enterprise data warehouse bus architecture – Updates to the dimension tables - Miscellaneous dimensions - The snowflake schema - Aggregate fact tables.

9 Hours

Unit III

Designing the Dimensional Modeling

Modeling process overview - Getting organized - Four step modeling process - Design the dimensional model – Embrace data stewardship - Extract, Transform and Load overview - Extract, Transform and Load requirements and steps - Data extraction - Data transformation - Data loading.

9 Hours

Unit IV

Business Intelligence Applications

Importance of business intelligence applications - Analytical cycle for business intelligence - Types of business intelligence applications - Navigating applications via the business intelligence portal.

9 Hours

Unit V

Designing and Developing Business Intelligence Applications

Business intelligence application resource planning - Business intelligence application specification - Business intelligence application development - Business intelligence application maintenance.

9 Hours

Total: 45 Hours

References

1. Raiph Kimball-Ross, *The Data Warehouse Lifecycle Toolkit*, Wiley Publication, 2008.
2. Ponniah, *Data Warehousing Fundamental*, Wiley Publication, 2010.

3. Anahory and Murray, *Data Warehousing in the Real World*, Pearson Education India, 2004.
4. Inmon, W. H. *Building the Data Warehouse*, Wiley Publication, 2005.

13CS55 SOFT COMPUTING

3 0 0 3

Course Objectives (COs)

- To become familiar with various Soft Computing Techniques
- To introduce different evolutionary and swarm algorithms
- To bring in the ideas of fuzzy sets, fuzzy logic and use of heuristics

Course Learning Outcomes (CLOs)

- Acquire the fundamentals of computational intelligence
- Gain knowledge on how to apply soft computing techniques to solve optimization problems
- Ability to understand fuzzy systems

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
g) Recognize the necessity and ability to engage in life-long learning
h) Acquire the knowledge of contemporary issues.

Unit I

Introduction to Soft Computing and Neural Networks

Introduction - Soft computing constituents – From conventional AI to computational intelligence – Evolutionary computation – Neuro-Fuzzy and soft computing characteristics

9Hours

Unit II

Genetic Algorithms

Introduction to Genetic Algorithm (GA) – Goals of optimization – Simple GA – Simulation – Important similarities - Applications of GA – Rise of GA - GA application of historical interest – Improvements in basic technique - De Jong and function optimization

9 Hours

Unit III

Neural Networks

Adaptive networks – Back propagation for feed forward networks – Batch learning – Pattern by pattern learning - Supervised learning neural networks – Radial basis function networks –Unsupervised learning neural networks – Competitive learning network – Kohonen self organising networks- Hebbian learning

9 Hours

Unit IV

Fuzzy Logic

Fuzzy sets – Set theoretic operations – Fuzzy rules and fuzzy reasoning – Extension principle and fuzzy relation – Fuzzy If-then rules - Fuzzy inference systems – Mamdani fuzzy models – Sugeno fuzzy models – Tsukamoto fuzzy models

9 Hours

Unit V

Neuro-Fuzzy Modeling

Adaptive neuro-fuzzy Inference systems – Classification and regression trees – Decision trees – CART algorithm for tree induction - Data clustering algorithms

9 Hours
Total: 45 Hours

References

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani, *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence*, New Delhi: Prentice-Hall of India, 2003.
2. David E. Goldberg, *Genetic Algorithms in Search, Optimization and Machine Learning*, Singapore: Addison Wesley, 2001.
3. James A. Freeman and David M. Skapura, *Neural Networks Algorithms, Applications, and Programming Techniques*. New Delhi: Pearson Education, 2003.

4. Mitchell Melanie, *An Introduction to Genetic Algorithm*. New Delhi: Prentice Hall, 1998.
5. George J. Klir and Bo Yuan, *Fuzzy Sets and Fuzzy Logic-Theory and Applications*. New Delhi: PHI 1995.
6. Jacek M. Zurada, *Introduction to Artificial Neural Systems*. Boston: PWS Publishers, 1992.

13CS56 PATTERN RECOGNITION

3 0 0 3

Course Objectives (COs)

- Study the fundamental algorithms for pattern recognition
- To instigate the various classification techniques
- To originate the various structural pattern recognition and feature extraction techniques

Course Learning Outcomes (CLOs)

- Understand and apply various algorithms for pattern recognition
- Realize the clustering concepts and algorithms
- Bring out structural pattern recognition and feature extraction techniques

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate, and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Pattern Classifier

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation -Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm - Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

9 Hours

Unit II

Unsupervised Classification

Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.

9 Hours

Unit III

Structural Pattern Recognition

Elements of formal grammars - String generation as pattern description - Recognition of syntactic description - Parsing - Stochastic grammars and applications - Graph based structural representation.

9 Hours

Unit IV

Feature Extraction and Selection

Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation - Binary feature selection.

9 Hours

Unit V

Recent Advances

Neural network structures for pattern recognition - Neural network based pattern associators – Unsupervised learning in neural pattern recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers -Pattern classification using Genetic Algorithms.

9 Hours

Total : 45 Hours

References

1. Robert J.Schalkoff, *Pattern Recognition : Statistical, Structural and Neural Approaches*, John Wiley & Sons Inc., New York, 2007.
2. Tou and Gonzales, *Pattern Recognition Principles*, Wesley Publication Company, London, 1974.
3. Duda R.O., and Hart.P.E., *Pattern Classification and Scene Analysis*, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., *Pattern Recognition Engineering*, John Wiley & Sons, New York, 1993.

13CS57 NATURAL LANGUAGE PROCESSING

3 0 0 3

Course Objectives (COs)

- To understand the use of state automata for language processing
- To provide the fundamentals of parsing
- To pioneer the basics of Information Retrieval (IR)

Course Learning Outcomes (CLOs)

- Attain fundamental knowledge in natural language processing
- Acquire in-depth knowledge in IR systems
- Gain skill in parallel and distributed IR systems

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
g) Recognize the necessity and an ability to engage in life-long learning
h) Acquire the knowledge of contemporary issues.

Unit I

Introduction

Knowledge in speech and language processing – Ambiguity – Models and algorithms – Language, Thought and understanding – History of NLP

9 Hours

Unit II

Words

Regular expressions and automata – Words and transducers – N- grams – Part-of-speech tagging – Hidden markov and maximum entropy models

9 Hours

Unit III

Speech

Phonetics – Speech synthesis – Automatic speech recognition – Advanced topics on speech recognition – Computational phonology

9 Hours

Unit IV

Syntax, Semantics and Pragmatics

Formal grammars of English – Syntactic parsing – Statistical parsing – Features and unification – Language and complexity – Representation of meaning – Computational semantics – Lexical semantics

9 Hours

Unit V

Applications

Information extraction – Question answering - Summarization – Dialog agents – Conversational agents – Machine translation

9 Hours

References

1. Daniel Jurafsky and James H. martin, *Speech and Language Processing* , Pearson Education, 2008.
2. David A. Grossman and Ophir Fedier, *Information Retrieval: Algorithms and Heuristics (The Information Retrieval Series)*, Springer, 2004.
3. Michael W Berry, *Survey of Text mining I: Clustering, Classification and Retrieval*, Copyrighted material, 2004.
4. Daniel Bikel and Imed Zitouni, *Multilingual Natural Language Processing Applications: From Theory to Practice*, IBM Press, 2012.

13CS58 SEMANTIC WEB

3 0 0 3

Course Objectives (COs)

- To know the techniques and standards of W3C
- To understand the XML with document type definition and schema
- To comprehend transformation/inference rules in XSLT and Rule XML

Course Learning Outcomes (CLOs)

- Develop resource description framework data
- Work with SPARQL queries
- Familiar with the applications of semantic web technology

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
g) Recognize the necessity and ability to engage in life-long learning.
i) Use the techniques, skills and modern engineering tools necessary for engineering practice.

Unit I

Introduction

History – Semantic web layers –Semantic web technologies – Semantics in semantic web – XML: Structuring – Namespaces – Addressing – Querying-Processing XML.

9 Hours

Unit II

RDF and Querying the Semantic Web

RDF data model-syntaxes-Adding semantics-RDF schema-RDF and RDF schema in RDF schema-An axiomatic semantics for RDF and RDF schema-Querying the semantic web-SPARQL-Basics-Filters-Constructs-Organizing result sets-Querying schemas.

9 Hours

Unit III

Ontology

Introduction – Ontology movement – OWL – OWL specification - OWL elements – OWL constructs: Simple and complex – Ontology engineering : Introduction – Constructing ontologies – Reusing ontologies – On-To-Knowledge semantic web architecture

9 Hours

Unit IV

Logic and Inference

Logic – Description logics - Rules – Monotonic rules: syntax, semantics and examples – Non-monotonic rules – Motivation, syntax, and examples – Rule markup in XML: Monotonic rules - Non-Monotonic rules

9 Hours

Unit V

Applications of Semantic Web Technologies

Good relations-BBC artists-BBC world cup 2010 website-Government data, Newyork times-Sigma and sindice-open Calais-schema.org-Future of semantic web

9 Hours
Total: 45 Hours

References

1. Grigorous Antoniou and Van Hermelen, *A Semantic Web Primer*. New Delhi: The MIT Press,2012.
2. James Hendler, Henry Lieberman and Wolfgang Wahlster, *Spinning the Semantic Web: Bringing the world wide web to its full potential.* New Delhi: The MIT Press, 2005.
3. Shelley Powers, *Practical RDF*. Mumbai: O'reilly publishers, 2009
4. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, *Foundations of Semantic Web Technologies*, Chapman & Hall/CRC, 2009

13CS59 DIGITAL IMAGING

3 0 0 3

Course Objectives (COs)

- Study the image fundamentals and mathematical transforms necessary for image processing
- To instigate the various image processing techniques
- To originate the various image enhancement techniques

Course Learning Outcomes (CLOs)

- Understand the various mathematical transforms of a digital image
- Realize the image enhancement, image restoration and image compression techniques
- Bring out image segmentation and representation techniques

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
d) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
f) Identify, analyze, formulate and solve engineering problems.
j) Use the techniques, skills and modern engineering tools necessary for engineering practice.

Unit I

Digital Image Fundamentals and Transforms

Elements of visual perception – Image sampling and quantization - Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier transform and discrete Fourier transform – Properties of 2D Fourier transform – Fast Fourier transform.

9 Hours

Unit II

Image Enhancement Techniques

Spatial domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters: Smoothing – Sharpening filters.

9 Hours

Unit III

Image Restoration

Model of Image degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse.

9 Hours

Unit IV

Image Compression

Lossless compression: Variable length coding – Lempel–Ziv–Welch (LZW) coding – Bit plane coding- predictive coding-Differential Pulse Code Modulation (DPCM)- Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG- MPEG.

9 Hours

Unit V

Image Segmentation and Representation

Edge detection – Thresholding - Region based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors.

9 Hours
Total: 45 Hours

References

1. Rafael C Gonzalez, Richard E Woods, *Digital Image Processing* - Pearson Education 2008.
2. A.K. Jain *Fundamentals of Digital Image Processing* , PHI, New Delhi 2003
3. William K Pratt, *Digital Image Processing*, John Willey 2007.
4. Chanda Dutta Magundar *Digital Image Processing and Application*, Prentice Hall of India, 2006.

13CS60 DISTRIBUTED COMPUTING

3 0 0 3

Course Objectives (COs)

- To understand the phases of distributed computing
- To be aware of the transaction models and deadlocks.
- To build concepts regarding the fundamental principles of distributed systems
- To learn the design issues and distributed system concepts

Course Learning Outcomes (CLOs)

- Apply the design and development principles of distributed operating systems in the construction of distributed middleware components.

- Create a distributed system through the integration of heterogeneous applications and web services using appropriate tools and technologies.
- Demonstrate the understanding of need for distributed systems and their applications.

PROGRAM OUTCOMES (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e) Identify, analyze, formulate and solve engineering problems.

Unit I

Introduction

Characterization of distributed systems - Examples - Resource sharing and the web - Challenges – System models - Architectural and fundamental models - Networking and internetworking - Types of networks - Network principles - Internet protocols.

9 Hours

Unit II

Message Passing and Synchronization

Interprocess communication - The API for the internet protocols - External data representation and marshalling - Client-Server communication - Group communication - Desirable features message passing system- Issues in message passing- Synchronization- Clock synchronization- Event ordering- Mutual exclusion- Deadlock- Election Algorithm - Buffering.

9 Hours

Unit III

Remote Procedure Call

RPC model - Transparency of RPC- Implementing RPC mechanism- Stub generation- Marshaling arguments and results- Server management- Parameter passing semantics - Call semantics- Communication protocols for RPCs- Complicated RPC client server binding- Exception handling- Security- Special types of RPCs- RPCs in heterogeneous environments- Lightweight RPC.

9 Hours

Unit IV

Distributed Shared Memory

General architecture of DSM systems- Design and implementation of DSM- Granularity- Structure of shared memory space- Consistency models- Replacement strategy- Thrashing- Other approaches to DSM- Heterogeneous DSM and advantages of DSM.

9 Hours

Unit V

Distributed Naming

Introduction- Desirable features of naming system- Fundamental concepts- System oriented names-Object locating mechanisms-Human oriented names- Name caches - Naming and security.

9 Hours

Total: 45 Hours

References

1. George Coulouris, Jean Dollimore and Tim Kindberg, *Distributed Systems Concepts and Design*, Pearson Education, 2009.
2. Pradeep K Sinha . *Distributed Operating Systems : Concepts and design*,. IEEE computer society press,2007.
3. Andrew S Tanenbaum, Maartenvan Steen, *Distibuted Systems –Principles and Pardigms*, Pearson Education, 2002.
4. Mullender, *Distributed Systems*, Addison Wesley, 1993.
5. M.L.Liu, *Distributed Computing Principles and Applications*, Pearson Education, 2004.

13CS61 SECURITY IN COMPUTING

3 0 0 3

Course Objective (COs)

- To learn the vulnerabilities and threats in the computing systems
- To understand the cryptography based approaches in security
- To know the implementation and use of security mechanisms

Course Learning Outcomes (CLOs)

- Understand a variety of generic security threats and the risks faced by computer systems.
- Identify and analyze security problems in computer systems.
- Apply appropriate security techniques to solve security problems.
- Understand the legal, copyright and privacy issues.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Use the techniques, skills and modern engineering tools necessary for engineering practice.

Unit I

Security Issues in Computing

Introduction to computer security – Computer criminals – Methods of defense – Cryptography-Substitution ciphers – Transpositions – Making encryption algorithms – Data encryption standard – Public key encryption- Possible attacks on RSA - Uses of encryption.

9 Hours

Unit II

Program Security and Network Security

Secure programs – Non-malicious program errors – Targeted malicious code- Trojans – Trapdoors – Salami attack – Keystroke logging– Man-in-the middle attack- Covert channels- Controls against program threats- Threats in networks – Network security controls - Firewalls – Intrusion detection system.

9 Hours

Unit III

Database Security and Data Mining Security

Introduction to databases - Security requirements – Reliability and integrity – Sensitive data – Inference – Multilevel database-Proposals for multilevel security – Data mining- Privacy and sensitivity – Data correctness and integrity – Availability of data- Privacy concepts-Privacy principles and policies - Authentication and privacy- Privacy-preserving data mining.

9 Hours

Unit IV

Design and Protection of Operating System

Protected objects and methods of protection- Memory and address protection- Control of access to general objects- File protection mechanisms – User authentication- Trusted system – Security policies – Models of security- Trusted operating system design- Assurance methods in trusted operating systems.

9 Hours

Unit V

Legal Issues in Computer Security

Protecting programs and data – Information and the law – Rights of employees and employers – Computer crime- Administering security- Security planning – Risk analysis – Organizational security policies- Physical security.

9 Hours

Total: 45 Hours

References

1. Charles B.fleeger and Shari Lawrence Pfleeger, *Security in Computing*, Pearson Education, 2009.
2. William Stallings, *Cryptography and Network Security: Principles and Practice,* Prentice Hall of India/Pearson Education, New Delhi, 2007.
3. Dieter Gollmann, *Computer Security,* John Wiley & Sons Ltd., 2011.
4. Douglas R.Stinson, *Cryptography Theory and Practice*, CRC, 2006

13CS62 MOBILE AND PERVASIVE COMPUTING

3 0 0 3

Course Objectives (COs)

- To understand the wireless networks, its transmission mechanisms and media access
- To know the function of GSM and application of mobile computing
- To design and develop a mobile application
- To use the mobile technology and tool kits to facilitated the mobile application

Course Learning Outcomes (CLOs)

- Understand the advanced concepts of wireless mobile networks
- Apply transactions for complex model
- Explore the modern design structures of pervasive computing
- Analyze various advanced mobile network models

Program Outcomes (POs)

b) Design and conduct experiments as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice
e) Identify, analyze, formulate and solve engineering problems
f) Understand the impact of engineering solutions in a global, economic, environmental and societal context
h) Acquire the knowledge of contemporary issues
i) Use the techniques, skills and modern Engineering tools necessary for engineering practice

Unit I

Introduction to Mobile Computing

Mobility of bits and bytes – Wireless the beginning – Mobile computing- Dialogue control- Networks – Middleware and gateways- Application and services- Developing mobile computing applications- Security- Standards- Players in wireless space- Architecture for mobile computing-Three tier architecture- Design considerations-Mobile computing through internet-Making existing applications mobile enabled-Developing IVR application.

9 Hours

Unit II

Mobile Technologies

Emerging technologies: Bluetooth-Radio frequency identification- Wireless broadband-Mobile IP-Internet protocol version 6-Java card- GSM- Short message services- General packet radio services: Packet data network-Architecture-Operations-Data services-Application for GPRS-Limitations of GPRS-Wireless application protocol-CDMA and 3G.

9 Hours

Unit III

Mobile Networking

Wireless LAN advantage-Standards-Architecture-Mobility-Deploying-Mobile Ad Hoc networks and sensor networks-Security- Wi Fi verses 3G-Internet networks and interworking: Fundamentals of call processing – Intelligence in the networks-SS #7 signaling-IN conceptual model-Soft switch-Programmable networks-Client programming. **9 Hours**

Unit IV

Introduction to Pervasive Computing

Introduction to pervasive computing: Scenarios–Roaming environment-Pervasive computing infrastructure-Personalized services – Pervasive computing market- m-business- Applications examples-Hardware - Human - Machine interfaces biometrics and Operating systems-Java for pervasive devices.

9 Hours

Unit V

Pervasive Computing Application

Device Connectivity – Protocols, security and device management - Pervasive web application architecture – Transcoding –Client authentication via internet- WAP and beyond - Voice technology: Speech application–Personal digital assistants: Device- Operating systems-Characteristics-Software components-Standards-Mobile applications.

9 Hours

Total: 45 Hours

References

1. Asoke K Talukder and Poopa R Yavagal, *Mobile Computing,Tata McGraw-Hill,2008.*
2. Jochen Buekhardt, Horst Henn, Stefan Hepper, Klaus Rintdorff and Thomas Schack, *Pervasive Computing:Technology and architecture of mobile internet applications,Pearson Education,2009.*
3. Reza B Fat and Roy T Fielding, *Mobile Computing Principles*, Cambridge University Press, 2010.
4. Hansmann Uwe, Merk Lothar and Nicklous Mart, *Pervasive Computing: The Mobile World,* Springer Professional, 2011.
5. Chimay J, Anumba and Xiangyu Wang, *Mobile and Pervasive Computing*, Springer Professional, 2012.

13CS63 AD HOC AND SENSOR NETWORKS

3 0 0 3

Course Objectives (COs)

- To gain knowledge on routing and protocols in Ad Hoc and sensor networks.
- To get skilled in wireless networks technology platforms and standards.
- To learn real time traffic support in wireless networks with working principles of wireless LAN.
- To get familiar in standards of wireless LAN and learn hybrid networks

Course Learning Outcomes (CLOs)

- Understand the principles of Ad Hoc wireless and sensor networks.
- Implement protocols with location based QoS.
- Design and simulate sensor networks and assess performance.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability and sustainability.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
g) Recognize the necessity and ability to engage in life-long learning.

Unit I

Ad Hoc Wireless Networks and MAC

Introduction – Issues in ad Hoc wireless networks- MAC protocols – Issues, classifications of MAC protocols, Contention based protocols - Contention based protocols with reservation mechanism- Multi channel CSMA and power control MAC protocol

9 Hours

Unit II

Routing Protocols and TCP over Ad Hoc

Issues in designing a routing protocol – Classifications of routing protocols – Hierarchical and power aware. multicast routing –Classifications- Tree based- Mesh based Ad Hoc transport layer issues- TCP over Ad Hoc – Feedback based - TCP with explicit link- TCP-Bus - Ad Hoc TCP and split TCP- Ad Hoc transport protocol.

9 Hours

Unit III

Quality of Service in Ad Hoc Wireless Networks

Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS solutions– MAC layer solutions – QoS routing protocols – Ticket based and predictive location based QoS routing protocols- On-Demand link state multipath QoS routing protocol- QoS frameworks- Energy management Ad Hoc – Battery and power management schemes - Transmission power management schemes.

9 Hours

Unit IV

Wireless Sensor Networks

Introduction – Sensor network architecture- Data dissemination – Gathering- MAC protocols for sensor networks – Self organizing- Hybrid TDMA/FDMA and CSMA based MAC - Location discovery and quality of sensor networks-Evolving standards - Energy efficient design.

9 Hours

Unit V

Hybrid Wireless Networks

Introduction- Next generation hybrid wireless architectures-Routing in hybrid wireless networks- Power control schemes and load balancing in hybrid wireless networks- Recent advances in wireless networks –Ultra wide band radio communication-Wireless fidelity systems-Optical wireless networks.

9 Hours

Total: 45 Hours

References

1. C. Siva Ram Murthy and B. S. Manoj, *Ad Hoc Wireless Networks – Architectures and Protocols*, New Delhi: Pearson Education, 2004.
2. Feng Zhao and Leonidas Guibas, *Wireless Sensor Networks*. Noida: Morgan Kaufman Publishers, 2004.
3. C. K. Toh, *Ad Hoc Mobile Wireless Networks.* New Delhi: Pearson Education, 2002.
4. Thomas Krag and Sebastin Buettrich, *Wireless Mesh Networking*. Mumbai: O'Reilly Publishers,2007

13CS64 NETWORK ENGINEERING AND MANAGEMENT

3 0 0 3

Course Objectives (COs)

- To understand the concepts of computer networks and to study the functions of different layers.
- To make the students to get familiarized with different protocols and network components.
- To understand how the network management protocol are actually implemented.

Course Learning Outcomes (CLOs)

- Analyze the requirements of modern communication network..
- Demonstrate the process of network management.
- Design the procedure remote monitoring.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
e) Identify, analyze, formulate and solve engineering problems
i) Use the techniques, skills and modern Engineering tools necessary for Engineering practice.

Unit I

Foundations of Networking

Data communication networks – Protocols and standards –OSI model – Layers in OSI –TCP/IP protocol suite – Error detection and correction – Flow control – Error control

9 Hours

Unit II

Data link Layer and Network layer

SONET architecture –Layers – Frames – STS multiplexing –SONET networks – Frame relay-ATM-ATM LAN – AAL- IPv4 Address – IPv6 address –Internetworking – Transition from IPv4 to IPv6 –Address mapping – ICMP– IGMP – ICMPv6 –Congestion control **9 Hours**

Unit III

SNMP and Network Management

Network management standards – Network management models – Organization model-Information model-Communication model-Abstract syntax notation-Encoding structure-Internet organization and standards

9 Hours

Unit IV

SNMPv1, SNMPv2 and SNMPv3

SNMPv1 Communication model-Functional model-SNMPv2 system architecture-Structure of management information-Management information base -SNMP v2 protocol -Compatibility with SNMPv1-SNMPv3 key features-Documentation architecture-Applications-MIB-Security-User based security model

9 Hours

Unit V

RMON and Telecommunication Network Management

Remote monitoring - RMON SMI and MIB - RMON1 - RMON2-ATM Remote monitoring - TMN -TMN conceptual model-TMN architecture - TMN management service architecture - TMN integrated view

9 Hours

Total: 45 Hours

References

1. Behrouz A. Forouzan, *Data Communication and Networking*. New Delhi: Tata McGraw Hill, 2007
2. Mani Subramanium , *Network Management Principles and practices*. New Delhi: Pearson Education,2010
3. Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*. Noida: Morgan Kaufman Publishers, 2007.
4. William Stallings, *SNMP, SNMPv2, SNMPv3 and RMON1 and RMON2.* New Delhi: Pearson Education, 2002.

13CS65 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS

3 0 0 3

Course Objectives (COs)

- To understand the concept of computer system performance evaluation.
- To know the implementation of M/M/1 queuing models
- To learn continuous parameter Markov chains and state dependent queuing models

Course Learning Outcomes (CLOs)

- Understand the mathematical and statistical models of computers and networks.
- Model communication networks and I/O computer systems
- Use Queuing theory to measure performances of systems
- Perform statistical analysis and interpretation of simulation results.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Fundamentals

Performance characteristics – Requirement analysis: Concepts – user, device, network requirements – Process – Developing RMA-Delay-Capacity requirements – Flow analysis – Identifying and developing flows models - Flow prioritization and specification.

9 Hours

Unit II

Probability and Stochastic Processes

Random variables – Stochastic process – Link delay components – Queuing models – Little's theorem – Birth and death process - Queuing disciplines. **9 Hours**

Unit III

Queuing Theory

Markovian FIFO queuing systems – M/M/1 – M/M/a – M/M/∞ - M/G/1 – M/M/m/m and other Markov – Non – Markovian and self – similar models – Network of queues – Burke's theorem - Jackson's theorem.

9 Hours

Unit IV

System performance

Multi- user uplinks/downlinks – Capacity regions – Opportunistic scheduling for stability and max throughput – Multi-hop routing – Mobile networks – Throughput - Optimality and backpressure.

9 Hours

Unit V

Analysis

Performance of optimal lyapunov networking – Energy optimality – Energy – Delay tradeoffs – Virtual cost queues – Average power constraints – Flow control with infinite demand – Auxiliary variables – Flow control with finite demand - General utility optimization.

9 Hours

Total: 45 Hours

References

1. James D.McCabe, *Network analysis, Architecture and Design*, Elsevier, 2007.
2. Sheldon Ross, *Introduction to Probability Models*, Academic Press, New York, 2007.
3. Bertsekas & Gallager, *Data Networks*, Pearson Education, 2003.
4. Paul J.Fortier, Howard E.Michel, *Computer Systems Performance Evaluation and Prediction*, Elsevier, 2003.

13CS66 CLOUD COMPUTING

3 0 0 3

Course Objectives (COs)

- To understand the key elements of cloud platform and thread programming
- To learn the concepts of map reduce programming
- To know intelligent cloud services and applications

Course Learning Outcomes (CLOs)

- Implement the elements of cloud platform and thread programming
- Design hadoop and know the map reduce programming
- Develop cloud applications based on the type of the cloud

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
d) Define, assess, and tailor software quality practices, and software processes and methodologies for appropriate application on software development projects in a variety of domain areas

Unit I

Introduction

Defining cloud computing –Cloud types –Characteristic of computing– Open standards –Measuring the cloud value – Exploring the cloud computing Stack-Connecting to the cloud – Understanding services and applications by type.

9 Hours

Unit II

Understanding Abstraction and Virtualization

Using virtualization technique – Load balancing- Understanding hypervisors –Machine imaging- Porting applications – Capacity planning – Baseline and metrics – Network capacity – Scaling – Exploring platform as service.

9 Hours

Unit III

Cloud Computing Web Services

Google Web service – Surveying the Google application portfolio – Google toolkit – Amazon web services – Components and services – EC2- Storage systems – Database services- Microsoft cloud services – Windows azure platform – Windows live.

9 Hours

Unit IV

Cloud Infrastructure

Managing the cloud – Administrating the cloud –Management products –Communicating with the cloud – Instant messaging – Collaboration technologies –Social networks – Media and streaming.

9 Hours

Unit V

Cloud Applications and Mobile Cloud

Working with mobile devices – Smartphone with the cloud – Mobile web services -Scientific applications – Business and consumer applications.

9 Hours
Total: 45 Hours

References

1. Barrie Sosinsky, *Cloud Computing Bible*, Wiley Publishing, Inc,.2011
2. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S , *Mastering in Cloud Computing*, McGraw Hill Education (India) Private Limited, 2013
3. Michael Miller,*Cloud Computing*, Pearson Education, New Delhi, 2012
4. Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2010
5. Fern Halper, Marcia Kaufman, Bloor Robin and Judith Hurwit, Cloud Computing for Dummies, Wiley India, 2009.

13CS67 HIGH PERFORMANCE COMPUTING

3 0 0 3

Course Objectives (COs)

- To know how modern high performance processors are organized their strengths and weaknesses.
- To study about the architecture of parallel systems.
- To gain depth knowledge about the analytical parallel algorithms.

Course Learning Outcomes (CLOs)

- Investigate modern design structures of pipelined and multiprocessors systems.
- Understand the algorithms using parallel programming principle.
- Design architectures to perform parallel processing.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Modern Processors

Stored-program computer architecture – General-purpose cache-based microprocessor architecture - Memory hierarchies - Multicore processors - Multithread processors - Vector processors - Basic optimization techniques for serial code - Common sense optimizations - Simple measures - large impact - Role of compilers.

9 Hours

Unit-II

Parallel Computers

Data access optimization - Balance analysis and lightspeed estimates - Storage order - Taxonomy of parallel computing paradigms - Shared memory computers - Distributed memory computers - Hierarchical systems – Networks - Basics of parallelization- Parallelism – Parallel scalability

9 Hours

Unit III

Introduction to Parallel Computing

Motivating parallelism - Scope of parallel computing - Parallel programming platforms: Implict parallelism trends in microprocessor architectures - Limitations - Dichotomy - Physical organizations - Communication costs - Routing mechanisms for interconnected networks- Impact of process.

9 Hours

Unit IV

Principles of Parallel Algorithm Design

Preliminaries - Decomposition techniques - Characteristics of tasks and interactions - Mapping techniques for load balancing - Methods for containing interaction overheads - Parallel algorithm models – Basic communication operations.

9 Hours

Unit V

Sorting and Graph Algorithms

Dense matrix Algorithm: Matrix-vector multiplication - Martix- matrix multiplication- Issues in sorting on parallel computing - Sorting networks - Bubble sorts and its variants - Quick sort - Graph algorithms - Definition and representation - Prims algorithm - Dijkstra's algorithm - All pairs shortest path - Transitive closure - Connected components.

9 Hours

Total: 45 Hours

References

1. Georg Hager and Gerhard Wellein, *Introduction to High Performance Computing for Scientists and Engineers*, Chapman & Hall, 2010.
2. Ananth Grama and George Karypis, *Introduction to parallel computing*, Addison-Wesley 2009.
3. John Levesque and Gene Wagenbreth, *High Performance Computing: Programming and Applications*, Chapman & Hall, 2010
4. John L. Hennessy and David Patterson, *Computer Architecture- A Quantitative Approach*, Elsevier, 2012.

13CS68 EMBEDDED REAL TIME OPERATING SYSTEMS

3 0 0 3

Course Objectives (COs)

- To know the hardware and software of embedded systems
- To learn the embedded programming concepts in Linux
- To understand the real time operating systems and inter-task communication

Course Learning Outcomes (CLOs)

- Understand the theoretical and practical differences between soft real time and hard real time
- Design multithread and multiprocess applications with the interprocess synchronization
- Design interfaces for real time applications

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research**.**
b) Design and conduct experiments as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice
f) Understand the impact of engineering solutions in a global, economic, environmental and societal context.
g) Recognize the necessity and ability to engage in life-long learning.

Unit I

Introduction and Architecture of Embedded Systems

Embedded systems – Application areas – Categories – Overview of embedded system architecture – Specialties - Recent trends in embedded systems – Hardware architecture – Software architecture – Application software – Communication software – Process of generating executable image

9 Hours

Unit II

Embedded System Development Process

Development process – Requirements engineering – Design – Implementation – Integration and testing – Packaging – Configuration management – Managing embedded system development projects – Hardware platforms – Communication interfaces-Need for communication interfaces – RS232/UART – USB – Infrared – IEEE 1394 Firewire – Ethernet – IEEE 802.11

9 Hours

Unit III

Embedded/Real Time Operating System Concepts

Architecture of kernel – Tasks and task scheduler – Interrupt service routines – Semaphores - Mutex – Mailboxes – Message queues – Event registers – Pipes – Signals – Timers – Memory management – Priority inversion problem – Off the shelf operating systems – Embedded operating systems – Real time operating systems – Programming for embedded systems – Programming in linux

9 Hours

Unit IV

Embedded System Applications

Representative embedded systems - RFID systems – DSP embedded systems- Need for DSP based embedded systems – Overview of digital signal processing – Applications of DSP – Digital signal processor architecture – DSP based embedded system design process.

9 Hours

Unit V

Embedded Software Development and Future Trends

Embedded software development: 89C51 Micro-controller platform – AVR Micro-controller platform – Intel StringARM platform – Future trends- Pervasive/ ubiquitous computing – Java for embedded systems - Security of embedded systems

9 Hours
Total: 45 Hours

References

1. K.V.K.K. Prasad, *Embedded/Real-Time Systems: Concepts, Design and Programming, Black Book*, Dreamtech Press, 2010.
2. Rajib Mall, *Real-time Systems: Theory and Practice*, Pearson Education India, 2007.
3. Phillip A. Laplante, *Real- Time Systems Design and Analysis*, John Wiley and Sons, 2006.
4. Iyer and Gupta, *Embedded Real Time Systems Programming*, Tata McGraw-Hill Education, 2003

13CS69 MULTIMEDIA SYSTEMS

3 0 0 3

Course Objectives (COs)

- To learn the ways of capturing, processing and rendering the multimedia information.
- To understand the principles and current technologies of multimedia systems and standards.
- To promote creative and innovative ideas to design multimedia applications.

Course Learning Outcomes (CLOs)

- Develop creative experiments using digital technology.
- Evaluate perceptual possibilities and technical information with state of art equipment.
- Create and support multimedia productions.

Program Outcomes (POs)

b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Introduction

Introduction – Multimedia presentation and production – Characteristics – Multiple media – Utilities – Uses – Promotion – Creation – Digital representation – Multimedia architecture.

9 Hours

Unit II

Components of Multimedia

Text: Text compression - file formats – Image – Audio – Video: Transmission of video signals - Television Broadcasting standards - Digital video standards – Animation: Key frames and Tweening – Principles of animation – 3D animation – file formats– Multimedia documents.

9 Hours

Unit III

Multimedia Systems

Visual display systems: Video adapter card – Video adapter cable – Optical storage media – CD technology – DVD technology – Compression: CODEC – Types and techniques – GIF image coding standards – Lossy /Perceptual – JPEG – MPEG-1– MPEG-2 – Fractals.

9 Hours

Unit IV

Multimedia Tools

Authoring Tools: features and types – Card and page based tools – Icon and object based tools – Time based tools – Cross platform authoring notes – Basic software tools: OCR software – 3D modeling and animation tools.

9 Hours

Unit V

Multimedia Application Development

Software life cycle – ADDIE model – Conceptualization – Content collection and processing – Story – Flow line – Script – Storyboard – Implementation – Authoring metaphors – Testing and feedback – Final delivery – Report writing/ documentation – Case study: Web application – Console application – Distributed application – Mobile application – Games consoles – itv – Kiosks

9 Hours

Total: 45 Hours

References

1. R. Parekh, *Principles of Multimedia*, New Delhi: Tata McGraw-Hill, 2010.
2. Tay Vaughan, *Multimedia: Making It Work*, New Delhi: McGraw-Hill Professional, 2007.
3. Ralf Steinmetz and Klara Nahrstedt, *Multimedia: Computing, Communications and Applications*, New Delhi: Pearson Education, 2012.
4. Fred Halsall, *Multimedia Communication-Application Networks, Protocols and Standard*, Singapore: Addison -Wesley, 2008.

13CS70 PC HARDWARE AND TROUBLE SHOOTING

3 0 0 3

Course Objectives (COs)

- To learn the characteristics of hardware devices
- To understand the troubleshooting fundamentals of computer hardware and software
- To know the installation, assembling and configuration management of computer hardware and software

Course Learning Outcomes (CLOs)

- Identify the purpose and operation of the internal components of a computer
- Diagnose and correct the common failures in a computer
- Install and troubleshoot the device drivers
- Assemble and disassemble the components of a computer

Program Outcomes (POs)

b) Design and conduct experiments as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.

i) Use the techniques, skills and modern engineering tools necessary for engineering practice.

Unit I

Introduction

Introduction - Computer organization – Number systems and codes – Memory – Arithmetic and Logic Unit – Control unit –Instruction prefetch – Interrupts – Input/Output techniques – Device controllers - Error detection techniques – Microprocessor – Personal computer concepts – Advanced system concepts –Microcomputer concepts – Operating system – Multitasking and multiprogramming – Virtual memory – Cache memory – Modern PC and user.

9 Hours

Unit II

Peripheral Devices

Introduction – Keyboard – CRT display monitor – Printer – Magnetic storage devices – Floppy disk drive – Hard disk drive – Special types of disk drives – Mouse and trackball – Modem – Fax modem – CD ROM drive – Scanner – Digital camera – Digital versatile disk – Special peripherals.

9 Hours

Unit III

PC Hardware Overview

Introduction – Hardware BIOS DOS interaction – The PC family – PC hardware – Inside the system box – Motherboard logic – Memory space – Peripheral interfaces and controllers – Keyboard interface – CRT display controller– Floppy disk controller – Hard disk controller.

9 Hours

Unit IV

Installation and Preventive Maintenance

Introduction – System configuration – Pre installation planning – Installation practice – Routine checks – PC assembling and integration – BIOS setup – Engineering versions and compatibility – Preventive maintenance – Disk operating system – Virus – Data recovery.

9 Hours

Unit V

Troubleshooting

Introduction – Computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and firmware – Programmable LSI's – Bus faults – Faults elimination process – Systematic troubleshooting – Symptoms observation and analysis – Fault diagnosis – Fault rectification – Troubleshooting levels – Serial port problems – FDC problems –HDC problems –Display adapter problems -FDD,HDD,CD-ROM problems

9 Hours
Total: 45 Hours

References

1. B. Govindarajalu, *IBM PC Clones Hardware, Troubleshooting and Maintenance*, TMH, 2008
2. Jean Andrews, *A+ Guide to Managing and Maintaining Your PC*, Cengage Learning, 2013
3. Peter Abel, Niyaz Nizamuddin, *IMB PC Assembly Language and Programming*, Pearson Education, 2007
4. Michael Meyers, *Introduction to PC Hardware and Troubleshooting*, McGraw Hill, 2003

13CS71 SOFTWARE PROJECT MANAGEMENT

3 0 0 3

Course Objectives (COs)

- To understand the requirement collection process for developing a software
- To learn the leadership qualities to manage peoples in an organization
- To understand the risk management for successful project completion

Course Learning Outcomes (CLOs)

- Understand project management activities and steps in project planning
- Create an effective cost estimation technique that suits all types of projects
- Design framework for risk management

Program Outcomes (POs)

d) Define, assess, tailor software quality practices, and software processes and methodologies for appropriate application on software development projects in a variety of domain areas.
e) Identify, analyze, formulate and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.
j) Pursue life-long learning through post graduate education, participation in professional activities, or the acquisition of new technical proficiencies, or managerial and leadership skills.

Unit I

Introduction to Software Project Management

Project definition – Contract management – Activities covered by software project management – Overview of project planning – Stepwise project planning- Decision making – Leadership – Organizational structures.

9 Hours

Unit II

Project Evaluation

Strategic assessment – Technical assessment – Cost benefit analysis –Cash flow forecasting – Cost benefit evaluation techniques – Risk evaluation- Risk management- Risk planning and control.

9 Hours

Unit III

Activity Planning

Objectives – Project schedule – Sequencing and scheduling activities –Network planning models – Forward pass – Backward pass – Activity float – Shortening project duration – Activity on arrow networks.

9 Hours

Unit IV

Monitoring and Control

Creating framework – Collecting the data – Visualizing progress – Cost monitoring – Earned value – Prioritizing– Getting project back to target – Change control – Managing contracts – Introduction – Types of contract – Stages in contract placement – Typical terms of a contract

9 Hours

Unit V

Managing Peoples and Organizing Team

Introduction – Understanding behaviour – Organizational behaviour - background – Selecting the right person for the job – Instruction in the best methods – Motivation– Hackman job characteristics model – Working in groups.

9Hours

Total: 45 Hours

References

1. Bob Hughes, Mikecotterell, *Software Project Management*, Tata McGraw Hill, 2008.
2. Watts S.Humphrey *Managing the Software Process*, Pearson Education,2011.
3. Ramesh, Gopalaswamy, *Managing Global Projects*, Tata McGraw Hill, 2006.
4. Jalote, *Software Project Management in Practice*, Pearson Education, 2002.

13CS72 SOFTWARE QUALITY ASSURANCE

3 0 0 3

Course Objectives (COs)

- To understand software quality assurance activities with tools and techniques.
- To analyze information through static and dynamic techniques.
- To customize software quality objectives for software

Course Learning Outcomes (CLOs)

- Establish software quality assurance practice in the software development process
- Perform software testing using testing tools
- Follow commitment to quality, Integrity and Insistence on measurable results

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
e) Identify, analyze, formulate and solve engineering problems.
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Organizing Quality Management

Quality management framework - Quality program concepts – Organizational aspects of quality program – Quality program organizational relationship.

9 Hours

Unit II

Standards used in Software Quality Assurance

Software Quality Assurance (SQA) in ISO standards – SQA in IEEE standards - ITIL standards - ANSI/EIA standards and RTLA/DO standards

9 Hours

Unit III

Software Quality Assurance

Identifying SQA personnel needs – Characteristics of a good SQA engineer – SQA engineering staff – Pareto principle applied to SQA – Defect identification – Software inspections and walkthroughs – Pareto chart comparisons – Measurements-Transition of cost to quality - Software audit – Performing the audit - Software safety

and its relation to SQA – CMMI – PPQA relationship to SQA - Software quality engineering/ management -Quality management infrastructure – Quality assurance infrastructure – Quality audit – Quality reporting – Software configuration management

9 Hours

Unit IV

Quality Management in IT

ITSM Processes – IT best practices – ITSM standards – Process improvement models – Customer requirements – Monitoring and measuring ITSM performance - Procurement quality – IT quality professional – Cost of software quality system – CoSQ system to organization.

9 Hours

Unit V

SQA Metrics

Software quality indicators – PSM – CMMI- PSP and TSP – Six sigma - Seven quality control tools: traditional and modern tools

9 Hours
Total: 45 Hours

References

1. Schulmeyer G. Gordon, *Handbook of Software Quality Assurance.* London: Artech House Inc, 2008.
2. Daniel Galin, *Software Quality Assurance from theory to implementation*, Pearson Education Limited, 2009.
3. Nina S. Godbole, *Software Quality Assurance: Principles and Practice.* New Delhi: Narosa Publishing House, 2008.
4. Murali Chemuturi, *Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers*, J. Ross Publishing Inc, 2011.

13CS73 SOFTWARE TESTING

3 0 0 3

Course Objectives (COs)

- To learn the different types of testing strategies.
- To know graph matrices and its applications.
- To understand the various methods to improve software testing.

Course Learning Outcomes (CLOs)

- Determine the right testing tools for various applications.
- Demonstrate skills in designing and developing the software solutions.
- Identify and apply the software standards for a software project.

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
d) Define, assess, tailor the software quality practices and software processes with methodologies for appropriate application on software development projects in various domain areas.
i) Use the techniques, skills and modern Engineering tools necessary for engineering practice.

Unit I

Introduction

Purpose of testing- Dichotomies- Model for testing- The taxonomy of bugs: Consequences of bugs- Taxonomy of bugs.

9 Hours

Unit II

Flow graphs and Path testing

Path-testing basics- Predicates, path predicates and achievable paths- Path sensitizing- Path instrumentation- Implementation and application of path testing.

9 Hours

Unit III

Transaction and Data Flow Testing

Transaction flows- Transaction flow testing techniques- Implementation Comments- Dataflow testing basics – Data flow testing strategies – Application, tools and effectiveness. **9 Hours**

Unit IV

Domain and Logic Based Testing

Domains and paths- Nice and ugly domains- Domain testing- Domains and interface testing- Domains and testability - Logic based testing: Decision tables- Path expressions again- KV charts.

9 Hours

Unit V

Graph Matrices and Application

Motivational overview- Matrix of graph- Relations- Power of a matrix- Node reduction algorithm- Building tools.

9 Hours

Total: 45 Hours

References

1. Boris Beizer, *Software Testing Techniques*,Dreamtech,2009
2. William Perry, *Software Testing : Effective Methods for Software Testing*, John Wiley, 2009
3. Cem Kaner, Jack Falk, Hung Quoc Nguyen, *Testing Computer Software*, Thomson Computer Press.
4. Roger S. Pressman , *Software Engineering – A practitioner's approach*, Tata McGraw Hill,2011

13CS74 DESIGN PATTERNS

3 0 0 3

Course Objectives (COs)

- To understand the knowledge about patterns
- To design patterns that enable the reuse of software architectures
- To investigate the development of good design patterns.

Course Learning Outcomes (CLOs)

- Provide simple and concise solutions to commonly occurring design problems.
- Create more flexible, elegant, and ultimately reusable designs.
- Describe how patterns fit into the software development process, and to leverage them to solve their own design problems most efficiently and help them to design object-oriented software as well

Program outcomes (POs)

b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
d) Define, assess, and tailor software quality practices, and software processes and methodologies for appropriate application on software development projects in a variety of domain areas
g) Recognize of the need for, and an ability to engage in life-long learning.

Unit I

Background on Design Patterns

Pattern concept - Pattern taxonomy - Design structures - Design principles- The singleton classifying patterns - Design patterns - The learning process - Studying design patterns - Object oriented approaches - The java foundation classes - Java design patterns - The development challenge

9 Hours

Unit II

Design Pattern Catalog

Creational patterns - Factory pattern - Abstract factory pattern - Builder pattern - Factory method – Prototype pattern – Singleton pattern - Summary of creational patterns.

9 Hours

Unit III

The Java Foundation Classes

Installing and using the JFC - Ideas behind swing - The swing class hierarchy - Writing a simple JFC program - Buttons and toolbars -Menus and actions - The JList class - The JTable class - The JTree class.

9 Hours

Unit IV

Structural Patterns

Adapter - Bridge – Composite – Decorator – Façade – Flyweight – Proxy - Comparison with structural patterns.

9 Hours

Unit V

Behavioral Patterns

Chain of responsibility- Command - Interpreter – Iterator – Mediator – Memento – Observer – State – Strategy - Template method – Visitor - Discussion of behavioral patterns.

9 Hours

Total: 45 Hours

References

1. James W. Cooper, *The Design Patterns Java Companions*, Addision Wesley Design Patterns Series, 2012.
2. Bruce Eckel, *Thinking in Patterns with Java*, MindView Inc, 2006.
3. Dr. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, *Design Patterns: Elements of Reusable Object-Oriented Software*, Pearson publications Ltd, 2004.
4. Cay S. Horstmann , *Object-Oriented Design and Patterns*, John Wiley & Sons, 2005.

13CS75 HUMAN COMPUTER INTERACTION

3 0 0 3

Course Objectives (COs)

- To Learn the design techniques and fundamentals of Human Computer Interaction(HCI)
- To know the various types of existing interfaces and evaluation techniques
- To understand the applications of HCI in emerging trends

Course Learning Outcomes (CLOs)

- Understand the requirements and specifications for the interaction design
- Analyze the evaluation techniques of human interaction
- Determine the most appropriate HCI methods to meet the needs of a practical software development project

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
e) Identify, analyze, formulate and solve engineering problems
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Unit I

Interaction Design and Conceptualizing Interaction

Introduction – Good and poor design – User experience – The process of interaction design – Interaction design and the user experience – Understanding the problem space and conceptualizing design – Conceptual models – Interface metaphors – Interaction types – Paradigms, theories, models and frameworks. **9 Hours**

Unit II

Social, Emotional Interaction and Interfaces

Introduction – Face-to-Face conversations – Remote conversations – Telepresence – Co-presence – Emergent social phenomena - Emotional interaction: Introduction – Emotions and the user experience – Expressive interfaces – Frustrating interfaces - Persuasive technologies and behavioral change – Anthropomorphism and zoomorphism – Models of emotion – Interface types.

9 Hours

Unit III

Data Gathering, Analysis, Interpretation and Presentation

Introduction – Five key issues – Data recording – Interviews – Questionnaires –Observation – Choosing and combining Techniques- Qualitative and quantitative – Simple quantitative analysis – Simple qualitative analysis – Tools to support data analysis.

9 Hours

Unit IV

Evaluation Framework

Goals of evaluation – Types of evaluation – DECIDE: A framework to guide evaluation – Usability testing – Conducting experiments – Field studies – Inspections- Heuristic evaluation and walkthroughs – Analytics – Predictive models.

9 Hours

Unit V

Ubiquitous Computing, Hypertext and World Wide Web

Ubiquitous computing application research – virtual & augmented reality –Understanding hypertext – finding things – Web technology and issues – Static web content – Dynamic web content- Groupware systems – Computer mediated communication – DSS – Frameworks for groupware- Information and data visualization.

9 Hours

Total: 45 Hours

References

1. Yvonne Rogers, Helen Sharp, Jenny Preece, *Interaction Design: beyond human-computer interaction*, John-Wiley and Sons Inc., 2011.
2. Alan Dix , Janet Finlay, Gregory D.Abowd, Russell Beale, *Human Computer Interaction*, Pearson Education, 2008.
3. Jonathan Lazar Jinjuan, Heidi Feng, Harry Hochheiser, *Research Methods in Human-Computer Interaction*, Wiley, 2010.
4. Dov Te'eni, Jane Carey, Ping Zhang, *Human-Computer Interaction: Developing Effective Organizational Information Systems*, John-Wiley and Sons Inc., 2007.

13CS76 WEB ENGINEERING

3 0 0 3

Course Objectives (COs)

- To develop a technical overview of the web & emerging platforms
- To appreciate the mechanisms by which web content can be enriched to take account of contextual factors
- To identify, evaluate and apply appropriate technologies for web development

Course Learning Outcome (CLOs)

- Evaluate and assess the security & privacy implications of web applications
- Use XML to enhance cross-application compatibility
- Demonstrate the issues in storing and retrieving data

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research
h) Acquire the knowledge of contemporary issues
i) Use the techniques, skills and modern engineering tools necessary for engineering practice

Unit I

An Introduction to Web Engineering

Motivation - Categories of web applications- Characteristics of web applications- Requirements Engineering (RE) for web applications: Introduction- Fundamentals- RE specifics in web engineering- Principles for RE of web applications- Adapting RE methods to web application development.

9 Hours

Unit II

Technologies for Web Applications

Client/ Server communications on the web- Client-side technologies- Document-specific technologies- HTML-DHTML- Synchronized Multimedia Integration Language- Extensible Markup Language – Extensible style sheet language- Java script- Server-side technologies- Servlet- URI handlers- Web service- Middleware technologies.

9 Hours

Unit III

Web Application Architectures

Introduction-Fundamentals-Specifics of web application architectures- Components of a generic web application architecture- Layered architectures- Data-aspect architectures- Modeling web applications: Introduction-

Fundamentals- Modeling specifics in web engineering- Modeling requirements- Hypertext modeling- Presentation modeling- Customization modeling.

9 Hours

Unit IV

Web Application Design

Introduction- Web design from an evolutionary perspective- Presentation design- Interaction design- User interaction user interface organization- Navigation design- Designing a link representation- Designing link internals- Navigation and orientation- Structured dialog for complex activities- Interplay with technology and architecture- Functional design.

9 Hours

Unit V

Testing Web Applications

Introduction- Fundamentals- Test specifics in web engineering- Test approaches- Test scheme- Test methods and techniques- Link testing - Browser testing- Usability testing- Load, stress, and continuous testing- Testing security- Test-driven development- Test automation- Web project management: System definition and indicators- Characterizing the workload- Analytical techniques- Performance optimization methods.

9 Hours

Total: 45 Hours

References

1. Gerti Kappel, Birgit Proll, *Web Engineering*, John Wiley and Sons Ltd, 2006.
2. Roger S.Pressman, David Lowe, *Web Engineering*, Tata Mcgraw Hill Publication, 2007.
3. Guy W. Lecky-Thompson, *Web Programming*, Cengage Learning, 2008.
4. Moller, "*An Introduction to XML and Web Technologies*", Pearson Education New Delhi, 2009.
5. Chris Bates, *Web Programming: Building Internet Applications*, Wiley India Edition, 2007.

13CS77 SERVICE ORIENTED ARCHITECTURE

3 0 0 3

Course Objectives (COs)

- To understand the evolution of Service Oriented Architecture(SOA)
- To design a complete business process in SOA.
- To integrate SOA technologies with web services paradigms.

Course Learning Outcomes (CLOs)

- Perform service oriented analysis.
- Design the application services of SOA.
- Assess SOA support provided by J2EE and .NET platform.

Program Outcomes (POs)

b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.

d) Define, assess and tailor software quality practices, software processes and methodologies for appropriate application on software development projects in a variety of domain areas.

i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I

Understanding SOA

Introduction of SOA- SOA architecture fundamentals-Overview of SOA implementation methodology - SOA reference architecture – Service identification –Service specification- Service realization –Service life cycle.

9 Hours

Unit II

Designing SOA

Business architecture – Business motivation model –Business process management and modeling –Conditional business process models – The importance of semantics in SOA- Core information modeling- Defining type.

9 Hours

Unit III
Service Oriented Design
Introduction to service-oriented design - WSDL related XML schema language – WSDL language –SOAP language– Service interface design tools- Steps to composing SOA-Considerations for choosing service layers - Considerations for positioning core SOA standards.

9 Hours

Unit IV
Business Process Design
Service design overview- Entity centric business service design- Application service design – Task centric business service design-Service design guidelines-WS-BPEL language basics– WS coordination.

9 Hours

Unit V
SOA Platform
WS addressing language- WS reliable messaging language-WS policy language – WS metadata exchange language- WS security language-SOA platform basics- SOA support in J2EE- SOA support in .NET.

9 Hours
Total: 45 Hours

References
1. Michael Rosen, Boris Lublinsky, Kevin T.Smith and Marc J.Balcer, *Service-Oriented Architecture and Design Strategies*, Wiley India Edition, 2008.
2. Thomas Erl, *Service-Oriented Architecture: Concepts, Technology and Design*, Pearson Education, 2008.
3. Newcomer, Lomow, *Understanding SOA with Web Services*, Pearson Education, 2009.
4. Dan Woods and Thomas Mattern, *Enterprise SOA Designing IT for Business Innovation*, O'REILLY, 2006.

13CS78 XML AND WEB SERVICES

3 0 0 3

Course Objectives (COs)
- To introduce the basic concepts of XML technology
- To understand the concepts of web services key technologies
- To know the ideas of XML security

Course Learning Outcomes (CLOs)
- Understand Web Services and its Infrastructure
- Building a Web Service
- Deploying and Publishing Web Services

Program Outcomes (POs)
a) Apply basic principles and practices of Computer Science and engineering to productively engage in the research.
c) Design a system component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate and solve engineering problems.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I
Introduction
Introduction to Internet and WWW – Role of XML – XML language basics - Document Type Definition (DTD) - Schemas.

9 Hours

Unit II
XML Technology
XML path language-Extensible stylesheet language transformations - Extensible stylesheet language formatting objects- Xlink- XPointer - XInclude - XBase.

9 Hours

Unit III
Web Services
Evolution of distributed computing- Client/Server - CORBA - Java RMI – Microsoft DCOM –Introduction to web services - Building web services architecture **9 Hours**

Unit IV
SOAP
Developing web services using SOAP –Anatomy of a SOAP message-SOAP encoding-SOAP message- Exchange model –SOAP communication-SOAP security.

9 Hours

Unit V
Description and Discovery of Web Services and Security in Web Services
Web services description language - Universal Description, Discovery, and Integration (UDDI) - Programming with UDDI - Inquiry APIs- Publishing APIs- Implementations of UDDI- Web services security-XML encryption-XML signature

9 Hours
Total: 45 Hours

References
1. H.M.Deitel, P.J.Deitel, T.R.Nirto, T.M.Lin, *XML How to Program*, Pearson Edition, 2004.
2. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, *Developing Java Web Services*, Wiley Publishing Inc., 2004.
3. Frank. P. Coyle, *XML, Web Services and the Data Revolution*, Addison-Wesley Professional, 2002.
4. Steve Graham and Doug Davis, *Building Web services with Java*, Pearson education 2008.

13CS79 COMPONENT BASED TECHNOLOGY

3 0 0 3

Course Objectives (COs)
- To learn the components of JAVA, CORBA and .Net
- To understand the properties of components, technologies, architecture and middleware
- To know the concept of Component Frameworks and Development

Course Learning Outcomes (CLOs)
- Develop a Application based on COM /DCOM
- Deploy EJB for Creating a simple Application
- Generate an Application using CORBA

Program Outcomes (POs)
b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
d) Define, assess, and tailor software quality practices, and software processes and methodologies for appropriate application on software development projects in a variety of domain areas
e) Identify, analyze, formulate and solve engineering problems.

Unit I
Introduction
Software Components – Objects – Fundamental properties of component technology – Modules – Interfaces – Callbacks – Directory services – Component architecture – Components and middleware.

9 Hours

Unit II
Java based Component Technologies
Threads – Java Beans – Events and connections –Properties – Introspection – JAR files –Reflection – Object serialization – Enterprise Java Beans – Distributed object models – RMI and RMI-IIOP.

9 Hours

Unit III
CORBA Component Technologies
CORBA to OMA –Common object service specifications – CORBA component model – CORBA compliant implementations- CORBA facilities – Application object.

9 Hours

Unit IV

.Net based Component Technologies

COM – Distributed COM – Object reuse – Interfaces and versioning – Dispatch interfaces – Connectable objects – OLE containers and servers – Active X controls – .NET components - Assemblies – App domains –Contexts – Reflection – Remoting.

9 Hours

Unit V

Component frameworks and development

Connectors – Contexts – EJB containers – CLR contexts and channels – Black box component framework – Directory objects – Cross-development environment – Component-oriented programming – Component design and implementation tools – Testing tools.

9 Hours

Total: 45 Hours

References

1. Clemens Szyperski, *Component Software: Beyond Object-Oriented Programming*, Pearson Education publishers, 2011
2. Rima Patel Sriganesh, Gerald Brose and Micab silverman *Mastering Enterprise Java Beans 3.0*, Wiley & India, 2010.
3. Mowbray, *Inside CORBA*, Pearson Education, 2010.
4. Hortsamann, Cornell, *CORE JAVA* Vol-II Sun Press, 2011
5. Freeze, *Visual Basic Development Guide for COM & COM+*, BPB Publication, 2001.

13CS80 INTERNET AND WEB TECHNOLOGY

3 0 0 3

Course Objectives (COs)

- To understand the client / server programming
- To learn CSS to implement a variety of presentation effects using HTML and XML documents
- To know the unique features of scripting languages

Course Learning Outcomes (CLOs)

- Create web pages using HTML, JavaScript and CSS
- Understand the key technologies of Internet
- Distinguish the concepts of Java script and Java servlet
- Understand the web service technologies

Program Outcomes (POs)

b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.
e) Identify, analyze, formulate, and solve engineering problems.
g) Recognize of the need for, and an ability to engage in life-long learning.
j) Pursue life-long learning through post graduate education, participation in professional activities, or the acquisition of new technical proficiencies, or managerial and leadership skills.

Unit I

Web Essentials

Internet – Web clients – Web servers – Markup languages – XHTML 1.0 – Cascading Style Sheets (CSS): Features-Style rule cascading and inheritance - Text properties –CSS box model.

9 Hours

Unit II

Client Side Programming

Java script operators - Java script objects – Arrays – Build-in objects - DOM: History and levels- Document tree-DOM event handling- Non compliant browsers.

9 Hours

Unit III
Server Side Programming
Java servlet: Architecture – Servlet life cycle – Parameter data – Sessions – Cookies – Other servlet capabilities – Data storage –Servlet and concurrency.

9 Hours

Unit IV
JSP Programming
Introduction to Java Server Pages – JSP and servlets – Running JSP applications - Basic JSP – Java beans classes and JSP - Tag libraries and files.

9 Hours

Unit V
Web Services
Web services concepts - Writing java web services – Web services for clients – WSDL – Representing data types: XML schema – Communicating object data: SOAP – SOAP encoding of struct data.

9 Hours
Total: 45 Hours

References
1. Jeffrey C Jackson, *Web Technology – A computer Science perspective*, Person Education, 2009.
2. Chris Bates, *Web Programming – Building Internet Applications*, Wiley India, 2006.
3. Deitel, Deitel and Neito, *INTERNET and WORLD WIDE WEB – How to program*, Pearson education, 2011.
4. Gopalan. N.P, *Web Technology A Developer Perspectives*, PHI, 2010.

13CS81 MOBILE OPERATING SYSTEMS

3 0 0 3

Course Objectives (COs)
- To know the emerging trends in mobile operating systems.
- To have systematic knowledge of Symbion and Mac OS X operating system.
- To have thorough knowledge of Android operating systems concepts.

Course Learning Outcomes (CLOs)
- Analyze the requirements of Mobile OS.
- Demonstrate the process of Android application development.
- Design the procedure for Tablet OS.

Program Outcomes (POs)
a) Apply basic principles and practices of Computer Science and Engineering to productively engage in the research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate, and solve engineering problems
f) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Use the techniques, skills, and modern engineering tools necessary for engineering practice

Unit I
Android Operating System
Android overview-The stack-Installing android SDK-Main building blocks-Android user interface-Preferences, file systems, option menu and intents.

9 Hours

Unit II
Android Application Development
Design of android user interface with views-Using list views to display long list-Understanding specialized fragments-Displaying pictures and menus-Data persistence.

9 Hours

Unit III
Windows Mobile Operating System
Introduction to Windows Mobile 8– Working with Apps- Customizing Windows 8- Surfing the web-Configuring the tablet-Implementing security –Maintaining Windows 8. **9 Hours**

Unit IV

Mac and iOS

The Evolution of OSX- OS X Versions-iOS-The future OS X-Architectural overview-User experience layer –Unix core –System directories-Applications-Frameworks-System calls- High level view of XNU.

9 Hours

Unit V

Symbion Operating System

The background of Symbion OS- History- Architecture of Symbion OS-OS Layered model-UI Framework layer-The application services layer.

9 Hours

Total: 45 Hours

References

1. Marko Gargenta, *Learning Android, New* Delhi: O'Reilley 2011.
2. Wei-Meng Lee, *Beginning Android 4 application development,* New Delhi: John Wiley 2012
3. Paul McFedrics. *Teach yourself Microsoft Windows 8 Tablets,* New Delhi: John Wiley 2012
4. Jonathan Levin,*Mac OS X and iOS Internal,*. New Delhi: John Wiley 2012.
5. Ben Morris, *The Symbion OS Architecture Source book,* New Delhi :John Wiley 2007.

13CS82 RESEARCH METHODOLOGY

3 0 0 3

Course Objectives (COs)

- To gain insights into how scientific research is conducted
- To learn and understand the optimization methods
- To identify the influencing factors or determinants of research parameters
- To prepare the documentation of research results

Course Learning Outcomes (CLOs)

- Familiarize with different types of research methods and design
- Critically evaluate current research and propose possible alternate directions for further work
- Developing hypothesis and methodology for research

Program Outcomes (POs)

a) Apply basic principles and practices of Computer Science and Engineering to productively engage in research.
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
e) Identify, analyze, formulate and solve engineering problems.

Unit I

Introduction

The nature of CS research - what is research? - Project planning, tools and techniques for planning - Literature searches, information gathering. **9 Hours**

Unit II

Project Development

Reading and understanding research papers - Project implementation and IT project management. - Presentation skills, written and oral - Time management- Team working.

9 Hours

Unit III

Optimization Methods

Linear Programming: Simplex method – Dynamic Programming – Integer Programming - Hill climbing

9 Hours

Unit IV

Advanced Optimization Techniques

Simulated annealing - Quantum annealing - Genetic algorithms - Ant colony optimization - Particle swarm optimization - Tabu search - Beam search

9 Hours

Unit V

Issues and Technical Writing

Commercial and economic considerations in the IT industry - Review of Legal, Ethical, Social and Professional (LSEP) issues, such as data protection, hacking, etc. - Technical writing, referencing, bibliographies.

9 Hours

Total: 45 Hours

References

1. C. W. Dawson, *The Essence of Computer Projects: A Student Guide*. New Delhi: PHI, 2006.
2. Duane A. Bailey, *A Letter to Research Students*. Massachusetts.
3. Humdy Taha, *Operation Research*. New Delhi: PHI, 2007.
4. S. Kirkpatrick and C. D. Gelatt and M. P. Vecchi. *Optimization by Simulated Annealing, Science*, Vol 220, 1983, 671-680.
5. B. Apolloni, N. Caravalho and D. De Falco. *Quantum stochastic optimization, Stochastic Processes and their Applications*, Vol. 33, 1989, 233-244.
6. David E. Goldberg. *Genetic Algorithms in Search, Optimization, and Machine Learning*, New Delhi : New Age, 1989.

13CS01 GRID AND CLUSTER COMPUTING FRAMEWORK

3 0 0 3

Course Objectives (COs)

- To understand the genesis of grid computing
- To know the application of grid computing
- To understand the grid technology and tool kits to facilitated the grid computing

Course Learning Outcomes (CLOs)

- Apply their knowledge and skills in grid computing applications
- Create a web services and grid services
- Use the grid computing tool kits in real time applications

Program Outcomes (POs)

b) Design and conduct experiments, as well as to analyze, interpret data on experiments relevant to Computer Science and Engineering practice.

e) Identify, analyze, formulate and solve engineering problems.

f) Recognize the necessity and an ability to engage in life-long learning.

h) Acquire the knowledge of contemporary issues

Unit I

Building Blocks of Grid - Globus Toolkit , Information Services

Unit II

Data Management in Grid, QoS-Based Grid Network Service Discovery

Unit III

A Practical Global File System for Cluster and Grid computing - Data Replication Optimization in Grid Delivery Network

Unit IV

Grid Distributed Middleware and its Application - Grid Computing Security Mechanisms

Unit V

Semantic Monitoring and Discovery of the Grid Systems - Semantic-Oriented Metadata Management Model in Semantic Grid

References

1. *Journal of Grid Computing*, New York: Springer
2. *International Journal for Grid and Utility Computing*, Inderscience