Contents

1.   **ABOUT THE REVISED SYLLABUS**

The third revised version of DOEACC syllabus came into effect in July 2003 examinations. Since then many advancements have taken place in the field of Information Technology. Consequently it has become necessary to revise the syllabus.

This document presents the fourth revised version of DOEACC C level syllabus which becomes effective for teaching w.e.f. July 2011. This 'C' Level syllabus is designed to facilitate students in the development of concept based approach for problem solving using IT as a tool. The self learning approach is built into the syllabus, thereby training the candidates to update themselves on the changing technologies in their area of work. The 'C' Level syllabus has been designed to produce Consultants, System Specialists, Trainers, R&D Scientists , Managers equipped with latest knowledge and skills.

2.   **DOEACC SOCIETY**

DOEACC Society is an Autonomous Scientific Society of the Department of Information Technology, Ministry of Communications & Information Technology, Govt. of India. The Society is registered under the Societies Registration Act, 1860. DOEACC Society is the only professional examination body in India, which accredits institutes / organizations for conducting particular course, specializing in the non-formal sector of IT education.

DOEACC is envisioned to be a premier knowledge institution pursuing human resource development activities in areas of Information Technology, Electronics and Communication Technology (IECT).

The office of the Society is situated at Electronics Niketan, 6, CGO Complex, New Delhi. The Society has its fifteen Centers at 23 locations namely Agartala, Aizawl, Aurangabad, Calicut (with Southern Regional Office at Pudukkottai), Chennai, Gorakhpur(with Eastern Regional Office at Patna), Imphal, Kohima/Chuchuyimlang, Itanagar, Gangtok, Kolkata, Srinagar/Jammu, Shillong, Tezpur/Guwahati, Chandigarh (Branches – New Delhi, Shimla, Lucknow). One more DOEACC Centre is being set up at Ajmer. These Centres provide quality education & training programmes in Information, Electronic Design and related technologies/areas on long term and short term basis.

3.   **DOEACC SCHEME**

DOEACC scheme on IT is a joint Scheme of the Department of information Technology (erstwhile Department of Electronics), Ministry of Communications & Information Technology, Govt. of India and All India Council for Technical Education (AICTE).

Objective of the Scheme

The objective of the Scheme is to generate qualified manpower in the area of Information Technology (IT) at the national level, by utilizing the facilities and infrastructure available with the institutions/organizations in the non-formal sector.

The Society is managed and administered by a Governing Council which consists of eminent academicians and professionals from IT industry. Minister of State for Communications & Information Technology, Govt. of India, is the Chairman, Governing Council of the Society. The Executive Director is the Chief Executive Officer of the

Society and manages day to day affairs of the Society. Manifold functions of the DOEACC Scheme are:

a)   Accreditation
b)   Registration and
c)   Examination

4.   DOEACC 'C' LEVEL COURSE

Objective of the 'C' Level Course

The objective of 'C' Level is to develop Project Managers/Consultants/System Specialists/R&D Scientists/Faculty who will be equipped with the knowledge and skills desired to perform the duties of the positions referred above. In order to develop the capabilities ,'C' Level course has been designed to give the students a sound background in latest Technologies, Tools and Techniques in Computer Science and Engineering.

The career options available to DOEACC 'C' level qualifiers are:

- Project Manager
- IT Consultant
- Training faculty
- R & D Scientist
- System Specialist

Employment eligibility as Faculty in Engineering Colleges for C level holders :

1. Any Engineering graduate with C level may be eligible to become a faculty in Computer Science & Engineering/IT Department of Engineering college & universities. The student may also be allowed to pursue research in any University/IIT/NIT
2. Other C level candidates without Engineering background with GATE percentile may also be eligible to become faculty in Computer Science & Engineering/IT Department of Engineering college & universities. The student may also be allowed to pursue research in any University/IIT/NIT

DOEACC 'C' Level Course consists of 12 theory modules (10 compulsory modules and 2 elective module), four Practical and two Projects (out of which one will be a comprehensive project). The minimum duration of the course is two years. The structure of 'C' Level syllabus is indicated below:

DOEACC 'C' LEVEL COURSE STRUCTURE

The structure of the 'C' Level course is:

Module	Title

*Bridge Course

Module	Title
C0-R4.B1	Elements of Mathematical Sciences
C0-R4.B2	Operating System
C0-R4.B3	Data Structure through JAVA
C0-R4.B4	Computer System Architecture

Semester I

C1-R4	Advanced Computer Graphics
C2-R4	Advanced Computer Networks
C3- R4	Mathematical Methods for computing
C4-R4	Advanced Algorithms
C5-R4	Data Warehousing and Data Mining
Lab I	Graphics and Visualisation
Lab II	Data Network and Management

Semester II

C6-R4	Multimedia Systems
C7-R4	Digital Image Processing and Computer Vision
C8-R4	Information Security
C9-R4	Soft Computing
C10-R4	Software Systems

Lab III	Image Processing and Computer Vision + Multimedia Systems
Lab IV	Information Security + Soft Computing

Semester III   **Any two from the following to be chosen**

CE1.1-R4	Digital Signal Processing
CE1.2-R4	Machine Learning
CE1.3-R4	Cyber Forensic & Law
CE1.4-R4	Project Management
CE1.5-R4	Mobile Computing

C11-R4	Dissertation-I

Semester IV

C12-R4	Dissertation -II

** Bridge course C0-R4.B1 to C0-R4.B4 will be exempted for the students who have successfully qualified the DOEACC 'B' level course or its equivalent course recognized by AICTE/MHRD/UGC on case to case basis.

5.   **PRACTICAL**

All 'O', 'A' ,'B' and 'C' Level Candidates under the revised syllabi (Revision 4) shall have to qualify the Practical Examination, in addition to qualifying the theory examinations as well as the Dissertation Work.

Practical assignments have been worked out for each theory paper. At 'C' Level, there are four Practical Examinations. The Practical I - Graphics & Visualisation will be based on the syllabi of C1-R4 Advanced Computer Graphics and C3-R4 Mathematical Methods for computing and Practical II - Data Network & Management will be based on the syllabi of C2-R4 Advanced Computer Networks and C5-R4 Data Warehousing and Data Mining. Similarly, Practical III – Image Processing and Computer Vision + Multimedia Systems will be based on the syllabi of C6-R4 Multimedia Systems and C7-R4 Digital Image Processing and Computer Vision and Practical IV – Information Security + Soft Computing will be based on the syllabi of C8-R4 Information Security and C9-R4 Soft Computing of the 'C' Level course.

6. DISSERTATION

DOEACC curriculum has Dissertation as an important component of 'C' Level course. There are two Dissertations at 'C' Level. The Dissertation is carried out by the student under guidance and support from faculty and management of the respective institute/organization.

It is felt that such a Dissertation provides an opportunity to the student to apply his/her knowledge and skills to real life problems (including oral and written communication skills), and as such the Dissertation should be given utmost importance and priority both by the students as well as institution faculty/management in respect of its identification, planning and implementation.

Objective of the Dissertation

The aim of the Dissertation is to give the students an integrated experience in solving a real life problem by applying knowledge and skills gained on completion of theory papers in a course at a given Level. It provides an occasion for students to develop written and communication skills, Dissertation also helps the students to realize the importance of resource and time management, ownership of task towards deliverables, innovation and efficiency in task management apart from presentation skills. It also provides a good opportunity for students to build, enhance and sustain high levels of professional conduct and performance and evolves a problem solver frame of mind in student. It is also felt that taking up the Dissertation by a student prepares him for a job in industry and elsewhere.

6.1 C Level First Dissertation (Dissertation – I)

Every candidate should do a Dissertation individually and no grouping is allowed. The Dissertation will be carried out under the guidance of the institute, if he/she is through the institute conducting an accredited course. The direct candidate will do the Dissertation in an organization where he/she is working. In that case, he/she will carry out the Dissertation under the guidance of experts/professional from his organization.

Who could be a Supervisor/Guide

A Supervisor/Guide should be a person with DOEACC 'C' Level/ M.Tech equivalent/higher qualification and adequate experience (minimum 3 years) in the area in which the student has chosen the Dissertation. In the case of a candidate from an accredited institute, the institute concerned will render all help including the nomination of the Supervisor. All help including the nomination of the supervisor/guide will be rendered by the institute concerned. In the case of a direct candidate, the candidate

should ensure that the facilities are available in the organization (where the Dissertation is taken up) and also the same are extended to them.

Dissertation work part-1 will be a part of main Dissertation. Dissertation report submission and presentation will be mandatory.

Time of Submission of First 'C' Level Dissertation

'C' Level student can submit the Dissertation-I only after clearing 10 papers from the first two semesters and appearing both elective papers in semester III.

Some important notes while preparing the Dissertation proposal

The following suggested guidelines may be followed in preparing the Final Dissertation Report:

Good quality white executive bond paper A4 size should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.
Page Specification: (Written paper and source code)
Left margin   3.0 cms
Right margin   3.0 cms
Top margin   2.7 cms
Bottom margin   2.7 cms
Page numbers – All text pages as well as Program source code listing should be numbered at the bottom center of the pages.

Submission of Dissertation Report to DOEACC

The student will submit his/her Dissertation report in the prescribed format along with requisite fee. The Dissertation Report should include:
- One hard copy of the Project Report.
- Soft copy of Project on Floppy / CD
- The Project Report may be about 50 pages (excluding coding).

Credits

This Dissertation would be approximately 330 man-hours and carries a total of 100 marks (80% for the Dissertation evaluation and 20% for the viva-voce). The marks and a certificate of conducting Dissertation – I of only the passed candidates should be submitted in the prescribed format by the Head of the Institute running the accredited course of the organization of which the candidate is an employee.

Proforma of the mini Project Completion Certificate is given below;

Proforma of the Dissertation Completion Certificate

This is to certify that the Dissertation work done of seminar (---------------------Title) attended at _____ by Mr.Ms._____ (DOEACC Registration No._____) in partial fulfillment of DOEACC 'C' Level Examination has been found satisfactory and the total marks obtained by the candidate is _____.
This report has not been submitted for any other examination and does not form part of any other course undergone by the candidate.

Signature:

Name:
(By head of the institution with

PROV No//Full No.) or by
Head of the Organization/Division
Name of the Organization
Address:

6.2   C Level Second Dissertation

At this academic level, the Dissertation is of great significance in the testing of a candidate's virtuosity in Information Technology and judges his of her ability to independently take charge of Dissertation/System development.

All 'C' Level candidates are required to get the synopsis of the Dissertation and the brief bi-data of the supervisor/Guide approved from the Society. The synopsis should clearly mention the scope of the Dissertation. The Dissertation is to be taken up only after obtaining the approval of the Society.

Topic of the Dissertation

Should enable bringing out the topics learnt and should be related to applications in the Industry/field in real life.

Methodology

Candidate should undertake a Dissertation work involving use of software engineering methodologies, tools and techniques.

Format

Candidate should see the format in the Student Project Guide at DOEACC website.

Credit

Dissertation would be of approximately **450 man-hours** and so credited by the Supervisor/Guide and will be presented in the form in conformance with the format given in the Student Guide. The Dissertation will also include a viva/voce examination. Dissertation carries a total of **300   marks.** 80% of the marks are earmarked for the Dissertation evaluation and 20% for the viva-voce.

To qualify for a pass, a candidate must obtain atleast 50% in each of Dissertation evaluation and viva-voce. Exact location of the viva-voce will be intimated by the examiner designated.

Time for submission

'C' Level student can submit the Dissertation only after clearing all the papers of third semester.

Fees :

A fee as applicable at the time of submission (available at DOEACC website www.doeacc.edu.in) of Dissertation-II should be remitted to DOEACC Society by a demand draft in favour of DOEACC payable at New Delhi along with the Dissertation report.

Authenticity

Should be an original work, of real life value and not copied from existing material from any source and a certificate to the effect will be provided with the Dissertation duly countersigned by the supervisor/Guide.

7. CREDIT SCHEME FOR DOEACC 'C' LEVEL COURSE

Introduction

A credit system based on the AICTE norms has been introduced for indicating the efforts required to pass a specific level of course under the DOEACC Scheme. Award of credit to a student will facilitate measurement/comparison of study hours including Theory Lectures, Tutorials and Practical Assignments put in a given module/paper/subject under the Scheme with similar course in IT in India and abroad. This will also facilitate other Universities/Apex Accrediting bodies to consider academic and professional equivalence of DOEACC courses. This will also help students/organizations to transfer credits from DOEACC to other academic bodies and vice-versa for ensuring continuing education. Following table gives the no. of hours of Lectures/Tutorials and Practical per week to be attended and the credits earned by the student:-

Calculation of Credits

Module	Title	No. of Hrs. per week		No. of Credits+
		L*	T/P**	
Bridge Course	*(Being bridge course no credit is allotted for the this Course)*			
C0-R4.B1	Elements of Mathematical Sciences			
C0-R4.B2	Operating System			
C0-R4.B3	Data Structure through JAVA			
C0-R4.B4	Computer System Architecture			
Semester I				
C1-R4	Advanced Computer Graphics	3	3	5
C2-R4	Advanced Computer Networks	3	3	5
C3-R4	Mathematical Methods for computing	3	3	5
C4-R4	Advanced Algorithms	3	3	5
C5-R4	Data Warehousing and Data Mining	3	3	5

Lab I	Graphics and Visualisation		6	3
Lab II	Data Network and Management		6	3
				31

Semester II

C6-R4	Multimedia Systems	3	3	5
C7-R4	Digital Image Processing and Computer Vision	3	3	5
C8-R4	Information Security	3	3	5
C9-R4	Soft Computing	3	3	5
C10-R4	Software Systems	3	3	5
Lab III	Image Processing & Computer Vision + Multimedia Systems		6	3
Lab IV	Information Security + Soft Computing		6	3
				31

Semester III   Any two from the following to be chosen (credit 8)

CE1.1-R4	Digital Signal Processing	3	3	5
CE1.2-R4	Machine Learning	3	3	5
CE1.3-R4	Cyber Forensic & Law	3	3	5
CE1.4-R4	Project Management	3	3	5
CE1.5-R4	Mobile Computing	3	3	5
C11-R4	Dissertation Part -I			22
				32

Semester IV

C12-R4	Dissertation Part -II		**30**

	Total Credit	**124**

Notes

1. One hour of lecture is equated to one credit and two hours of tutorial/practicals are similarly equated to a credit, every week for a semester consisting of 20 weeks.

2.   Total No. of credits earned in a module is calculated using AICTE Formula (as applicable to Under Graduate Courses in IT namely $C = L+(T+P)/2$ where L, T and P indicate no. of hours per week for Lectures, Tutorials and Practical.
3.   The credit scheme was implemented from July, 2003 examinations.
4.   Fractions in credits have been rounded to nearest integer.

8.   EXAMINATION PATTERN

The theory examination for each module under the fourth revised syllabus would be for duration of three hours and the total marks for each subject would be 100. Four Practical examinations of three hours duration and 100 marks each have been introduced. The first examination with the revised syllabus will be held in January 2012, for which teaching will commence in July, 2011.

Dates for the various activities connected with examinations will be announced on DOEACC website, well in advance of the examinations.

8.1   Pass percentage

To qualify for a pass in a module, a candidate must have obtained at least 50% in each theory and practical examination each. The marks will be translated into grades, while communicating results to the candidates. The gradation structure is as below:-

Pass percentage	Grade
Failed (<50)	F
50%-54%	D
55%-64%	C
65%-74%	B
75%-84%	A
85% and over	S

8.2   Registration

Registration is a pre-requisite for appearing in DOEACC examinations. A candidate can register at only one Level at a time to appear for the examination. Registration is only for candidates and not for institutes. Registration forms are available from the DOEACC Society free of cost and also can be downloaded from the website. The eligibility criteria for registration at 'C' Level is as follows:

8.2.1   Eligibility

For students appearing through an institute: Level 'B' / B.Tech / BE / MCA / M.Sc / Master's Degree in Mathematics / Statistics / Operation Research / MBA (or equivalent) with B.Sc / BA (Mathematics / Statistics). GATE (Computer), followed in each case by an accredited 'C' level course.

For students-at-large (Direct Applicants) Level 'B' / B.Tech / BE / MCA / M.Sc / Master's Degree in Mathematics / Statistics / Operation Research / MBA (or equivalent) with B.Sc / BA (Mathematics / Statistics). GATE (Computer) followed in each case by one and half year relevant experience.*

* Relevant experience connotes job experience in IT, including teaching in a   recognized

institution as faculty member excludes coaching.

Registration is open throughout the year, however cut off dates are specified for submitting registration applications for each examinations for the convenience of processing and allotting Registration Numbers.

Level	Cut off Dates	
	January Exams	July Exams
C Level	Preceding 31st July	Preceding 31st January

Accredited Institutes are allowed to submit the Registration Application Form of their candidates one month beyond the cut off dates

8.3 Re-registration

Candidates who are not able to clear the level within the validity period of initial registration, are allowed to re-register for once, at the same level for another full term. i.e. 6 years to clear the left over papers by submitting filled in Registration application and full Registration fee within one year of the expiry of the validity period of existing 'C' Level Registration.

8.4 PRACTICAL EXAMINATION SCHEME

No of Practical Examination : Four
Duration of each Examination :Three hour duration including viva-voce
Max. marks in each Examination : 100=80 (Practical) + 20 (Viva)

Grading : Students will be awarded grades in practical examinations based on the marks scored by them in the practical and viva voce. Every candidate has to pass in both Theory and Practical examinations.

Date(s) :**Date(s) will be announced on the DOEACC website.**

The examinations will be conducted by the Society in reputed institutions for all candidates.
The institutes are obliged to facilitate the conduct of Practical examinations and arrange infrastructure, faculty for the conduct of practical examination. The institutes are not allowed to charge any fee from the candidates, for the practical examination.

9. HARDWARE REQUIREMENT FOR 'C' LEVEL COURSE

a. Computer configuration recommended

Processor	:	1 GHz or higher
RAM	:	1 GB or higher
HDD	:	250 GB or higher
Monitor	:	SVGA
Mouse	:	Windows compatible
Keyboard	:	Standard
NIC	:	Standard

Optical Drive	:	Standard
Speaker, Mic, Webcam	:	Standard

b. Printer

Laser printer / Inkjet Printer	:	Standard
Dot matrix printer	:	Standard
OHP /LCD Projector	:	Standard
MODEM, DIAL UP/DSL	:	Standard
SCANNER	:	Standard

c. Networking Requirement

NIC	:	Standard
RJ-45 Connector	:	Standard
Punching Tool	:	Standard
Crimping Tool	:	Standard
UTP/STP/Coaxial Fibre Optic Cables & their connectors	:	Standard
8/16 port Hub/Switches	:	Standard
Wi-Fi Router	:	Standard

d. Internet connections & sufficient number of Computers / nodes in Client server configuration mode satisfying the criteria of accreditation.

10.   SOFTWARE REQUIREMENT FOR 'C' LEVEL COURSE

Operating system	:	Linux / Windows / 2000/xp/vista
NOS	:	Linux / Unix / Windows NT/Novell Netware
SW Packages	:	Star Office / MS Office, Internet Explorer, Internet Explorer / Web Publishing Tool, JDK / Oracle J Developer2, AUTOCAD/CorelDraw / MS Visio, Microsoft Visual Studio .Net.,Oracle / SQL Server. Standard Multimedia Tools,CASE Tool,Win Runner/Load Runner, RASMOL, BLAST,Fasta,WorkBench and NCBI Software Tools(Entrez), Small Talk Laboratories, Rational Rose and other Rational Corporation products, Gemstore,Versent, Matlab/Mathematics (with relevant tool boxes), Network Simulation Software, Network management tools, Firewall, Network traffic analysis tool, RTOS etc.
Antivirus Software	:	Standard
Compilers	:	C & C++ Compiler, Java MPI,PVM , SMIL Interpreter and OpenMP

Code	Revision IV	Code	Revision III
C1-R4	Advanced Computer Graphics	C10-R3	Computer Graphics & Animation
C2-R4	Advanced Computer Networks	C7-R3	Advanced Computer Networks
C3-R4	Mathematical Methods for Computing		No equivalence
C4-R4	Advanced Algorithms	C4-R3	Algorithm Analysis & Design
C5-R4	Data Warehousing and Data Mining	CE3-R3	Data Warehousing & Mining
C6-R4	Multimedia Systems	C11-R3	Multimedia Technology & Virtual reality
C7-R4	Digital Image Processing and Computer Vision	CE5-R3	Image Processing & Computer Vision
C8-R4	Information Security	CE4-R3	Network Security & Cryptography
C9-R4	Soft Computing	C14-R3	AI & Neural Networks
C10-R4	Software Systems		No equivalence
CE1.1-R4	Digital Signal Processing		No equivalence
CE1.2-R4	Machine Learning		No equivalence
CE1.3-R4	Cyber Forensic & Law		No equivalence
CE1.4-R4	Project Management	C9-R3	Advanced Software Project Management
CE1.5-R4	Mobile Computing	CE2-R3	Mobile Computing

1. The above table shows the equivalence between the modules of new syllabus (Revision IV) and the old (Revision III) syllabus.
2. Candidates would not be allowed to appear in the equivalent papers of the Revision IV (new syllabi), if they have already passed the relevant papers in earlier revision.
3. Candidates would have to pass a total of 12 papers, 4 practicals and 2 Dissertations in order to qualify 'C' Level in Revision IV syllabus.
4. Candidates would not be allowed to appear for more than two elective papers as per the Revision IV. Candidates who have passed/cleared certain papers, and such papers have either become elective or have no equivalence in Revision IV and the candidate has already passed/cleared the required number of elective papers, the candidate must replace the papers with equal number of introduced compulsory papers in Revision IV i.e papers which have no equivalence in earlier Revisions.

C0-R4.B1: ELEMENTS OF MATHEMATICAL SCIENCES

Objective of the Course

Mathematics is the language of all sciences, specifically of Computer Science. A minimum standard of mathematical knowledge and maturity is to be assumed from students who desire to pursue a C Level programme in Computer Science. The present course is designed to bridge the gap between the mathematical knowledge that the students have and knowledge that would be required to understand the curriculum at the C level. Mathematical software need to be utilized for the solution of mathematical problems on computers. After completion of the course, the students should have sufficient knowledge to appreciate, understand and solve problems in topics like signal and image processing; data compression; mobile and wireless communications; computer graphics, vision and multimedia etc.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Linear Algebra: Matrices, Vectors, Determinants	12
2.	Calculus: Differential & Integral Calculus	12
3.	Analytical Geometry	06
4.	Infinite Series	06
5.	Probability Theory and Distributions	12
6.	Statistics	12

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Linear Algebra: Matrices, Vectors, Determinants   12 Hrs.
Basic concepts, Matrix addition, Scalar multiplication, Matrix multiplication, Linear systems of equations-Gauss elimination, Rank of a matrix, Vectors, Dot product, Cross product, Linear independence, Solutions of linear systems:
Existence, Uniqueness, Determinants-Cramer's rule, Inverse of a matrix, Gauss Jordan elimination, Eigen values, Eigen vector, Some application of Eigen value problems.

2. Calculas: Differential and Integral Calculas   12 Hrs.
Binomial Theorem, Trigonometric functions e^x log x and their graphs, Real numbers and real line, Functions.
Limit and Continuity: L'Hospital rule, Continuity, Tangent lines, Differentiation rules, Implicit differentiation, Mean value Theorem, Extreme values, Asymptotes.
Integration: Indefinite integrals, Integration by parts, Partial Fractions, Integration by substitution, Definite Integrals, Fundamentals theorem of calculus(statement only), Properties of integrals, area, Evaluation of definite integrals.

3. Analytical Geometry   06 Hrs.
Equation of a line and circle, Parameterized curves, Polar coordinates: Conic sections and Quadratic equations, Classifying conics.

4. Infinite Series **06 Hrs.**

Limit of sequences and series, Theorem for calculating limits, Infinite series, Integral test, Ratio test, Comparison test, Alternate series, Taylor and Mclaurin series.

5. Probability Theory and Distributions **12 Hrs.**

Rules of probability, Conditional probability, Independent events, Bayes Theorem, Continuous and Discrete random variables, Expected value of a random variable, Moment and moment generating functions, Product moment, Covariance, Probability Distributions – Bernoulli, Binomial, Poisson, Geometric, Uniform, Exponential, Normal and Bivariate normal distribution.

6. Statistics **12 Hrs.**

Introduction, Random sampling, Estimation of parameters, Confidence intervals, Testing of hypothesis, Goodness of Fit, Chi-square test, Regression analysis.

RECOMMENDED BOOKS (*)

MAIN READING

1. E Kreyszig, "Advanced Engineering Mathematics", 10th Ed., 2011, Wiley Publication.
2. G. B. Thomas and R. L. Finney, "Calculus and Analytical Geometry", 9th Edition, 2002, Pearson Education Asia
3. Sheldon Ross, A First Course in Probability, 8th edition, 2009, Pearson Education

SUPPLEMENTARY READING

1. H.Anton, I.Bivens, S.Davis, Calculus: Early Transcendental, 9th Edition, 2010, Wiley

(*) Latest edition of the books need to be procured.

C0-R4.B1: ELEMENTS OF MATHEMATICAL SCIENCES

Model Question Paper

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

1.

a) Five persons in a group of 20 are graduate. If 3 persons are picked out of 20 at random,
   i. Compute the probability that all are graduate.
   ii. Find the probability of at least one being graduate.

b) Let X be normal with mean 5 and variance 4. Find c corresponding P(X>=C)+95%.

c) Consider a Bernoulli random variate that has probability mass function $P_X(k)=p^k(1-p)^{1-k}$, where $P[X=1]=p$ and $p[X=0]=1-p$. We make n independent observations X1, X2,……..Xn of random variable X. Obtain the maximum likelihood estimate of the parameter p.

d) Evaluate $\int_{-1}^{2}(x+x^2)dx$

e) Examine the convergence of following series
$$\frac{1}{2}+\frac{1}{2.2^2}+\frac{1}{3.2^3}+\frac{1}{4.2^4}+...$$

f) $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix}$, Find $C=A^T B^T$ and its determinant.

g) Find $\frac{dy}{dx}$, if $x^y.y^x = k$, where k is constant.

(7x4)

2.

(a) Solve the following system of equations using Cramer's rule:
   2 x - 5y +7z = 6
   3x - 8 y +11z =11
   x - 3 y + 4 z =3

b) Find the asymptotes of the curve
   $y^3+x^2y+2xy^2-y+1=0$

c) For what values of p are $A = p\vec{i} - 2\vec{j} + \vec{k}$ and $B = 2p\vec{i} + p\vec{j} - 4\vec{k}$ perpendicular?

(4+5+9)

3.

a) Obtain the equation of two lines of regression for the following data. Also find the estimate of X for Y=70.

X:	65	66	67	67	68	69	70	72
Y:	67	68	65	68	72	72	69	71

b) In a random sample of 400 students of the university teaching departments, it was found that 300 students failed in examinations .In another random sample of 500 students of affiliated colleges, the number of failures in the same examinations was found to be 300.Find out whether the proportions of failures in the university teaching departments is significantly greater than the proportion of failures in the university teaching departments and affiliated colleges take together.

c) A survey of 800 families with four children each revealed the following distribution

No. of boys	0	1	3	3	4
No. of girls	4	3	1	1	0
No. of families	32	178	290	236	64

Is this result consistent with the hypothesis that male and female births are equally probable? Use $\chi^2_4(0.05) = 9.488$

(**5 +4 + 9 = 18**)

4.

(a) If ω is cube root of unity, then find the value of the determinant.

$$\begin{vmatrix} 1+\omega & \omega^2 & -\omega \\ 1+\omega^2 & \omega & -\omega^2 \\ \omega+\omega^2 & \omega & -\omega^2 \end{vmatrix}$$ b) Evaluate: $\int\limits_0^{\Pi} x\, Sin^2\, x\, Cos^4\, x\; dx$

(b) Show the system of equation x-3y-8z=10; 3x+y-4z=0 and 2x+5y+6z=13 is consistent and find the solution.

c) Evaluate $\int\limits_0^6 \dfrac{1}{1+x}\, dx$ by using simpson's 1/3 rule and compare the result with its exact value

(**4 +5 + 9= 18**)

5.

a) $Find \quad \dfrac{dy}{dx}, if$

$y = \dfrac{(x+2)^3(3x+5)^{-4}\sin x}{(2x+2)^2}$

b) Evaluate

$$\int\limits_{-\pi/2}^{\pi/2} \sin^2 x\; \cos^2 x(\sin x + \cos x)dx$$

c) Find the area of the region
$$\{ (x, y) : x^2 \le y \le |x| \}$$

(**4+5+9 = 18**)

6.

a)Use the mean value theorem to prove that tavx>x for all x ε (0, Π/2)

b) Show that the line 5x+3y+λx=2λy-6 always passes from a fixed point. Determine the coordinates of the point.

c) Find the sum of the following series as $n \to \infty$.

$$\frac{n}{n^2+1^2} + \frac{n}{n^2+2^2} + \frac{n}{n^2+3^2} + \ldots\ldots + \frac{n}{n^2+n^2}$$

(**4+5+9 = 18**)

7.

a) The time in minutes, it takes to reboot a certain system is a continuous random variable with density

$$f(x) = \begin{cases} c(10-x)^2 & 0 \le x \le 10 \\ 0 & \text{otherwise} \end{cases}$$

i.   Compute C.

ii.   Obtain the probability that it takes between 1 and 2 minutes to reboot.

b) A program consists of two modules. The numbers of errors X in the first module and the number of errors Y in the second module have joint distribution:

$$P(0,0) = P(0,1) = P(1,0) = 0.20$$
$$P(1,1) = P(1,2) = P(1,3) = 0.10$$
$$P(0,2) = P(0,3) = 0.05$$

Find

i.   The marginal distribution of X and Y.
ii.   The probability of number errors in the first module.
iii. The probability distribution of the total number of errors in the program.
iv.   If the errors in the two modules occur independently?

(**9+9 = 18**)

C0-R4.B2: OPERATING SYSTEM

Objective of the Course

This course is covering all the fundamental operating systems concepts such as processes, interprocess communication, input/output, virtual memory, file systems and security. The students are expected to learn these principles through UNIX/LINUX/Windows/2000/XP/NT/Vista like operating systems.

The course outline is about the concepts, structure and mechanism of operating systems. Its purpose is to present, as clearly and completely as possible, the nature and characteristics of modern day operating systems. It examines the operating systems that run in multiprocessing environments and covers distributed computing in the context of open system interconnection(OSI) standards and protocols.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Overview	08
2.	Process management	10
3.	Storage Management	10
4.	I/O Systems	08
5.	Distributed Systems	10
6.	Protection & Security	08
7.	Case Studies	06

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Overview   08 Hrs.
Introduction: Operating Systems, Multi programmed batched system, Time sorting systems, Parallel and Distributed Systems, Real Time Systems, Computer System Structures :I/O Structure, Storage Structure, Storage Hierarchy, hardware, Protection, General System Architecture.

Services: User Interface Services, Graphics and Multimedia Services, Messaging and Collaboration, Network basics, Web Services

Operating System Structures: System Components, Operating System Service, System Calls, System programmes, System Structure, System Design and Implementation, System Generation, Virtual machines and Hypervisor.

2. Process Management   10 Hrs.
Processes: Process Concept, Process Scheduling, Operation on Processes, Cooperating Process, Interprocess Communication, Symmetric vs. asymmetric multiprocessing, Background Process.
CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real Time Scheduling, Algorithms Evaluation, Thread Scheduling, System Jobs.

Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Deletion, Recovery from Deadlock, Combined approach to Deadlock Handling.

3. Storage Management   10 Hrs.
Memory management: Logical versus Physical Address Space Swapping, Contiguous Allocation, paging, Segmentation, Segmentation with paging.

Virtual memory: Demand Paging, Performance of Demand paging, Page Replacement Algorithms, Thrashing, Demand Segmentation.

File System Interface: Access Methods, Directory Structure, Protection, Consistency Semantics, Partitions, Simple Volumes, Shadow Volumes, Virtual Disks, Bitlocker.

File System Implementation: File System Structure, Allocation Methods, Free Space management, Directory Implementation, Efficiency and Performance, Recovery.

4. I/O Systems   08 Hrs.
I/O Systems: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to hardware Operations, Performance, Synchronous I/O and Asynchronous I/O, File Caching.

Secondary Storage Structure: Disk Structure, Disk Scheduling, Disk management, Swap-Space management, Disk Reliability, Stable Storage Implementation.

Tertiary-Storage Structure: Tertiary-Storage Devices, Operating-System Jobs, Performance Issues.

File System: File System Formats (CDFS, FAT, exFAT etc.), Kernal Mode and User Mode Driver Framework.

5. Distributed Systems   10 Hrs.
Network Structure: Topology, Network Types, Communication, Design Strategies.

Distributed System Structures: Network Operating Systems, Distributed Operating Systems, Remote Services, Robustness, Design Issues.

Distributed File Systems: naming and Transparency, Remote File Access, Stateful versus Stateless Service, File Replication.

Distributed Coordination: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election Algorithms, Reaching Agreement.

6. Protection & Security   08 Hrs.
Protection: Goals of Protection, Domain of Protection, Access matrix, Implementation of Access matrix, Revocation of Access Rights.

Security: The Security Problem, Authentication, One-Time Passwords, Program Threats, System Threats, Threat Monitoring, Encryption, Computer-Security Classification, Common

Criteria, VPN, Protocol Security, Access Checks (ACL, DACLs), Auditing, Policy Management, User Account Controls(UAC).

7. Case Studies   **06 Hrs.**
The Unix System, The Linux System, Windows Server.

RECOMMENDED BOOKS

MAIN READING

1. Silberschatz Galvin, "Operating System Concepts", 1999, Addison-Wesley Longman.
2. Andrew S. Tanenbaum, Albert S.Woodhull, "Operating Systems:Design & Implementation"' 2002, Pearson Education Asia.
3. Mark E. Russinovich and David A. Solomon, "Windows Internals 5th Edition" June 2009:Microsoft Press.

SUPPLEMENTARY READING

1. D.M. Dhamdhere, "Operating Systems: A Concept based Approach", 2002, Tata McGraw Hill Publishing Company.
2. A.S. Godbole, "Operating Systems", Tata McGraw Hill, 2002.
3. Stephen G. Kochan, Patrick Wood, "Unix Shell Programming" SAMS Publishing 2007, Third Edition, Pearson Education.
4. Richard L. Petersen, "LINUX: The Complete Reference "fifth edition, Tata McGraw Hill, 2006.
5. Kate Wrightson, Joe Merlino, "Introduction to Unix", McGrawHill Irwin, 2003.

Note: *For all modules explanation must carry case study of either UNIX family or Windows family or both and the last module then can be covered with features of the case study studied throughout.*

(*) Latest edition of the books need to be procured.

C0-R4.B2: OPERATING SYSTEM

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.

(a) How can one distinguish between Processes, Threads and Jobs ?

(b) What is a software interrupt?

(c) What is a virtual memory space? How is it different from a physical memory space?

(d) Distinguish between Partitions, Volumes and Multi-Partition Volumes..

(e) What does Process Virtualization do? What security threat does it address ?

(f) Briefly discuss one of the ways of implementing memory protection using special hardware support.

(g) Differentiate between Symmetric and Asymmetric multiprocessing.

                                                                  (7 x 4)

2.

(a) Describe in brief, the different attributes associated with any file in a typical computer system along with the relevance/usefulness of each of these attributes.

(b) What is Hypervisor? Define the two types of Hypervisor. Give Examples of each type.

(c) How does Bitlocker ensure OS integrity and encrypt files in the hard drive.

                                                           (6+8+4)

3. Assume that a producer is producing non zero integers £ 1000 and putting them in a circular buffer of size 100, while the consumer is consuming the non zero integers contained in that circular buffer at its own speed. Using counting and binary semaphores, write the outline of the producer process and the consumer process.

                                                                (18)

4.

(a) Explain the basic differences between a security/protection policy and protection mechanism as existing in any contemporary computer system.

(b) Explain the Application level filtering feature of Windows firewall .

(c) What is a password? Why is it used? Describe the various types of password validation techniques as used in any computer system.

                                                           (4+6+8)

5. Consider a hypothetical computer system having the following CPU scheduling features**.**

It has gopt 3 (three) priority levels 1,2 & 3 with 1 being the highest and 3 being the lowest. It supports a multilevel preemptive scheduling policy having the features mentioned below:

Priority level	Allotted Time Quantum (in units)	% CPU time allotted

1	10	50%
2	15	30%
3	20	20%

Context switching time among jobs/processes having same priority = 2 units.
Context switching time from one priority level to another = 5 units.
Dispatcher execution time = 5 units (fixed)

Time Quantum allotted/job excludes the time taken by the dispatcher as well as the context switching time.
Jobs/Processes are services in a Round Robin fashion.

Before servicing the very first job, one needs to execute the dispatcher and perform a context switch i.e., no job can possess a zero waiting time.
If any job finishes well within its allotted time quantum the remaining part of that time quantum is not allotted to any other job rather a context switch takes place.

For the previously mentioned computer system having the aforesaid scheduling policy, the following job mix/processes is required to be serviced.

Process/Job	Service time (in units)	Priority	Arrival time (in units)
P_0	20	2	0
P_1	15	1	5
P_2	25	2	8
P_3	30	3	10
P_4	12	1	15
P_5	40	3	20
P_6	18	2	22
P_7	24	1	30

(a) Specify the queue status at each priority level.
(b) Specify the Gantt chart for the given job mix.
(c) From the Gantt chart compute the turnaround time as well as waiting time for eaxh process.

(5+10+3)

6. Consider the following specifications about the physical and virtual spaces as existing ina computer system.
   - Physical space = 64K words out of which 16K is occupied by the resident operating system. Remaining portion is available to accommodate user process.
   - Physical space is divided into 2K word size frames.
   - Virtual space for user 1 = 256K words.

- Virtual space for user 2 = 512K words.
- Both the users share a common 8K word Library, which is required at all time by both the users.

(a) Specify the address layout of the following, clearly highlighting each field:

      i.   Virtual address of user 1

      ii.   Virtual address for user 2

      iii.   Address of library

      iv.   Physical Address

(b) How many Page Map Table (PMT) entries will be needed for user 1, user 2 & Library? Clearly justify your answer.

(c) Specify in detail a typical PMT entry assuming the following features of each page.

- Each page has got an associated modify bit which helps to identify whether the corresponding frame has been written into and hence nedded to be written back to the virtual space during any page replacement.
- A use bit indicating whether the page has been accessed recently.
- Access permission bits signifying the following modes of access.

      i.   READ

      ii.   WRITE

      iii.   EXECUTE

(d) Assuming that the library needs to be present at all time in memory and the system has a TLB Cache that can contain maximum 16 entries, how many user pages can be referred from TLB? Justify your answer.

(8+2+5+3)

7.

(a)   State the necessary conditions for a deadlock to occur with examples.

(b)   Explain the Kernel Structure in UNIX. Discuss with examples the Directory entry attributes and Inode table Attributes in detail.

(c)   Consider the following process and resource map.

- The system has got 4 (four) concurrently non-shareable and reusable resources with following unit allocation/resource.

Resource	Units
R_0	8
R_1	5
R_2	9
R_3	7

- There are 5 (five) processes in the system P_0........P_4 having the following maximum resource requirements.

Process	R_0	R_1	R_2	R_3
P_0	3	2	1	4
P_1	0	2	5	2
P_2	5	1	0	5

P$_3$	1	5	3	0
P$_4$	3	0	3	3

Applying banker's algorithm, show that

i) The following is a safe Allocation State

Process	R0	R1	R2	R3
P$_0$	2	0	1	1
P$_1$	0	1	2	1
P$_2$	4	0	0	3
P$_3$	0	2	1	0
P$_4$	1	0	3	0

ii) The following is an unsafe Allocation State

Process	R0	R1	R2	R3
P$_0$	2	0	1	1
P$_1$	0	1	2	1
P$_2$	4	0	0	1
P$_3$	1	2	1	0
P$_4$	1	0	3	0

(5+5+8)

C0-R4.B3: DATA STRUCTURE THROUGH JAVA

Objective of the Course

The course emphasizes programming methodology, procedural abstraction, and in-depth study of algorithms, data structures, and data abstractions. It also aims to introduce basic data types, data structures, types of data structures - Linear and Non-Linear data structure, representation of stack, queue and linked list; complexity and efficiency of various types of sorting and searching techniques; applications of data structures

At the end of the course, the student will understand:
- Data Structure.
- Analysis techniques.
- Linear data Structure like array, stack, queue and linked list.
- Non-linear data structure like tree and graphs.
- Sorting and Searching methods

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction	04
2.	Introduction to Object Oriented Programming and Java	15
3.	Performance Analysis Techniques	05
4.	Elementary Data Structures	10
5.	Recursion	04
6.	Trees	04
7.	Graphs	04
8.	Strings	04
9.	Sorting and Searching Methods	10

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Introduction   **04 Hrs.**
Algorithms, Data Structures, Summation Formulas and properties, Sets, Relations, Functions, Graphs, Trees, Counting, Probability Concepts

2. Introduction to Object Oriented Programming and Java   **15 Hrs.**
Object-Oriented Design Principles, Encapsulation, Inheritance, Polymorphism, Basic goals and concepts of Java, Programming Skills, Xtreme Programming, debugging, testing, Application of OO concepts.

3. Performance Analysis Techniques   **05 Hrs.**
Space Complexity, Time Complexity, Running Time, Pseudo-Code, Quick Mathematical Review, Analysis of Algorithms, Asymptotic Notation, Asymptotic Analysis.

4. Elementary Data Structures **10 Hrs.**

Introduction of Stack, Queue and Linked List, Application of Stacks and Queue, Representation of Queue and its types, Representation of Linked List and its types, Priority Queue, Implementing Objects, Java Code for Linked List, Stack, Queue.

5. Recursion **04 Hrs.**

Characteristic of recursive Methods, Efficiency of Recursive methods, Tower of Hanoi Example, Java code for Tower of Hanoi, Eliminating Recursion, Applications of Recursion.

6. Trees **04 Hrs.**

The Tree Abstract Data Type, Basic Algorithms on Trees, Types of trees and algorithms, Binary Search Tree, Red Black Tree, B-Tree, AVL Trees, Java Code for Binary Search Tree, Red Black Tree, B- Tree and AVL Tree

7. Graphs **04 Hrs.**

The Graph Abstract Data Type, Data Structures for Graphs, Graph Traversal: BFS and DFS of Directed and Undirected Graph, Connected Components, Spanning Trees, Bi- connected Components and DFS. Java Code for DFS and BFS.

8. Strings **04 Hrs.**

The String Abstract Data Type, Brute-Force String Pattern Matching, Regular Expression Pattern Matching, Tries.

9. Sorting and Searching Methods **10 Hrs.**

Introduction to Sorting Techniques: Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Quick Sort, Merge Sort, Radix Sort, Analysis of Efficiency and Complexity of Sorting of various cases (Best, Average and Worst); implementation via Java programs.

RECOMMENDED BOOKS (*)

MAIN READING

1. Jean-Paul Tremblay and Paul G, "An Introduction to Data Structures with Applications", Sorenson Publisher – Tata McGraw Hill.
2. Wiley Higher Education, "Data Structures and Algorithms in Java", 3rd Edition, John Wiley & Sons.

SUPPLEMENTARY READING

1. Michael T. Goodrich and Robert Tamassia, "Data Structures and Algorithms in Java", John Wiley Publication
2. Robert Lafore, "Data Structures and Algorithms in Java", 2nd Edition, Pearson Education.

(*) Latest edition of the books need to be procured.

C0-R4.B3: DATA STRUCTURE THROUGH JAVA

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a) What is data structure? Why do we need data structure? Give classification of data structure.
b) What are the applications of linked list?
c) State Whether the given statement is True or False with Justification.
   It is impossible to implement recursion without using stack-like data structure.
d) Explain how 3-dimensional array is stored in memory?
e) Explain following terms:
   (a) isolated node
   (b) Complete binary tree
   (c) weighted graph
   (d) input restricted deque
f) Discuss the factors, which affect different sorting methods.
g) Explain threaded binary tree.

                                                                          (7X4)

2.
a) Write an algorithm for conversion of general tree into binary tree & trace with the following example.
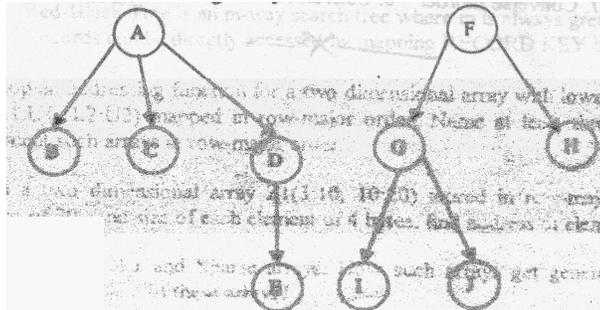
b) Explain how circular queue is advantageous as compared to simple queue? Write an algorithm to insert and delete an element in a circular queue.
c) What is algorithm analysis? Explain how it is done? Also explain Big-oh notation.

                                                                        (7+8+3)

3.
a) Perform DFS traversal of the following graph. Whenever the algorithm has a choice, assume that the node that comes earlier in the alphabet is considered first.
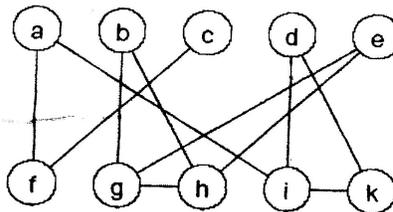
b) Write an algorithm for push and pop operation of stack.
c) Write a C program for following string operations:
1. In a given text T, replace all occurrences of pattern P1 by a pattern P2,i.e replace (T,P1,P2)
2. In a given text T, delete all occurrences of pattern P1,i.e (T,P)

(8+4+6)

4.
a) Construct an Expression tree for following data and write the inorder, pre order and post order of it.

i). a + b − c / d * e / f - g
b) What is Hashing? Explain mid-square hashing and division remainder hashing giving suitable example.
c) Describe sequential storage allocation and linked storage allocation. Compare them and give advantages and disadvantages of each.

(6+7+5)

5.
a) Explain Priority Queue.
b) Write a recursive and non-recursive program for finding factorial of a given number. Which one is better? Why?
c) Write a C program for linked list that performs following operations:
(a) Insert a node at the end of the linked list.
(b) Delete a node before specified position.
(c) Insert a node such that linked list is in ascending order (according to information field)

(4+5+9)

6.
a) Given input { 4371,1323,6173,4199,4344,9679,1989} and a hash function h(X)= X(mod 10), show the result:
1. Separate chaining hash table.
2. Open addressing hash table using linear probing.
3. Open addressing hash table using Quadratic probing.
4. Open addressing hash table with second hash function h2 (x)= 7-(Xmod-7)
b) Answer the following questions with reference to the given tree:
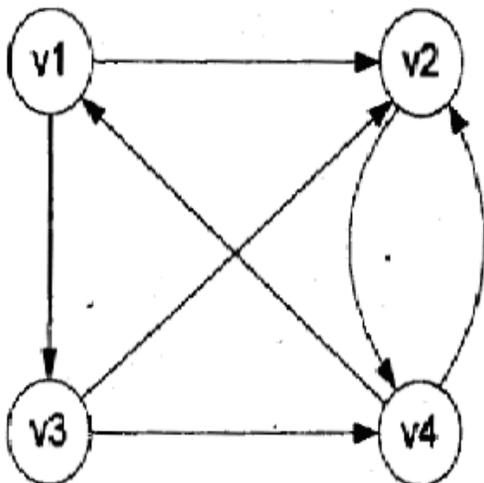
1. Write an adjacency matrix A for the graph.
2. Find A^2 from the adjacency matrix A.
3. What is the in degree, out degree and total degree of the v1 node?

c) Discuss the behavior of Quick Sort method depending upon initial order of data.

(7+6+5)

7.

a) Insert the following keys in an AVL tree and show the rotations, wherever required. A, V, L, T, R, E, I, S, O, K.

b) Write a program for searching an element using binary search method.

c) Write an algorithm for Radix sort method. Trace the algorithm on following data:
11, 60, 100, 20, 30, 50, 80, 75, 65. 55. 23, 32.

(9+5+4)

C0-R4.B4: COMPUTER SYSTEM ARCHITECTURE

Objective of the Course

This course aims to introduce basic and fundamental knowledge of computer architecture, bus organization, and memory organization.

At the end of the course, the student will understand:
- Assemble the computer.
- Develop the hardwired or micro-programmed ALU and CU.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction to Computer Arithmetic	08
2.	Register Transfer language	06
3.	Instruction Set Design	12
4.	Pipelining	06
5.	Programming the Basic Computer	06
6.	I/O Fundamentals	08
7.	Memory Organization	08
8.	Multiprocessor and Multiple Computers	06

Lectures	=	**60**	
Practical/Tutorials	=	**60**	
Total	=	**120**	

Detailed Syllabus

1. Introduction to Computer Arithmetic   08 Hrs.
Decimal Representation, Complements, Fixed point representation, Addition, Subtraction with Signed- magnitude, Signed 2's Complement method, Booth Multiplication Algorithm, Array Multiplier, Division Algorithm, hardware Implementation, Floating Point Arithmetic operations.

2. Register Transfer Language   06 Hrs.
Register Transfer, Bus and Memory transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic logic and shift

3. Instruction Set Design   12 Hrs.
Assembly/machine language, Von Neumann machine cycle, Microprogramming/firmware, Memory addressing, Classifying instruction set architectures, Computer Registers, General Registers Organization, Computer Instructions, Timing and control, Instruction Cycle, Memory Reference Instructions, Input-output and interrupt, Instruction Format, Addressing modes, Data transfer and manipulation, program Control, RISC and CISC.

4. Pipelining   06 Hrs.
General considerations, Comparison of pipelined and nonpipelined computers, Instruction and arithmetic pipelines – examples, Structural hazards and data dependencies, Branch delay and multicycle instructions, Superscalar computers.

5. Programming the Basic Computer   06 Hrs.

Introduction to Machine Language, Assembly language, Program loops, Programming arithmetic and logic operations, Subroutines, Input-output programming.

6. I/O Fundamentals   08 Hrs.
Typical I/O devices, Programmed I/O, Peripherals Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of transfer, Priority Interrupt, DMA, I/O Processor, CPU-IOP Communication, Serial Communication, Interrupts and DMA, I/O bus operation, TRAP instruction, Role of OS.

7. Memory Organization   08 Hrs.
Memory Hierarchy, Main memory, Auxiliary Memory, Associative memory, Cache memory, Virtual Memory, Memory management hardware, Case study of PC architecture and hardware, bias and interrupts, DMA control, Different types of bus, ISA, EISA.

8. Multiprocessor and Multiple Computers   06 Hrs.
SISD, SIMD and MIMD architectures, Centralized and distributed shared memory-architectures.

RECOMMENDED BOOKS (*)

MAIN READING

1. Morris Mano, "Computer System Architecture", Prentice Hall of India Edition.
2. Pal Chaudhary, " Computer Organization and Design", Prentice Hall of India

SUPPLEMENTARY READING

1. David A Patterson and John L Hennessy, "Computer Architecture: A Quantitative Approach" 4th edition, Morgan Kaufmnn Publishers
2. B Govindarajalu, "IBM PC and clones", Tata McGraw-Hill
3. P.V.S. Rao, "Perspective in Computer Architecture", Prentice Hall of India
4. M.R. Bhujade, "Digital Computer Design Principles", Prentice Hall of India
5. Cook and White, "Computer Peripherals", Edward Arnold

(*) Latest edition of the books need to be procured.

C0-R4.B4: COMPUTER SYSTEM ARCHITECTURE

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a)   What are the differences between RISC and CISC architecture?
b)   An 8-bit register contains the binary value 11010101. What is the register value after each operation of arithmetic shift left, arithmetic shift right, logical shift left and circular shift right?
c)   How many AND gates and address are required for the multiplication of b4, b3, b2, b1 (Multiplicand) and a4, a3, a2, a1 (Multiplicand) using array multiplier?
d)   What are the differences between Centralized and distributed shared memory architecture?
e)   What are the differences between serial communication and parallel communication?
f)   Define following terms
  1)   Micro-Operation
  2)   Three State Gate
  3)   Effective Address
  4)   Instruction Code
g)   What are the different types of Memory available? Write down advantages and disadvantages of all types of Memory.

(7x4)

2.
a)   What are essential features of associative memory? Explain how a memory address is mapped into cache memory address using set associative mapped cache. The main memory is 64K words. The cache has words with block size of 128 words.
b)   Hazard refers to the possibility of erroneous computation when a CPU tries to simultaneously execute multiple instructions. Give solution to solve data hazard in pipeline processor.
c)   Explain following Architecture and give example of each.
  1)   SISD
  2)   SIMD
  3)   MIMD

(6+6+6)

3.
a)   What is subroutine? How stack is useful in execution of the subroutine?
b)   DMA is used to transfer data between memory and I/O Device with interrupting CPU. Draw logical circuit diagram of DMA controller and explain working of it.
c)   Write an assemlbly program to multiply two unsigned positive numbers, each with 16 significant bits to produce unsigned double precision product.

(3+10+5)

4.
a)   List and explain different types of addressing modes used to design general purpose computer.
b)   Write an assembly program to subtract two double precision numbers.

(10+8)

5.

a)   Write a short note on Interrupt.

b)   Explain Instruction pipelining with suitable example.

c)   Write the basic computer instruction format. Describe memory reference instructions; register reference instructions and Input-Output Instructions.

(6+6+6)

6.

a)   Wire algorithm of Booth multiplication. Show step by step multiplication process of

Multiplier: 15

Multiplicand: 10

b)   Design the combinational circuit for common bus system for four bit register using multiplexer.

(10+8)

7.

a)   Draw hardwired implementation for signed magnitude addition and subtraction.

b)   An instruction cycle' is the sequence of actions that the <u>central processing unit</u> (CPU) performs to execute each <u>machine code</u> instruction in a program. Explain phases of execution of instruction.

c)   By taking suitable example, write different ways of presenting floating numbers.

(6+6+6)

C1-R4: ADVANCED COMPUTER GRAPHICS

Objective of the Course

Computer Graphics is becoming increasingly important for data visualization, video games, animated movies, image based rendering, flight simulators, CAD-CAM, reconstruction of 3D medical data from 2D slices, Terrain visualization in Geographical Information Systems, and a host of other simulation situations.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Basic Background	07
2.	3D Viewing	07
3.	Representing Curves and Surfaces	10
4.	Solid Modeling	06
5.	Visible Surface Determination	10
6.	Illumination models & Rendering	09
7.	Color Models	06
8.	Introduction to Animation	05

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Basic Background　　　　　　　　　　　　　　　　　　　　　　　　　**07 Hrs.**
Two Dimensional Geometric Transformations.
Clipping: Point clipping, Line clipping, Polygon clipping, Text clipping, Logical Classification of input devices, Different input modes, Interactive picture-construction techniques, Three Dimensional Geometric Transformations.

2 3D Viewing　　　　　　　　　　　　　　　　　　　　　　　　　　　　**07 Hrs.**
Viewing pipeline, Viewing coordinates, Parallel and Perspective Projections, View volumes and Projection transformations, Clipping.

3. Representing Curves and Surfaces　　　　　　　　　　　　　　　　**10 Hrs.**
Polygon Meshes: Representing polygon Meshes, Consistency of polygon-mesh representations, Plane equations.
Parametric Cubic Curves: Hermite curves, Bezier curves, Uniform nonrational B-splines, Subdividing Curves, Drawing curves, Comparison of the cubic curves, Parametric Bicubic surfaces.

4. Solid Modeling　　　　　　　　　　　　　　　　　　　　　　　　　　**06 Hrs.**
Representation of Solids, Primitive Instancing, Sweep representations, Boundary representations, Spatial-partitioning representations, Constructive solid geometry methods, Octrees, Binary, Space Partitioning trees.

5. Visual Surface Determination　　　　　　　　　　　　　　　　　　**10 Hrs.**

Introduction, Techniques for efficient visible-surface algorithms, Coherence, The Perspective Transformation, Extents and bounding volumes, Back-face culling, Algorithms for visible-line determination: Appel's Algorithm, Z-Buffer Algorithm, Depth-sort Algorithm, Binary Space Partitioning Trees, Representing 3D data using Octrees, Boolean Operations on Octrees, Visible Surface ray tracing.

6. Illumination Models and Surface-Rendering Methods   09 Hrs.
Basic Illumination models: Diffuse reflection, Specular reflection and Phong model, Warn model, Intensity attenuation, color considerations, Transparency, Shadows, Displaying light intensities, Halftone patterns and Dithering techniques, Polygon-rendering methods, Gouraud and Phong Shading, Ray Tracing methods, Problems with interpolated shading, Bump mapping.

7. Color Models   06 Hrs.
Properties of light, Intuitive color concepts, RGB color model, YIQ color model, CMY color model, HSV color model, Conversion between HSV and RGB models, HLS color model.

8. Introduction to Animation   05 Hrs.
Introduction, Methods of controlling Animation, basic rules of Animation, Problems peculiar to animation, Raster animations, Computer-Animation languages, Key-frame systems, Motion specifications.

RECOMMENDED BOOKS

MAIN READING

1. James D. Foley, Andries Van dam, Steven K. Feiner & John F. Hughes, "Computer Graphics – Principles and Practices", 2nd Edition in C, 2005
2. Donald Hearn and M Pauline Baker, "Computer Graphics", 2nd Edition, 2003, Prentice Hall of India.

SUPPLEMENTARY READING

1. Woo, Neider, Davis, Shreiner, "Open GL Programming Guide", 3rd edition, 2000, Pearson Education.
2. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata-McGraw Hill.
3. Zhigang Xiang and Roy Plastock, "Computer Graphics", 2nd Edition, 2002, Tata McGraw-Hill Edition.

(*) Latest edition of the books need to be procured.

C1-R4: ADVANCED COMPUTER GRAPHICS

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
 a) Distinguish between Gouraud and Phong's method of shading.
 b) How OpenGL can be used in implementation of graphics application
 c) Which are the applications of Computer Graphics? Explain in a brief.
 d) Explain Multimedia system and multimedia server.
 e) Explain true curve generation algorithm.
 f) Describe briefly ray tracing technique for rendering an object.
 g) What is morphing? How morphing can be implemented in computer graphics?

                                                               (7x4)

2.
 a) Write down the properties of Bezier curve.
 b) Compare RGB, HVS, and CMY color model.
 c) Explain z-buffer algorithm for hidden-surface removal.

                                                               (3+8+7)

3.
 a) What is parallel projection? Explain the types of parallel projection.

 b) Write a short note on 3D clipping.
 c) Derive the transformation matrix for scaling an object by a scaling factor s in a direction defined by the directional angles a, b and c.

                                                               (6+5+7)

4.
 a) Determine the Bezier blending functions for five control points. Plot each function and label the maximum and minimum values.
 b) Why a cubic form is chosen for representing curves?
 c) Explain the painter's algorithm for hidden surface removal. Why painter's algorithm is a priority algorithm?

                                                               (7+3+8)

5.
 a) Write a program to shear an object with respect to any of the three coordinate axes, using input values for the shearing parameters.
 b) What are the advantages in storing color codes in lookup table? Describe the content of color table.
 c) Determine the blending functions for uniform, periodic B-spline curves for $d = 6$.

                                                               (8+3+7)

6.
 a) Modify the two-dimensional Liang-Barsky line clipping algorithm to clip three-dimensional lines against a specified regular parallelepiped.
 b) Develop a procedure, based on a back-face detection technique, for identifying all the visible faces of a convex polyhedron that has different-colored surfaces. Assume that the object is defined in a right-handed viewing system with the xy-plane as the viewing surface.
 c) Design a storyboard layout and accompanying key frames for an animation of a single

polyhedron.

(5+8+5)

7.
a) Describe in brief the following viewing parameters. What role do they play in 3D viewing process?
    1. Video reference point
    2. Line of sight
    3. Clipping planes
b) Explain the following terms in brief:
    1. Specular reflection
    2. Diffused reflection
    3. Point-Source Illumination
c) Compare Bezier and B-spline functions for generating curves and discuss the properties of each.

(6+6+6)

C2-R4: ADVANCED COMPUTER NETWORKS

Objective of the Course

The course aims to impart knowledge about advanced techniques used in analysis, modeling, design and operation of modern computer networks. Internet has grown phenomenally over past several decades and has posed new challenges in view of new service demands. The course addresses the issues concerning the above.

The course builds on the basics covered in the introductory course on computer/data networks and provides in-depth understanding of topics of seminal and current interests. It allowed students to build sufficient expertise to design local and wide area network protocols and acquire skills to conduct R & D in computer networks.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Networking Concepts	06
2.	Performance Models	10
3.	Multiple Access Networks	06
4.	Cell Relay and Asynchronous Transfer Mode (ATM)	10
5.	IP Networks	07
6.	Multicast and Internetworking	07
7.	End-to-End Protocols	07
8.	Multimedia Networking	07

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Networking Concepts   06 Hrs.
Layered operation, Protocol Suites, Flow and Congestion Control, Multiplexing, Synchrinization.

2. Performance Models   10 Hrs.
Queuing Systems-M/M/S/K' Queues, Burke's Theorem, M/G/1 Queues, Delay in synchronous and asynchronous time-division multiplexing.

Network of Queues: Jackson's Theorem, Closed Queuing Networks.

3. Multiple Access Networks   06 Hrs.
Review of ALOHSs and CSMA, Stability in Slotted ALOHA-Pseudo Bayesian Algorithm, Splitting Algorithms – Tree and First Come First Serve FCFS Spitting.

4. Cell Relay and Asynchronous Transfer Mode(ATM)   10 Hrs.
ATM features, Protocol Architecture, Virtual Channel and Virtual Paths, ATM Cells – Structure at UNI and NNI, Generic Flow Control, Header Error Control, ATM Services – CBR,VBR,UBR,ABR. ATM Adaptation Layers-AAL1, AAL2, AAL3/4, AAL5. ATM Traffic Control: Connection Admission Control (CAC), Usage Parameter Control (UPC)-Virtual Scheduling Algorithm, Continuous State Leaky Bucket Algorithm. Traffic Shaping.

5. IP Networks   07 Hrs.

Limitations of current IP Networks, Internet Protocol Version 6 (IPv6) features, IPv6 Extension Header, Quality of Service in IP: Integrated Services Architecture (ISA), Processor Sharing, Weighted Fair Queuing (WFQ), Random Early detection (RED), Differentiated Services.

6. Multicast and Internetworking   07 Hrs.

The Multicast Backbone (MBONE), Link State Multicast, Distance Vector Multicast, Reverse Path Broadcast, Reverse Path Multicast (RPM), Protocol Independent Multicast (PIM), Multiprotocol Label switching (MPLS)-Destination Based Forwarding, Explicit Routing, Virtual Private Networks (VPNs) and Tunnels.

7. End-to-End Protocols   07 Hrs.

Transmission Control Protocol (TCP) and User Datagram Protocol (UDP), TCP Connection Establishment, TCP Flow Control, TCP Congestion Control – Jacobson's and Karn's Algorithms, Window Management. TCP Extensions. Remote Procedure Call (RPC). Bulk Transfer (BLAST)

8. Multimedia Networking   07 Hrs.

Requirements on Internet. Streaming Audio and Video – Access through Web Server, Real-Time Streaming Protocol (RTSP). Voice over IP (VoIP) and Internet Phone-Packet Loss, End-to-End Delay, Delay Jitter, Fixed and Adaptive Play-out, RTP, RTCP and SIP protocols

RECOMMENDED BOOKS

MAIN READING

1. Bertsekas and Gallager, "Data Networks". 2nd Ed., Prectice Hall India.
2. Stallings, "High-Speed Networks and Internet", 2nd Ed., Pearson Education.
3. Peterson and Davie,"Computer Networks-A Systems Approach", 3rd Ed., Elsevier (India)
4. Kurose and Ross, "Computer Networking", 3rd Ed., Pearson Education.

SUPPLEMENTARY READING

1. Robertazzi, "Computer Networks and Systems", 3rd Ed., Springer (India)
2. Tanenbaum, "Computer Networks", 4th Ed., Prentice-Hall India
3. Huber, Handel and Schroder, "ATM Networks – Concepts, Protocols, Applications", 3rd Ed., Pearson Education.

(*) Latest edition of the books need to be procured.

C2-R4: ADVANCED COMPUTER NETWORKS

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a)   Give the differences between TDMA and CDMA.
b)   What are issues of Packet-Delay in Voice over IP?
c)   What are the Limitations of Traditional Fixed Capacity Networks?
d)   Explain concepts of Cards and Decks in designing of programs in WAP.
e)   What are the applications of wireless subscriber loop?
f)   How EDGE technology is emerged from GSM?
g)   What are the applications of Mobile IP?

                                                                        (7 X 4)

2.
a)   Wireless Application Protocol is an open international standard for application-layer network communications in a wireless-communication environment. What are the protocol elements of WAP?
b)   What are the technical features of GSM?
c)   In Mobile IP, when any mobile host moves from one region to another region deregistration and registration process occurs. Explain the registration process and role played by each entity in Mobile IP.

                                                                        (6+6+6)

3.
a)   Write a short note on: Various Configuration models of Voice over IP.
b)   Remote procedure call (RPC) is an Inter-process communication technology that allows a computer program to cause a subroutine or procedure to execute in another computer. Explain mechanism of RPC.

                                                                        (10+8)

4.
a)   What are IPv4 and TCP performance issues? And also write Limitations of current generation TCP and IPv4.
b)   What are the features of Ipv6 as compared to IPv4?
c)   Explain Following Terms:
      1) In band Congestion Method
      2) Congestion Control
      3) Flow Control
      4) Throughput

                                                                        (5+5+8)

5.
a)   Describe various Types of AALS.
b)   What are the radio propagation issues to implement Mobile IP?
c)   Explain functions of following entities
      1) Home Agent
      2) Foreign Agent
      3) Mobile Agent

                                                                        (5+4+9)

6.
a) How multicasting differs from unicasting and broadcasting?
b) IPv6 is a new version of IP which is designed to be an evolutionary step from IPv4. What are the changes required in ICMP and DNS to support IPv6 protocol.
c) MPLS makes it easy to create "virtual links" between distant nodes. How virtual links are made and maintained in MPLS?

(3+7+8)

7.
a) What are the two types of ATM cell format and explain functions of each field of cell format.
b) What are the challenges of MBONE routing?
c) Why there is need for Mobile IP? What are the design issues for developing Mobile IP concept?

(8+6+4)

C3-R4: MATHEMATICAL METHODS FOR COMPUTING

Objective of the Course

The aim of the course is to provide grounding in analytical frameworks and tools which are becoming increasingly important and useful in research and development in the area of computer science. Probabilistic approaches and optimization methods are required to analyze problems in almost all areas. viz Mobile/wireless network, analysis of algorithms, AI, Image processing, Machine learning ,communication network etc. Thus, knowledge of these techniques has become necessary for design and analysis of computational models of these systems. The first part of course provides a comprehensive foundation of the theory of probability and information theory and stochastic processes. The second part deals with optimization methods for solving various real life problems. This course will thus equip students with analytical approaches required to pursue research in emerging areas of computer science.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Probability and Information Theory	12
2.	Stochastic Processes	12
3.	Queueing Theory and Performance Evaluation	12
4.	Optimization	14
5.	Laplace and Fourier Transforms	10

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Probability and Information theory   12 Hrs.

Axioms and Probability, Bayes' Formula, Expectations of Random Variables, Jointly Distributed Random Variables, Conditional Expectation, Bivariate and multivariate Gaussian distribution, some applications- A list model, A random graph. Limit theorems, random number Generation, Simulating continuous random variables, Monte Carlo integration.
Information theory, Measure of uncertainty, Shannon's Measure, Entropy, Joint and Conditional Entropies, Mutual Information , Kullback-Leibler Directed Divergence, Coding theory and Entropy.

2. Stochastic Processes   12 Hrs.
Stochastic Processes and specifications, Stationary Processes, Markov Chains, Markov processes, Poisson Process, Renewal process, Birth and date Process, Random Walk, Brownian motion.

3. Queuing Theory and Performance Evaluation   12 Hrs.
The M/M/1 Queueing System, State dependent M/M/1 Queueing System, M/M/1/N : Finite buffer case, M/M/∞ Queueing system: Infinite number of servers, The M/G/1 Queueing system, Network of Queues, Open networks and Closed networks.

4. Optimization   **14 Hrs.**

Modeling with linear programming, Simplex Method, Dual Problem, Integer Linear programming [Branch and bound algorithm], Deterministic dynamic programming [forward and backward recursions], Introduction to nonlinear programming Karush-Kuhn-Tucker (KKT) condition.

5. Laplace and Fourier Transforms   **10 Hrs.**

Laplace transform, Inverse transform, Linearity, Shifting, Transforms of Derivatives and Integrals, Differential Equations, Convolution and Integral equations.

Fourier series, Integrals, and Transforms: Periodic Functions, Trigonometric Series, Fourier series, Forced Oscillations, Fourier transforms.

RECOMMENDED BOOKS

MAIN READING

1. K.S.Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", 2nd Edition, John Wiley, 2008.
2. E.K.P.Chong and S.H.Zak, "An Introduction to Optimization", 3rd Edition, 2008, John Wiley.
3. S.Ross, "A First Course in Probability", 6th Edition, Pearson, 2010.
4. E.Kreyszig, "Advanced Engineering Mathematics," 10th Edition, 2011, Wiley

SUPPLEMENTARY READING

1. T.G.Robertazzi, "Computer Networks and systems:Queueing Theory and performance Evaluation", 3rd Edition, Springer, 2002
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Alpha Science International, 2007.
3. J.C.A Van der Lubbe, "Information Theory", Cambridge, 1997.
4. H.A.Taha, "Operations Research:An Introduction", 8th Edition, Pearson Education, 2006..

(*) Latest edition of the books need to be procured.

C3-R4: MATHEMATICAL METHODS FOR COMPUTING

Model Question Paper

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.

a) An infinite sequence of independent trails is to be performed. Each trial results in a success with probability p and a failure with probability 1-p. What is the probability that
   i.   At least one success occurs in the first n trials;
   ii. Exactly k success occur in the first n trials;
   iii. All trials result in success.

b) The joint density function of X and Y is given by

$$f(x, y) = \begin{cases} 2e^{-x}e^{-2y} & 0 < x < \infty, 0 < y < \infty \\ 0 & \text{otherwise} \end{cases}$$

Compute (i)P(X<Y)   (ii)P(X<a)

c) For an M/M/1/N queuing system, calculate the blocking probability when N=5 and $\lambda/\mu=1$

d) The transition probability matrix of a four-state Markov Chain is

$$P = \begin{bmatrix} 0.7 & 0 & 0.3 & 0 \\ 0.5 & 0 & 0.5 & 0 \\ 0 & 0.4 & 0 & 0.6 \\ 0 & 0.2 & 0 & 0.8 \end{bmatrix}$$

Obtain two-step transistion probability matrix.

e) Consider the following optimization probability

   maximize $x_2 - x_1$

   subject to $3x_1 = x_2 - 5$

   $|x_2| \le 2$

   $x_1 \le 0$

Convert the problem into a standard form linear programming problem.

f) Show that the relative error in Hit or Miss Monte Carlo methods is $O(n^{-1/2})$

g) If X can taken on any of n possible values with respective probabilities P1, P2, Pn; prove that the entropy H(X) is maximized when pi=1/n, i=1,2,3…….n. What is H(X) equal to in this case?

(7x4)

2.

a) In the open queuing network, the routing probability are shown on the diagram. Obtain throughputs φ_1 and φ_2. Calculate the joint probability distribution of numbers in the queuing system.
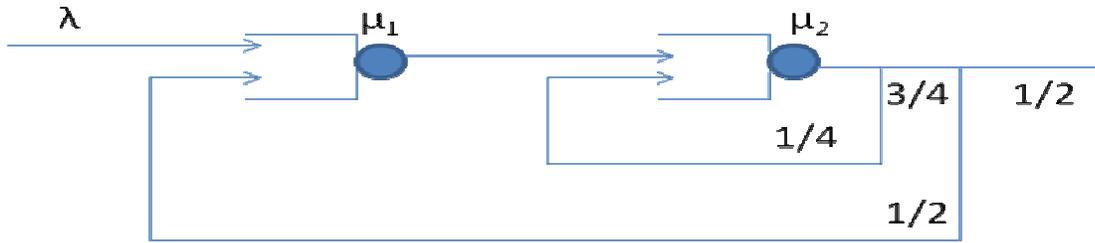
b) Is the following table realizable for a finite buffer state-independent M/M/1 system? Why or why not?

n	P(n)
0	0.4
1	0.3
2	0.2
3	0.1
≥ 4	0.0

(9+9)

3.

a) Two experiments, X and Y, are given. The sample space with regard to X consists of x_1, x_2 and x_3, that of Y consists of y_1, y_2 and y_3. Then joint probabilities $r(x_i, y_j) = r_{ij}$ are given in the following matrix R:

$$P\{X_1 = 1 | X_0 = 2\}, P\{X_2 = 2 | X_1 = 1\}, P\{X_2 = 2, X_1 = 1 | X_0 = 2\}$$

$$P\{X_2 = 2, X_1 = 1, X_0 = 2\}, P\{X_3 = 1, X_2 = 2, X_1 = 1, X_0 = 2\}$$

i. How much information do you receive if someone tells you the outcome resulting from X and Y?
ii. How much information do you receive if someone tells you the outcome of Y?
iii. How much information do you receive if someone tells you the outcome of X, while you already knew outcome of Y?

b) Verify that the relationship

$$H(P_1, P_2, P_3, ..., P_N) = H(P_1 + P_2, P_3, ..., P_N) + (P_1 + P_2)H\left(\frac{P_1}{P_1 + P_2}, \frac{P_2}{P_1 + P_2}\right)$$

Is satisfied by the entropy function for a random variable with three possible outcomes, H(P1,P2,P3).

c) Is the following code uniquely decipherable?

x_1 010 x_3 0110 x_5 0011 x_7 11110

x_2 0001 x_4 1100 x_6 00110 x_8 101011

If not, construct an ambiguous sequence.

(6+6+6)

4.

a) Consider the process $X(t) = A\cos\omega t + B\sin\omega t$

where A and B are uncorrelated random variables each with mean 0 and variance 1 and ω is a positive constant. Is the process a covariance stationary?

b) Let $\{X_n, n \geq 0\}$ be a Markov chain with three states 0, 1, 2 and with transition matrix

$$\begin{pmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{pmatrix}$$

and the initial distribution P{X₀=i}=1/3, i=0,1 ,2.
Obtain

$$P\{X_1 = 1 | X_0 = 2\}, \ P\{X_2 = 2 | X_1 = 1\}, \ P\{X_2 = 2, X_1 = 1 | X_0 = 2\}$$

$$P\{X_2{=}2, X_1{=}1, X_0{=}2\}, \ P\{X_3{=}1, X_2{=}2, X_1{=}1, X_0{=}2\}$$

(9+9)

5.

a) Find the Fourier transform of

$$f(x) = \begin{cases} k & if \ 0 < x < a \\ 0 & otherwise \end{cases}$$

b) Solve the integral equation

$$y(t) = t + \int_0^t y(\tau)\sin(t-\tau)\,d\tau$$

(9+9)

6.

a) Let X be uniformly distributed an (0.1). Show that $Y = -\lambda^{-1}\ln(1-x)$ has an exponential distribution with parameter $\lambda > 0$.

b) The joint density of X and Y is given by

$$f(x, y) = \begin{cases} e^{-(x+y)} & if \ 0 < x < \infty, \ 0 < y < \infty \\ 0 & otherwise \end{cases}$$

Find the density of the random variable X/Y.

c) Present a method to simulate a random variable having distribution function

$$f(x, y) = \begin{cases} 0 & x \leq -3 \\ \dfrac{1}{2} + \dfrac{x}{6} & -3 < x < 0 \\ \dfrac{1}{2} + \dfrac{x^2}{32} & 0 < x \leq 4 \\ 1 & x > 4 \end{cases}$$

(6+6+6)

7.

a) Consider the problem:

$$\text{Minimize } z = x_1^2 + x_2^2 + x_3^2$$

subject to

$$4x_1 + 2x_2^2 + 2x_3 - 14 = 0$$

b) Consider the following minimization problem:

$$\text{Minimize } f(x) = x_1^2 + x_2^2 + x_3^2$$

subject to

$$g_1(X) = 2x_1 + x_2 - 5 \le 0$$
$$g_2(X) = x_1 + x_3 - 2 \le 0$$
$$g_3(X) = 1 - x_1 \le 0$$
$$g_4(X) = 2 - x_2 \le 0$$
$$g_5(X) = -x_3 \le 0$$

Obtain Kuhn-Tucker Conditions.

(9+9)

C4-R4:ADVANCED ALGORITHMS

Objective of the Course

This course aims to introduce theoretical analysis of various types of algorithms, Design of efficient algorithms for a variety of problems, with mathematical proof of correctness and analysis of time and space requirements, Create data structure and algorithms to solve the problem, Prove algorithm's work and examine the properties of algorithms like simplicity, running time, space, to check the efficiency as a function of its input size, how long does it take? Space efficiency as a function of its input size, to review mathematical background, to check how parallel algorithms work, to study various techniques like dynamic, randomization etc, to prove algorithm's correctness, to determine its resource usage, topics include lower bounds for sorting and medians, analysis of advanced data structures, graph algorithms (strongly connected components, shortest paths, minimum spanning trees, maximum flows and bipartite matching), and NP-Completeness.

At the end of the course the student will understand
- The methods of analyzing various types of algorithms.
- Efficiency of algorithms as a function of its input size in terms of both time and memory.
- Properties of algorithms
- Effective and efficient exploration of advanced data structures to be used in algorithms.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction	06
2.	Greedy Algorithms	06
3.	Divide & Conquer Algorithms	06
4.	Dynamic Programming Algorithms	06
5.	Amortized Analysis	04
6.	Graph Algorithms	08
7.	String Matching	06
8.	Sorting	06
9.	Computational Complexity	06
10.	Approximate Algorithms	06

Lectures	=	60	
Practical/Tutorials	=	60	
Total	=	120	

Detailed Syllabus

1. Introduction   06 Hrs.
Mathematics for Algorithmic, Sets , Functions and Relations, Vectors and Matrices , Linear Inequalities and Linear Equations, Review of basic concepts; Worst case and average case analysis: big oh; small oh, omega and theta notations, Solving recurrence equations.

2. Greedy Algorithms   06 Hrs.
Knapsack Problem , O-I Knapsack , Fractional Knapsack , Activity Selection Problem , Huffman's Codes , Minimum Spanning Tree , Kruskal's Algorithm , Prim's Algorithm , Dijkstra's Algorithm.

3. Divide & Conquer Algorithms   06 Hrs.
Multiplying large integers, Binary Search, Finding Median, Quick Sort and Matrix Multiplication.

4. Dynamic Programming Algorithms   06 Hrs.
Making Change, Principle of optimality, Knapsack Problem, Shorthest Path, Matrix Chain Multiplication, Activity Selection Problem DP Solution.

5. Amortized Analysis   04 Hrs.
Aggregate Method, Accounting Method, Potential Method, Dynamic Table.

6. Graph Algorithms   08 Hrs.
Breadth First Search (BFS), Depth First Search (DFS), Branch and Bound, Topological Sort, Strongly Connected Components, Euler Tour, Generic Minimum Spanning Tree, Bellman-Ford Algorithm, Matching, Incremental Design, Closest pair problem.

7. String Matching   06 Hrs.
Naïve String Matching, Knuth-Morris-Pratt Algorithm, Boyer-Moore Algorithm, Applications in Bioinformatics.

8. Sorting   06 Hrs.
Bubble Sort, Insertion Sort, Selection Sort, Shell Sort, faster Methods-Tree, Heap Sort, Merge Sort, Quick Sort, Linear-Timer Sorting-Counting (Enumeration) Sort, Radix Sort, Bucket Sort.

9. Computational Complexity   06 Hrs.
Information-Theoretic Argument, Adversary Argument, P and NP, NP-Completeness and Reduction, Primality tests, Quadratic residues, Applications to cryptography, Lower bound theory, Information theoretic bounds, Adversary arguments and NP completeness.

10. Approximate Algorithms   06 Hrs.
Vertex Cover, The Traveling Salesman Problem, Approximate algorithms, Scheduling problems, Set cover problem, Bin packing problem, Polynomial time approximate schemes, basics of parallel algorithms, Flynn's classification, SIMD algorithms for simple problems, List ranking, Basics of randomized algorithms, GCD algorithm.

RECOMMENDED BOOKS (*)

MAIN READING

1. T H Corman et al, "Introduction to Algorithms", Pearson Education, 2001.
2. Aho, Hopcroft, Ullman, "The Design and analysis of computer algorithms", Pearson Education.

SUPPLEMENTARY READING

1. M T Goodrich, R Tamassia, "Algorithm Design- Foundations, Analysis & internet Examples", John Wiley & Sons, 2002.
2. Gilles Brassard and Paul Bratley, "Fundamentals of Algorithms", Prentice Hall India, 2004.

(*) Latest edition of the books need to be procured.

C4-R4: ADVANCED ALGORITHMS

Model Question Paper

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a)   Define Time Complexity of an algorithm. What is the time-complexity of tractable problem?
b)   What is the main advantage of backtracking? How do we achieve this?
c)   Is a recursive algorithm less efficient compared to an iterative one? Why or why not?
d)   Give an example where the choice of data structure has a bearing on the performance of the algorithm.
e)   What are the possible causes if a program hangs up, aborts, terminates without proper output, and produces the garbage? What is your action?
f)   Give the worst-case no. of moves required to solve Tower of Hanoi problem using recursion for given n rings and three rods.
g)   Give the worst-case Time complexity of finding if there exist a cycle in the directed graph of n nodes and edges.

(7x4)

2.
a)   Design an efficient algorithm to decide whether a given undirected graph G(V,E) contains a cycle of length L.
b)   What do you mean by backtracking? How it differs from Branch & Bound?
c)   What is amortized analysis? Give the usefulness of it. Give the various types of it using examples.
d)   What is the major difference between dynamic programming and greedy strategies?

(6+4+4+4)

3.
a)   Is dynamic programming a Top-Down or a Bottom-Up technique? Why? Explain with an example.
b)   Develop an algorithm and a recursive function to calculate the GCD of two integers a and b.
c)   Can we say that Divide and Conquer strategy is inherently recursive? Why?

(6+8+4)

4.
a)   Give the Kruskal's algorithm for Minimum Spanning Tree and compare it with Prim's algorithm.
b)   Is there any NP hard problem, which is also NP? If yes give example. If no why?
c)   Write the nondeterministic algorithm to solve knapsack problem.
d)   Give an algorithm to find the longest monotonically increasing subsequence of a sequence of n number? Give the worst case Time complexity.

(5+5+4+4)

5.
a)   If a problem can be split using Divide and Conquer strategy in almost equal portions at each stage, then it is a good candidate for recursive implementation, but if it cannot be

so divided in equal portions, then it is better to be implemented iteratively. Can we have a general statement like this? Explain with example.
b) Explain how N-Queen problem can be solved using backtracking.
c) Construct the recurrence for finding the nth Fibonacci number and solve it.
d) What are the issues that govern or influence the choice of either adjacency matrix or a adjacency list for storage of graphs?

(5+3+3+7)

6.
a) There is method known for calculating n! with time complexity of $n \log_2 n$. Can we use that method for solving Traveling Salesman Problem with the same time-complexity instead of n! Explain.
b) Given a finite set of distinct coin types, say 50, 20, 10,5,2,1 pcs, and an integer amount C. Each type is available in unlimited quantity. Write an algorithm to find the exact change with minimum no. of coins. What strategy will you use?
c) Write down the parenthesized equation and number of multiplications required to get Z so that multiplication in this way cost least number of multiplication.
A = 9×7; B = 7×10; C = 10×6; D = 6×15: E = 15×9

(6+6+6)

7.
a) Give names of all sorting algorithms you know of which use the Divide and Conquer strategy? Can you name any sorting algorithm that uses Greedy Strategy?
b) Differentiate between Greedy, Dynamic Programming and Divide and Conquer Problem.
c) What do you mean by polynomial time complexity and logarithmic complexity? Which one is higher?

(6+8+4)

C5-R4:DATA WAREHOUSEING AND MINING

Objective of the Course

Data warehousing and data mining are the essential components of decision support systems for the modern day industry and business. These techniques enable the knowledge worker (analysis, manager, executive) to make better and faster decisions. The objective of this course is to introduce the student to various Data Warehousing and Data Mining concepts and Techniques. A database perspective has to be used throughout the course to introduce principles, algorithm, architecture, design and implementation of data mining and data warehousing techniques.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction and Background	03
2.	Data Preprocessing	08
3.	Data Warehousing and OLAP Technology	08
4.	Data Cube computation and Data Generalization	08
5.	Mining frequent patterns, associations and correlations	08
6.	Classifications and Predictions	08
7.	Cluster Analysis	08
8.	Mining streams Time series and sequence data	06
9.	Applications of Data Warehousing and Data Mining	03

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Introduction and Background   **03 Hrs.**
An introduction to multidisciplinary filed of data mining, Discussion on the evolutionary path of database technology that has led to the need for data warehousing and data mining, different kind of data on which data mining applied, classification of data mining system, Major issues in Data miming, Stress on important of its application potential.

2. Data Pre-processing   **08 Hrs.**
Why preprocess the data?, descriptive data summarization, .Data cleaning, data integration and transformation, data reduction, and data discretization and concept hierarchy generation

3. Data warehousing and OLAP Technology   **08 Hrs.**
Data warehouse, multi dimensional model, Data Warehouse Architecture and implementation, OLAP overview and OLAP operators, Data cube constructions.

4. Data Cube Computation and Data Generalization   **08 Hrs.**
Efficient methods for data cube computation – A road map for materialization of different kinds of cube, multi way array aggregation for full cube computation, Computing iceberg queries from

apex cuboids, star cubing, pre-computing shell fragments for fast high dimensional OLAP and computing cubes with complex iceberg conditions

Data Generalization and Summarization based characterization: Attribute Oriented Induction (AOI) – Efficient implementation of AOI, Analytical Characterization, Mining class comparison: Discriminating between Different classes, Mining Descriptive Measures in Large database.

5. Mining frequent Patterns, Associations and Correlations   08 Hrs.
Basic concepts and a road map for Association rule mining, efficient and scalable frequent itemset mining methods, mining various kinds of association rules, from association mining to correlation analysisi, constraint based association rule mining.

6. Classification and Predictions   08 Hrs.
Issues regarding classification and predication, Different classification methods including Decision tree induction – Bayesian Classification, Neural network technology, K- Nearest Neighbor Classifier- Case-based Reasoning - Fuzzy set theory - genetic algorithm, Prediction: Linear and Multiple Regression – Nonlinear Regression – Other Regression Models, Classifier Accuracy. Prediction, accuracy and error measures evaluating accuracy of a classifier , model selection

7. Cluster Analysis   08 Hrs.
Types of data in cluster analysis, Partition based Clustering, Hierarchical Clustering, Density based Clustering, Grid based Clustering, Model based Clustering, Discussion on scalability of clustering algorithm, Outlier analysis, Parallel approaches to clustering and outlier analysis

8. Mining Stream, Time Series and Sequence Data   06 Hrs.
Mining data streams, mining time-series data, mining sequence patterns in transactional databases and mining sequence patterns in biological data

9. Application of Data Warehousing and Data Mining   03 Hrs.
Exploration of web sites on data warehousing and data mining application including bibliography databases, Corporate Houses and Research labs.
Use of data mining packages and data warehousing packages, e.g. SAS, IBM, excel miner tools.

RECOMMENDED BOOKS (*)

MAIN READING

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", second edition, 2006.
2. Margaret Dunham, "Data Mining: Introductory and Advanced Topics", Prentice Hall India
3. Arun K Pujari, "Data Mining Techniques", Orient Longman Publishers

SUPPLEMENTARY READING

1. Tom Mitchell, "Machine Learning", Tata McGraw-Hill.
2. S.M. Weiss and N Indurkhya, "Predictive Data Mining", Morgan Kaufmann Publishers
3. M.Jarke, M Lenzerni and Y Vassiliou and P.Vassiladis, "Fundamentals of Data Warehouses", Springer-Verlag New York, 1st edition, 2000

(*) Latest edition of the books need to be procured.

C5-R4: DATA WAREHOUSING AND DATA MINING

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a)   Elaborate the major operating components, which are regularly monitored in data warehouse environment. What are the major features that differentiate OLTP from OLAP?

b)   What are cuboids? Use example to illustrate its use in data warehouse implementation. Briefly explain drill-up and drill–down Analysis.

c)   From the architecture point of view what are the three data warehouse models?

d)   Briefly describe any two methods to generate concept hierarchy.

e)   Explain the difference between Star schema and Fact constellation schema in terms of their usage.

f)   Give the significance and relationship between the terms - Associative Rule, support, and confidence in data mining.

g)   For what purpose Data Cube Aggregation and Dimensionality Reduction strategies are used.

(7x4)

2.
a)   Define data cleaning. Explain the basic methods for data cleaning.

b)   What is a data cube? The weather bureau has about 10,000 probes which are scattered throughout various land and sea locations across the country to collect data such as air pressure and temperature at each hour. All the data have to be stored at a central office of the bureau. Give a 4-D view clearly mentioning the dimensions of the data collected at the central office.

c)   Define a data warehouse elaborating its key features. How do the organizations benefit from it?

d)   What is a data cube measure? List the categories of measures based on the kind of aggregate functions used in computing a data cube.

(6+4+4+4)

3.
a)   For a company x, min_sup=10%,min_conf is 75% ,while for another company y min_sup is 20% & min_conf is 60% ,for which of the two companies ,the rule a => b is more strong? Why?

b)   Outline major ideas of naive Bayesian classification.

c)   Briefly explain the criteria to compare any two classification methods.

(10+4+4)

4.
a)   What should be the similarity measure in cluster analysis? Why is scaling important for clustering?

a)   Briefly describe the three problems with naturally evolving architecture.

b)   Can a quantitative characterization rule and a quantitative discriminant rule be expressed together in the form of the rule? Justify.

d)   Define k-itemset. Explain the **join** and **prune** steps and the terminating condition of Apriori algorithm.

5.
a) List out requirement of clustering in data mining.
b) Briefly describe each type of CH with example.
c) Explain the algorithm for inducing a decision tree from training samples. Why is tree pruning useful in decision tree induction?
d) Where Attribute Relevance Analysis is used? How does the information gain calculation works? How entropy based method is related to it? Explain in detail.

(4+3+6+5)

6.
a) Consider the following data.

	B	~B
A	200	45
~A	50	150

Find correlation between A and B.
b) Give an example of how specific clustering method may be integrated with the other concepts in data mining.
c) Differentiate: precision & sensitivity.

(6+6+6)

7.
a) Differentiate between supervised & unsupervised learning. How can the accuracy of the classifiers be increased?
b) Write down the steps of AOI. Write down two common approaches to control generalization process.
c) What is MLP? How does MLP work? What are the parameters required to set for this?

(6+6+6)

LAB I: GRAPHICS AND VISUALISATION

Sample Practical List

1. Display/Draw bar Chart to indicate the population of the different states of India.

2. Display/Draw the following face unfilled and filled, using line drawing and circle drawing functions.
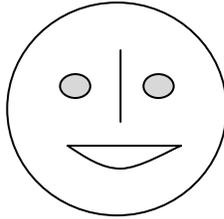
3. Display/Draw the following picture unfilled and filled, using line drawing and circle drawing functions.
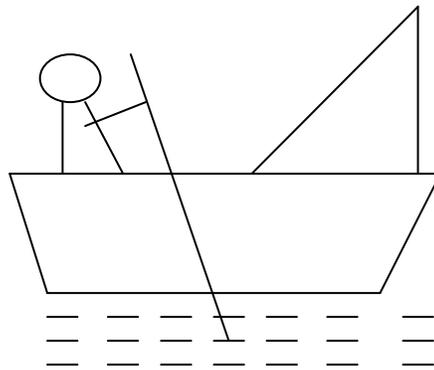
4. To create Bezier curves using four control points. The program should run for ten different sets of control points.

5. To clip a polygon using Sutherland-Hodgeman Algorithm.

6. To perform one point perspective projection of a cube, with origin as one of the corner points, onto the Z=0 plane with centre of projection on +ve Z axis.

7. To generate Coon's Bicubic Surface.

8. To implement Z-Buffer algorithm for handling visible surface problem.

9. To map any set of RGB values into corresponding HSV values and conversely.

Note: *These are suggested Assignments. Teachers may use these assignments as reference guide. Teachers are encouraged to innovate keeping in view with the current technologies.*

LAB II: DATA NETWORK AND MANAGEMENT

Sample Practical List

1. Create a computer for studying M/M/K queues using the following steps.
  (a) Write a program to simulate poisson arrivals.
  (b) Write a program to generate packets with their lengths distributed exponentially.
  (c) Write a program for computing total average queue length, waiting delay and total average delay for traffic intensities in the range of 0.1 to 0.9 using 1,2 and 3 servers. Display the characteristics in all the above cases.

2. Write a program to simulate.
  (a) Simplex stop-and-wait protocol at data link layer when the channel is error-free.
  (b) Repeat (a) when the channel is error prone (choose an appropriate probability of error in transmission of a bit.
  (c) Repeat (a) when the channel is a satellite link (delay of the order of 250 ms).
  (d) Modify the program to implement 3-bit and 7-bit sliding window protocols for ©, and compare results with (c).

3. Simulate continuous-state leaky bucket algorithm for ATM traffic. Vary the input traffic rate nominally (say +(-) 10%) to create traffic bursts and then check conformance and obtain sustainable cell rate.

4. Simulate pure and slotted Aloha protocols for per packet time load ranging from 0 to 5. Simulation should show load-throughput and delay-throughput characteristics.   Use poisson distributed input and geometrically distributed retransmission probability.

5. Take an 8-port hub and connect 8 computers. Input standard Ethernet traffic and measure the throughput for a large range of input load.

6. Simulate standard IEEE 802.5 token ring protocol showing all the events. It should display throughput, delay and priority operations.

7. Simulate the following scenario.
  Create a mesh network of six or more nodes which are not fully connected.   The link capacities (cost) should be variable.   Then implement shortest cost routing for each node pair. Now input the traffic using poisson arrivals with exponentially distributed service time. Output of the simulator should show delay per link and overall average delay per packet for varying input traffic and varying per packet service time.

8. Implement subnet masking on an emulated IP network by using the IP addressing scheme. Also implement IP packet fragmentation and show its effect on the network performance.

9. Study the operation of interconnecting devices viz. repeater, hub, router and gateway.

10. Write a program to simulate a transport protocol. It should include the following events.
(a) Opening and closing of transport connections including 3-way handshake.
(b) Dynamic buffer management using credit mechanism.
(c) Should be able to demonstrate deadlock condition.

11. Using slow start algorithm in TCP write a program to show its congestion avoidance behaviour. Vary RTT over wide range and use Jacobson's algorithm to improve the performance.

12. Capture a voice segment and then carry out data compression. Input the compressed data in a simulator for voice over IP (VOIP). The VOIP simulator should be created to generate small packets from voice segments, varying queuing and transmission delays for each packet in the IP network (total delay in the range of 120-200 ms) and up to 5% random packet loss. At the receiver, reassemble IP packets and apply decompression and play out the voice segment. Compare it with the original voice segment. Also study the effect of receiver buffer depth.

Note: *These are suggested Assignments. Teachers may use these assignments as reference guide. Teachers are encouraged to innovate keeping in view with the current technologies.*

C6-R4: MULTIMEDIA SYSTEMS

Objective of the Course

Multimedia systems are concerned with the capture, storage and presentation of information in a variety of forms, including text, image, video and sounds. Such systems are becoming widespread in modern computing due to the rapid emergence of cheap multimedia technology. The aim of this course is to enable students appreciate the capabilities and limitations of this technology and the implication for future applications. The course will give students concise and consistent view on multimedia theory and practice with the emphasis on the applications in the virtual environment.

The learning outcomes expected out of this course are:
- To develop understanding of the fundamental principles of speech , image and video capture, compression and decompression
- To demonstrate an understanding of the methods involved in the design of multimedia systems and their applications
- To develop an understanding about features of virtual reality systems
- To demonstrate an understanding of the future directions of multimedia systems development

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction	08
2.	Compression of Multimedia data	12
3.	Multimedia Systems	08
4.	Delivery of Multimedia Data	08
5.	Multimedia Information Management	08
6.	Multimedia Programming Tagging(SMIL)	02
7.	Introduction to MIDI (Musical Instrument Digital Interface)	02
8.	Virtual Reality	12

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Introduction   **08 Hrs.**
Concept of Temporal and Non-Temporal Data, Basic Characteristic of Non-Temporal Media; Images, Graphics, Text, Basic characteristic of Temporal Media; Video, audio and animation, Hypertext and Hypermedia, Presentation: Synchronization, Events, Scripts and Interactivity. Introduction to Authoring Systems.

2. Compression of Multimedia Data   **12 Hrs.**
Basic concept of compression, Still image compression: JPEG, Features of JPEG 2000,Video compression: MPEG-1 &2 compression Schemes, MPEG-4 Natural video compression.

Audio Compression; Introduction to Speech and Audio Compression, MP3 Compression Scheme.
Compression of Synthetic Graphic Objects

3. Multimedia Systems   08 Hrs.
General Purpose Architecture for Multimedia Support:
Introduction to Multimedia PC/ Workstation Architecture, Characteristics of MMX instruction set,
I/O System: Overview of USB port and IEEE 1394 interface,
Operating System Support for Multimedia Data:
Resource Scheduling with real-time considerations, File System, I/O Device Management

4. Delivery of Multimedia Data   08 Hrs.
Network and Transport Protocols for Multimedia Data
QoS issues, RTP and RSVP
Video-conferencing and video-conferencing standards
Overview of Voice/ Video over IP

5. Multimedia Information Management   08 Hrs.
Multimedia Database Design
Content Based Information Retrieval: Image Retrieval, Video Retrieval, Overview of MPEG-7,
Design of Video- On Demand Systems

6. Multimedia Programming Tagging (SMIL)   02 Hrs.
Introduction to SMIL, Running SMIL applications, SMIL Authoring.

7. Introduction to MIDI (Musical Instrument Digital Interface)   02 Hrs.
Components of MIDI, Hardware Aspects to MIDI, MIDI Messages, General MIDI, Digital Audio and MIDI

8. Virtual Reality   12 Hrs.
Introduction to Virtual Reality and Virtual Reality Systems
Related Technologies: Tele-operation and Augmented Reality Systems
Interface to the Virtual World- Input; Head and hand trackers, data globes, haptic input devices
Interface to the virtual world- Output; Stereo display, head-mounted displays, auto-stereoscopic displays, holographic displays, haptic and force feedback
VRML Programming; Modeling objects and virtual environments
Domain Dependent applications : Medical, Visualization, Entertainment etc.

RECOMMENDED BOOKS (*)

MAIN READING

1. Ralf Steinmetz and Llara Nahrstedt, "Multimedia: Computing, Communications & Applications", Pearson Education
2. P.K. Andleigh and K.Thakrar, "Multimedia Systems Design", Prentice Hall India, 1996
3. John Vince, "Virtual Reality Systems"., Thomson training & Simulation Ltd.
4. Fred Halsall, "Multimedia Communications", Addison Wesley Longman Publishing Co., 2000.

SUPPLEMENTARY READING

1. Tay Vaughan, "Multimedia: Making it work", seventh edition, McGraw-Hill Publication.
2. Jed hartman, Josie Wernecke, Rick Carey, "Multimedia: Concepts and Practice"
3. The VRML 2.0 Handbook, "Building Moving Worlds on the Web", Addison Wesley Longman Publishing Co.
4. William Sherman, Alan Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann Publishers, 2002.

(*) Latest edition of the books need to be procured.

C6-R4: MULTIMEDIA SYSTEMS

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a) Mention four approaches to providing Quality of Services in high-speed network for multimedia.
b) Explain time-domain sampled representation of sound.
c) Explain how speech recognition can be implemented in computer application?
d) Explain JPEG- DCT encoding and quantization.
e) Write a short note on Real Time RPC.
f) Which are the advantages of compression?
g) Write down the advantages of Multimedia system in computer applications.

(7x4)

2.
a) Describe the role of multimedia standards.
b) Which are the challenges for developing multimedia system?
c) Describe multimedia authoring system.

(3+8+7)

3.
a) Explain HDTV standard.
b) Explain Media Stream Protocol.
c) Explain video compression techniques.

(6+5+7)

4.
a) Which are the limitations in workstation operating system for multimedia application? Describe all.
b) Write a short note on Virtual Device.
c) What is the need to measure performance of video? Which are the various parameters of display can be used for measuring performance?

(7+3+8)

5.
a) Describe the structure of the encoder for MPEG layers 1 and 2.
b) Write a short note on Color balance error.
c) Explain different modes of interchange in architecture of multimedia computer system.

(8+3+7)

6.
a) Write a short note on multimedia tool kit.
b) Explain the following terms:
    1. Aspect ratio
    2. Vertical Retrace
    3. Resolution
    4. Sync
c) Describe the architecture of MPEG.

(5+8+5)

7.
   a) Write down the characteristic of Multimedia System Services.
   b) Explain how MIDI files are created and their roles are in multimedia system.
   c) Describe the data modeling for hypermedia information.

(6+6+6)

C7-R4: DIGITAL IMAGE PROCESSING & COMPUTER VISION

Objective of the Course

This course presents the theory and practice of digital image processing with Mathematical and focuses on the Digital Image Processing package. The features and capabilities of the package are demonstrated, and numerous examples and practical hands-on exercises are included. The material is presented as a sequence of eight one-hour lectures. Each lecture covers a major image processing topic, typically consisting of a discussion of the basic theoretical concepts and including examples that illustrate relevant, practical imaging problems. The lectures are followed by exercise sessions to help attendees understand the material and to provide a focused and practical learning experience.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction to Image Processing & Computer Vision	07
2.	Image Formation	05
3.	Image Enhancement & Restoration	10
4.	Color Image Processing	05
5.	Wavelets and Multi resolution processing	06
6.	Image Compression	05
7.	Edge and Boundary Detection	04
8.	Morphological Image Processing	06
9.	Motion Estimation, Detection & Tracking	06
10.	Shape Representation and Reconstruction	06

Lectures	=	**60**
Practical/Tutorials	=	**60**
Total	=	**120**

Detailed Syllabus

1. Introduction to Image Processing & Computer Vision   07 Hrs.
Fundamentals, Purpose, Application, Image processing system components, image sensing & Acquisition, sampling & Quantization. Neighbors of a pixel adjacency connectivity, regions & boundaries, Distance Measures, stereo vision.
.

2. Image Formation   05 Hrs.
Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, stereo and multi view geometry, Binocular imaging systems.

3. Image Enhancement & Restoration   10 Hrs.
Spatial filtering: Intensity transformations – piece-wise linear transformations, bit plane slicing, histogram equalization, smoothing filtering masks, sharpening filters – gradient operators and Laplacian filters.
Frequency domain filtering: Image sampling, 2D Discrete Fourier Transform, lowpass filtering- ideal and Gaussian, highpass filtering- ideal, Gaussian, Laplacian. Noise Models. Mean, median and min-max filters. Minimum mean square error filter.

4. Colour Image Processing   05 Hrs.
Colour models, pseudocolour, image processing, colour transformation, segmentation.

5. Wavelets and Multi resolution Processing   06 Hrs.
Image pyramids, subband coding, Harr transform, multi resolution expansions, discrete and continuous wavelet transforms

6. Image Compression   05 Hrs.
Fundamentals, Basic compression methods – Huffman, Arithmetic, LZW, run length coding schemes, Error free & Lossy compression, Standards: JPEG, JBIG

7. Edge and Boundary Detection   04 Hrs.
Edge detection, boundary detection, edge detection performance, boundary detection performance.

8. Morphological Image Processing   06 Hrs.
Erosion and dilation, opening and closing, boundary extraction, hole filling.

9. Motion Estimation, Detection & Tracking   06 Hrs.
Regularization theory, optical computation, Motion estimation, Structure from motion.

10. Shape Representation & Reconstruction   06 Hrs.
Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multiresolution analysis.

RECOMMENDED BOOKS (*)

MAIN READING

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing" , 3rd Edition, Pearson Education.
2. D.Forsyth, J Ponce, "Computer Vision – A Modern Approach", Prentice Hall, India

SUPPLEMENTARY READING

1. Anil K Jain, "Fundamentals of Digital Image Processing", Prentice Hall India
2. E.Trucco, A Verri, "Introductory Techniques for 3-D Computer Vision", Prentice Hall.

(*) Latest edition of the books need to be procured.

C7-R4: DIGITAL IMAGE PROCESSING AND COMPUTER VISION

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a)   Define Image Segmentation. Explain any one method of image segmentation.
b)   Describe HIT-or-MISS Transformation.
c)   What is meant by a band limited function?
d)   Explain edge detection using laplacian operator.
e)   Define luminance (intensity) and contrast.
f)   Write down the steps to inverse the image using Discrete Fourier Transform.
g)   Explain Image Enhancement by Arithmetic and Logic Operation.

(7x4)

2.
a)   Prove the following properties of Fourier transform of 2-D sequences.
      1. Separability
      2. Spatial correlation
      3. Shifting
b)   Give the general orthogonal series expansion of an N×N image. Identify the image transform from the expansion. When the transformation is called unitary?
c)   Find the impulse response of the reconstruction filter and find the expression of the signal reconstructed from the samples.

(6+6+6)

3.
a)   Define Hierarchical Clustering. Give K-Means Algorithm for the Hierarchical clustering.

b)   Briefly Explain Application of Fuzzy Logic in Pattern Analysis.
c)   Describe Spatial resolution & Gray level-Resolution. Also show how image content are affected with change of both.

(6+6+6)

4.
a)   Explain Un-sharp Masking & High Boost Filtering.
b)   Compare RGB, CMYK and HIS color models.
c)   Define point spread function and region of support. When is a system said to be FIR or IIR?

(6+6+6)

5.
a)   Impulse response of an imaging system is given as
$h(x,y) = 2 * sin^2[p(x-x0)] / [p(x-x0)]^2 * sin^2[p(y-y0)] / [p(y-y0)]^2$. Find its frequency response, OTF and MTF.
b)   Calculate D_4 distance, D_8 distance and D_m distance for pixels in square. Find the connected component for each if possible & give minimum path length. Set V={3}

```
3  3  3  2  1  2  2  5
4  3  4  5  3  2  2  2
2  3  2  3  1  3  3  1
1  4  3  3  2  4  3  4
2  1  2  2  1  2  1  3
```

(8+10)

6.
a) Explain the basic transformations: translation, scaling, rotation, concatenation and inverse transformation.
b) Using perspective transformation and assuming the world coordinate system is aligned with the camera coordinate system, derive expression for x, y, z.

(8+10)

7.
a) Explain median filtering. How does the size of the window affect the filtered output?
b) Show that DFT of two dimensional circular convolution of two arrays is the product of their DFTs.
c) Explain in detail the elements of Digital Image Processing systems.

(6+6+6)

C8-R4: INFORMATION SECURITY

Objective of the Course

This course aims to introduce students to some of the basic ideas of number theory, and to apply some basic techniques of number theory to cryptography. The module will introduce and illustrate different methods of proof in the context of elementary number theory. To familiarizes the students with the principles of symmetric cryptography, and methods of cryptanalysis, with particular emphasis on the design and deployment of computer-based block ciphers. To equip the student with a background in elementary number theory, and to cover some basic methods of public key cryptography.

The learning outcomes expected out of this course are:
- Understand the basics of modular arithmetic
- State and prove Fermat's little Theorem & its generalisation using Euler's function & use them to implement the RSA cipher.
- Understand proofs of some theorems in the Number Theory.
- Implement and break simple substitution ciphers and the Vigenere cipher
- Provide historical background to cryptography
- Understand strength and weaknesses of different encryption algorithms.
- Various attacks on encryption schemes
- Hash Functions
- Public-key Cryptography
- Integrity and Digital Signature

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction to cryptography	06
2.	Mathematics of Cryptography	04
3.	Introduction to Number Theory	06
4.	Conventional Encryption	08
5.	Pseudo-random Number Generators (PRNGs)	08
6.	Hash Functions and MAC	10
7.	Key Establishment and Public-key Cryptography	10
8.	Integrity and Digital Signature	08

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Introduction to Cryptography   06 Hrs.
Terminology, Security Aspects, Attack Models, Classical Cryptography, Shift Cipher, Substitution Cipher, Vigenere Cipher, Basic Cryptanalysis

2. Mathematics of Cryptography   04 Hrs.

Groups, Rings, and Fields, Integer Arithmetic, Modular Arithmetic, The Euclidean Algorithm, Finite Fields of The Form GF(p), Polynomial Arithmetic, Finite Fields Of the Form GF(2^n), Linear Congruence

3. Introduction to Number Theory   06 Hrs.
Prime Numbers, Primality Testing, Factorization, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms

4. Conventional Encryption   08 Hrs.
Attacks on Encryption Schemes, Perfect Security, Cipher Machines, Modes of Operation (ECB, CBC, CFB, OFB) , Multiple Encryption , DES, Triple-DES, AES,RC4 Stream Cipher , Attacks on DES.

5. Pseudo-random Number Generators (PRNGs)   08 Hrs.
Random and Pseudorandom Numbers, Next-bit Test, Removing Biases, ANSI X9.17 Generator Blum-Blum-Shub Generator, Statistical Tests.

6. Hash Functions and MAC   10 Hrs.
Standard hashes (MD5, SHA-1, SHA-256/384/512, RIPEMD-160) , Birthday Attack , Collision-freeness and recent attacks , Message Authentication Code (MAC) Algorithms , Authenticated Encryption

7. Key Establishment and Public-key Cryptography   10 Hrs.
Key Management, Diffie-Hellman Key Exchanga ,Attacks on Diffie Hellman, RSA, , Attacks on RSA , ElGamal , Attacks on ElGamal , Semantic Security and Chosen-ciphertext Security , Provably Secure Schemes

8. Integrity and Digital Signature   08 Hrs.
Message Integrity, Digital Signature, Authentication Protocol, Digital Signature Standards, Attacks on Digital Signature, Variation and Applications

RECOMMENDED BOOKS (*)

MAIN READING

1. William Stallings, "Cryptography and Network Security, Principles and Practice", Prentice Hall India.
2. Behrouz A Forouzan, "Cryptography & Network Security", Tata McGraw-Hill Publications

(*) Latest edition of the books need to be procured.

C8-R4: INFORMATION SECURITY

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a) How many keys are required for two people to communicate via a cipher? Explain with an example.
b) How the Discrete algorithm works and computes the power of integers for the module 19.
c) What requirements must a public-key cryptosystem fulfill to be a secure algorithm?
d) What are the two different uses of public key cryptography related to key distribution?
e) What is the difference between direct and arbitrated digital signature.
f) Explain the principal of public key cryptography and show how it differs from conventional and classical technique
g) What type of information might be derived from a traffic analysis attack?

(7X4)

2.
a) What are the requirements for secure use of conventional encryption? Explain the model of conventional cryptosystem.
b) When a combination of symmetric key encryption and an error control code is used for message authentication, in what order must the two functions be performed? Justify with an example.
c) What are the three tests used in evaluating a random number generator?

(6+9+3)

3.
a) Which parameters and design choices determine the actual algorithm of a Fiestel Cipher?
b) What is differential cryptanalysis attack? How is it different from linear cryptanalysis attack?
c) What is the difference between statistical randomness and unpredictability?

(9+4+5)

4.
a) If a bit error occurs in the transmission of a cipher text character in 8 bit CFB mode, how far does error propagate?
b) Explain Modular arithmetic and show the Arithmetic operations of Modular operations.
c) Using Extended Euclid's algorithm , find multiplicative inverse of 550 mod 1769

(7+7+4)

5.
a) What is the difference between an unconditionally secure cipher and a computationally secure cipher?
b) In public key system using RSA, you intercept the ciphertext C=10 sent to a user whose public key is e=5, n=35. What is the plaintext M?
c) Identify the attacks in context of communication across the network and show how basic usages of MD for dealing with any one of attack.

(3+8+7)

6.

a) What is the need of Digital Signatures? / Discuss the requirements of digital Signature. What are problem associated with Direct Digital Signature?

b) Justify the requirement of Authentication and explain the Message Authentication using one of the Authentication techniques with example.

c) What are the two basic functions used in encryption algorithm?

(7+7+4)

7.

a) List out types of Attach on Encrypted messages also explain how the Average Time required Exhaustive Key search affected by key size.

b) What is purpose Chinese Reminder algorithm and where in security algorithm it is used

c) Explain how Secrecy and authentication can be achieved using Public-key Cryptosystem

(9+5+4)

C9-R4:SOFT COMPUTING

Objective of the Course

Soft computing uses soft computational techniques in machine learning and artificial intelligence to study and model complex phenomena where classical hard computing techniques have not yielded complete solutions. The purpose of this course is to introduce to the students the general topics and techniques of soft computing and learning. It will focus on some of the classic soft computing topics, such as fuzzy logic, neural networks and their hybridizations, some concepts of optimization and regression

At the end of the course the student will understand:
- Fundamentals of soft computing
- Neural network concept.
- Fuzzy logic
- Hybridization of neural network and fuzzy logic
- Fundamentals of Optimization and regression

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction to Soft Computing	06
2.	Introduction to Genetic Algorithm	06
3.	Genetic Modeling	08
4.	Regression and Optimization	08
5.	Neuro-Fuzzy Modeling	08
6.	Advances Neuro-Fuzzy Modeling	08
7.	Neuro-Fuzzy Control	08
8.	Other Hybrid System	08

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Introduction to Soft Computing   06 Hrs.
Hard Computing, Soft Computing, Features of Soft Computing, Constituents of Soft Computing, Applications of Soft Computing Crisp Logic, Fuzzy Logic (FL), Rough Logic and Systems based on it Probabilistic Theory, Genetic Algorithms (GA), Artificial Neural Network (ANN).

2. Introduction to Genetic Algorithm   06 Hrs.
Introduction to Genetic Algorithms - Definition of GA - Description of Terminology/Vocabulary of GA - Importance and Goal of Traditional Optimization Methods - Classification of Search Techniques - Introduction to Hill climbing - Simulated annealing – Decision Tree - Difference between Genetic Algorithms and Traditional Methods - Simple Genetic Algorithm Examples

3. Genetic Modeling   08 Hrs.
Offspring – Encoding - Fitness Function – Reproduction – Crossover - Inverse and Deletion - Mutation Operator - Generational Cycle – Convergences - Application

4. Regression and Optimization   08 Hrs.
Least Square Methods for System Identification System Identification Introduction, Basics of Matrix Manipulation and Least Squares Estimators, Recursive Least Squares Estimators, Introduction to Derivative Based Optimization, Introduction to Derivative Free Optimization

5. Neuro-Fuzzy Modeling   08 Hrs.
Introduction to Neuro-Fuzzy Modeling, Approaches of Neuro-Fuzzy Systems, Fuzzy Neural approach, Cooperative Neuro-Fuzzy Approach, Concurrent Neuro-Fuzzy Approach, Hybrid Neuro-Fuzzy Approach, Applications of Cooperative Neuro-Fuzzy Systems

6. Advanced Neuro-Fuzzy Modeling   08 Hrs.
Framework of Adaptive Neuro-Fuzzy Inference Systems(ANFIS), Hybrid Learning Algorithm, Learning Methods, Universal Approximation, Generalized Adaptive Neuro-Fuzzy Inference Systems(ANFIS), Neuro-Fuzzy Spectrum, Analysis of Adaptive Learning Capability, Rule extraction, and Evolution, Evolution of Antecedents, Evolution of Consequents, Evolving Partitions

7. Neuro-Fuzzy Control   08 Hrs.
Introduction, Feedback control Systems, Neuro-Fuzzy Control, Expert Control, Inverse Learning, Specialized Learning, Back-propagation through Time and Real Time Recurrent Learning, Reinforcement Learning Control, Introduction to Fuzzy Filtered Neural Network

8. Other Hybrid System   08 Hrs.
Genetic–Fuzzy Systems, Genetic Algorithms Controlled by Fuzzy Logic, Fuzzy Evolutionary Systems, Evolving Knowledge Base and Rule Sets, Neuro-Genetic Systems, Neural Network Weight Training, Evolving Neural Nets, Genetic Fuzzy Neural Network

RECOMMENDED BOOKS (*)

MAIN READING

1. Jang J S R, Sun C T, Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education Edition, 1997, Reprint 2007
2. Akerker and Sajja, MS and Jones and Bartlett, MA, USA, "Knowledge-Based Systems", 2009
3. Ian Cloete and Jacek Zurada, "Knowledge Based Neuro-Computing" University Press, Massachusetts Institute of Technology, USA, 2002
4. Oscar Cordon, Francisco Herrera, Frank Hoffmann, Luis Magdalena, "Genetic Fuzzy Systems", Word Scientific Publishing Ltd. , 2001

SUPPLEMENTARY READING

1. Partihar D K, "Soft Computing" , Narosa Publication, 2008
2. Sivanandam S N and Deepa S N, "Principles of Soft Computing", Wiley India Edition, 2007
3. Rushell and Norvig, "Modern Approach to Artificial Intelligence", Prentice Hall of India Ltd., 2006
4. Rich and Knight, "Artificial Intelligence", Tata McGraw Hill Publishing Co. Ltd. 21st Indian Reprint, 2001
5. Anupam Shukla, Ritu Kala, Rahul Kala, "Real Life Applications of Soft Computing", CRC Press.

(*) Latest edition of the books need to be procured.

C9-R4: SOFT COMPUTING

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a) How many keys are required for two people to communicate via a cipher? Explain with an example.
b) How the Discrete algorithm works and computes the power of integers for the module 19.
c) What requirements must a public-key cryptosystem fulfill to be a secure algorithm?
d) What are the two different uses of public key cryptography related to key distribution?
e) What is the difference between direct and arbitrated digital signature.
f) Explain the principal of public key cryptography and show how it differs from conventional and classical technique
g) What type of information might be derived from a traffic analysis attack?

(7X4)

2.
a) What are the requirements for secure use of conventional encryption? Explain the model of conventional cryptosystem.
b) When a combination of symmetric key encryption and an error control code is used for message authentication, in what order must the two functions be performed? Justify with an example.
c) What are the three tests used in evaluating a random number generator?

(6+9+3)

3.
a) Which parameters and design choices determine the actual algorithm of a Fiestel Cipher?
b) What is differential cryptanalysis attack? How is it different from linear cryptanalysis attack?
c) What is the difference between statistical randomness and unpredictability?

(9+4+5)

4.
a) If a bit error occurs in the transmission of a cipher text character in 8 bit CFB mode, how far does error propagate?
b) Explain Modular arithmetic and show the Arithmetic operations of Modular operations.
c) Using Extended Euclid's algorithm , find multiplicative inverse of 550 mod 1769

(7+7+4)

5.
a) What is the difference between an unconditionally secure cipher and a computationally secure cipher?
b) In public key system using RSA, you intercept the ciphertext C=10 sent to a user whose public key is e=5, n=35. What is the plaintext M?
c) Identify the attacks in context of communication across the network and show how basic usages of MD for dealing with any one of attack.

(3+8+7)

6.

a) What is the need of Digital Signatures? / Discuss the requirements of digital Signature. What are problem associated with Direct Digital Signature?

b) Justify the requirement of Authentication and explain the Message Authentication using one of the Authentication techniques with example.

c) What are the two basic functions used in encryption algorithm?

(7+7+4)

7.

a) List out types of Attach on Encrypted messages also explain how the Average Time required Exhaustive Key search affected by key size.

b) What is purpose Chinese Reminder algorithm and where in security algorithm it is used

c) Explain how Secrecy and authentication can be achieved using Public-key Cryptosystem

(9+5+4)

C10-R4:SOFTWARE SYSTEMS

Objective of the Course

This course aims to introduce various topics relevant to development of modern quality software system. This course is a graduate-level software engineering course. Assuming a basic knowledge of software engineering principles, we will explore advanced specification and design in UML, component-based software engineering, rapid development processes and techniques, advanced validation and verification methods, configuration management, and other advanced topics.

Graduate standing in Computer Science, and at least one undergraduate software engineering course. A basic knowledge of software engineering and UML diagramming methods will be assumed.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Basic of Software Engineering and Study of Different Life cycle Models	06
2.	Requirements & Specification	06
3.	Design Concept and Methods	08
4.	Object Oriented Methodology for Analysis and Design	08
5.	Modeling with UML	08
6.	Testing Object Oriented System and Quality Assurance	08
7.	Software Architecture	08
8.	Software Agent	08

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Basic of Software Engineering and Study of Different Life cycle Models   06 Hrs.
Software Characteristics, Components, Applications, Layered Technologies, Processes, Product, Methods and Tools. Software Engineering Concepts, S/W Engineering Development Activities, Software Reusability and Re-Engineering. Generic View of Software Engineering, Waterfall, Prototype, Incremental, Spiral and Concurrent, Development Model.

2. Requirements & Specification   06 Hrs.
Problem Recognition, Evaluation And Synthesis, Modeling, Specifications And Review Techniques Requirements engineering; analysis; system model; software prototyping; formal specification; algebraic specification; model based specification

3. Design Concept and Methods   08 Hrs.
Design process, concept effective modular design, architectural design, function oriented design, user interface design, Data Design, Architectural Designing, Process And Optimization, Interface Design, Procedural Design, Difference Between Data And Information, ER Diagram, Dataflow Model, Control Flow Model, Control And Process Specification, Data Dictionary.

4. Object Oriented Methodology for Analysis and Design 08 Hrs.

Introduction to OO Methodology, Object model, Dynamic model, Functional Model for Software Analysis and Design. Requirement's Analysis and Model – Actors and Use cases, Use case Narratives and Scenario, Managing Requirements.

5. Modeling with UML 08 Hrs.

Basic Structural Modeling, Class Diagram and Relationship, Package Diagram, Object Diagram. Use case diagram: Extends, Uses and Includes Relationship. Interaction Diagram (Sequence Diagram and Coloration Diagram), Components, Pattern and Frame works, State Transition Diagram, Activity Diagram, Deployment and Component Diagram.

6. Testing Object Oriented System and Quality Assurance 08 Hrs.

Overview of Testing activities and Techniques, Test case generation and Test suites, Managing Testing. Test case from Use case.
OO Metrics, Quality models, Software reliability; software reuse; safety-critical software.

7. Software Architecture 08 Hrs.

Software Architecture in Practice: Industrial Best Practices; Role of the Architect; Evaluation; Case Studies; Cultural Aspects. Foundations of Software Architecture: Description Languages; Analysis Methods; Transformations; Assessment; Extraction/Recovery. Software connectors: Architecture description languages (ADLs), Dynamism in software architectures, Architecture-based testing and analysis, From architecture to design: overview of UML, Role of UML in software architectures.

8. Software Agent 08 Hrs.

Agent Oriented Vs. OO Software Development, Design Methods, Multi Agent System, Use of UML, Agent methodologies in Industries, Component based Software Engineering.

RECOMMENDED BOOKS (*)

MAIN READING

1. Pressman R.S., "Software Engineering: A Practitioner's Approach" Tata Mcgraw Hill.
2. Sommerville I., Addision-Wesley, "Software Engineering"

SUPPLEMENTARY READING

1. Ian Sommerville, "Software Engineering", Addison Wesley
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall of India
3. Jacobson, Jonsson , Overgaard, Christerson, "Object Oriented Software Engineering " Addison Wesley.
4. Martin Fowler, Kendall Scott, "UML Distilled:A Brief Guide to the Standard Object Modeling Language", Addison Wesley, Second Edition, August 18, 1999, ISBN: 0-201-65783-X.
5. Jacobson, Jonsson, Overgaard, Christerson, "Object Oriented Software Engineering", Addison Wesley.

(*) Latest edition of the books need to be procured.

C10-R4: SOFTWARE SYSTEMS

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a) Why the Spiral life cycle model is considered to be a meta model? Also differentiate between throw away and evolutionary prototype in prototype model.
b) Why should a requirement engineer avoid making any design decision during requirement analysis?
c) What are functional and non-functional requirements for software? Who will specify those requirements?
d) What is the difference between cardinality and modality? How structure partitioning can help to make s/w more maintainable?
e) Describe the difference between verification and validation. Who should perform the validation tests-the software developer or the software user? Justify the answer.
f) Explain: Why high quality software process should lead to high quality software products.
g) When are verification and validation performed? Who should perform validation test (developer or user)? Justify your answer

(7x4)

2.
a) What are the major phases of the entire life of the s/w? Specify the percentage of efforts required on each phase. Which phase requires the maximum efforts?
b) Define the problem domain and establish the scope for the following system.
"Examination System for an academic institution.
c) Draw the use case diagram for the following system.
"A simple invoicing system for a small business".

(7+5+6)

3.
a) What purpose do "walkthrough" serve? How do they accomplish this?
b) Develop an E-R diagram and prepare data dictionary for the following system.
"Hotel reception desk management".
c) What is the content of data dictionary? Is it a part of analysis or design? Is it prepared before or after DFD and ER Diagram?

(6+4+8)

4.
a) Explain the need for various measures and describe various metrics. How are the concepts of coupling and software portability related? Give example for the same.
b) Develop a set of use cases for the following system.
"Software for a general purpose personal digital assistant".
c) Discuss the relationship between the concept of information hiding as an attribute of effective modularity and the concept of module independence. Why is it good idea to keep the scope of effect of a module within its scope of control?

(7+3+8)

5.
a) Develop a state chart diagram for the following system.
"A university student record keeping system".

b) Differentiate between object based and object oriented programming. Explain how object oriented design provide separation of interface and implementation.

c) What is the difference between a milestone and a deliverable? Give examples for the same.

(7+7+4)

6.

a) A manager decides to use the reports of program inspections as an input to the staff appraisal process. These reports show who have made and who have discovered program errors. Is this ethical managerial behavior? Would it be ethical if the staff were informed in advance that this would happen? What difference might it make to the inspection process?

b) What is qualification to object modeling? Define the role of qualifier. Identify what type of association (e.g. one to one) etc. may be qualified. What are the advantages of qualified association?

c) Explain: the role of UML in software architecture design.

(7+7+4)

7.

a) What are the major phases of the entire life of the software? Specify the percentage of efforts required on each phase. Which phase requires the maximum efforts?

b) Describe what is meant by data and tool integration. How structure partitioning can help to make software more maintainable? Write advantages of different structural models for architectural design of System.

c) How Quality and Reliability of software are differing? Can a software be correct and still not exhibit good quality? Can a software be correct and still not be reliable?

(6+6+6)

LAB III: IMAGE PROCESSING AND COMPUTER VISION

Sample Practical List

1. Introduction to MATLAB & Image processing Toolbox.

2. Write a m-function for following image transforms for grayscale image.
    (Input: Gray Scale Image)
    - a.   Inverse Transform
    - b.   Power-law Transform
    - c.   Log Transform

3. Write m-function for Histogram Equalization for grayscale image.
    (Input: Gray Scale Image)

4. Write m-function for Local Histogram Equalization.
    (Input: Gray Scale Image)

5. Write m-function for Histogram Specification for grayscale image.
    (Input: 2 Gray Scale Images)

6. Demonstrate the use of Smoothing and Sharpening using various Filters for Smoothing (Average(Mean) Filter, Weighted Filter, Median Filter, Gaussian Averaging Filter, Laplacian Filter for Sharpening (H-V and H-V-D))
    (Input: Gray Scale Image)

7. Perform the BIT PLANE SLICING for the gray scale image. Show the effect of removing the each bit plane from the image.
    (Input: Gray Scale Image)

8. Demonstrate the use of Filtering in Frequency Domain. Implement the function for the IDEAL, GAUSSIAN, and BUTTERWORTH (both High pass and Low pass) filters. Also compare and analyze results.
    (Input: Gray Scale Image)

9. Demonstrate the use of different filter applied for image restoration which is degraded by Raleigh, Gaussian, and Salt & Pepper Noise. Implement following filters:
    - a.   Mean Filter
    - b.   Arithmetic Mean filter
    - c.   Geometric filter
    - d.   Harmonic Filter
    - e.   Contra Harmonic filter
    - f.   Order Statistics Filters
    - g.   Median filter
    - h.   Max & Min Filters
    - i.   Mid point Filter

    (Input: Gray Scale Image)

10. Demonstrate use of Prewit , Sobel, Robert, Canny edge detector for Edge detection.
    (Input: Gray Scale Image)

11. Implement Fourier Descriptor for shape detection and prepare CHAIN CODE for shape.
> **(Input:** Binary Image with one Shape)

12. Demonstrate use of Morphological Operations (Dilate & Erosion).
> **(Input:** Binary Image with one Shape)

13. Write a M-function for Color space Transformation. (RGB↔YUV↔CMYK)
> **(Input:** Color Code)

Software Requirement: MATLAB 6.0

Note: *These are suggested Assignments. Teachers may use these assignments as reference guide. Teachers are encouraged to innovate keeping in view with the current technologies.*

LAB III: MULTIMEDIA SYSTEMS

Sample Practical List

1. Write a Program to copy one Bitmap File to another using Header and Data information.

2. Implement RLE Compression Algorithm for a BMP file

3. Write a program to read Wav file header.

4. Write a program to read TIFF file header information.

5. Write a program for color space conversion (RGB-YUV-LAB).

6. Generate a Quantization Table for JPEG.

7. Implementation of 2D DCT & IDCT for 8x8 image.

8. Study of DirectX for Multimedia Applications.

9. Study of MPEG File Structure.

10. Study of Content Based Image/Video Retrieval Techniques.

11. Study of TWAIN architecture.

12. Study of Distributed Multimedia System & its Components.

Note: *These are suggested Assignments. Teachers may use these assignments as reference guide. Teachers are encouraged to innovate keeping in view with the current technologies.*

LAB IV: INFORMATION SECURITY

Sample Practical List

1. To implement Caesar cipher encryption-decryption.
   (Input: Text Based Value)

2. To implement Monoalphabetic cipher encryption-decryption.
   (Input: Text Based Value and keys)

3. To implement Playfair cipher encryption-decryption.
   (Input: Text Based Value and keys)

4. To implement Polyalphabetic cipher encryption-decryption.
   (Input: Text Based Value and keys)

5. To implement columnar transposition cipher encryption-decryption.
   (Input: Text Based Value and keys)

6. To implement Hill cipher encryption-decryption.
   (Input: Text Based Value and keys)

7. To implement Rail-Fence cipher encryption-decryption.
   (Input: Text Based Value and keys)

8. To implement diffie-hallman key exchange algorithm.

9. To implement diffie-hallman key exchange algorithm.

10. To implement SHA-1 compression techniques.

11. To implement S-DES encryption techniques.

Software Requirement: C / C++

Note: *These are suggested Assignments. Teachers may use these assignments as reference guide. Teachers are encouraged to innovate keeping in view with the current technologies.*

LAB IV: SOFT COMPUTING

Sample Practical List

1. What is Soft Computing? Introduction of Fuzzy Logic with Advantage and Disadvantages and Application of Fuzzy Logic.

2. Study of Difference between Traditional approach and Soft Computing.

3. Introduction of Genetic Algorithm with Advantage and Disadvantages and Application of Genetic Algorithm.

4. Study and Implementation of various Genetic Operators.

5. Study and Implementation of various Reproduction techniques of Genetic Algorithm.

6. Introduction of Neural network with advantages and disadvantages and its applications.

7. Study of different types of Learning Techniques.

8. Implement 2-2-1 Configuration Neural Network Architecture and Observe effect of Learning Rate.

9. Implement XOR Problem using Neural Network.

10. Study of Various kind of Parameter of Neural Network

Note: *These are suggested Assignments. Teachers may use these assignments as reference guide. Teachers are encouraged to innovate keeping in view with the current technologies.*

CE1.1-R4: DIGITAL SIGNAL PROCESSING

Objective of the Course

This subject aims to introduce theoretical analysis of various types of signal, different signal with mathematical proof of correctness, Discrete time signal, digital Fourier transform, Z-transform, frequency analysis and system, design of digital filter, DSP coprocessor and its application to review mathematical background.

At the end of the course the student will understand:
- Analysis of various types of signal.
- Mathematics for signal.
- Examine the properties of signal.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Discrete Time Signals & System	05
2.	Z-Transform	04
3.	Applications of z-transform	02
4.	Frequency Analysis of Signals and Systems	05
5.	Discrete Fourier Transform	08
6.	Implementation of Discrete Time Systems	08
7.	Design of Digital Filters	08
8.	Introduction to DSP co-processors	04
9.	Applications	08
10.	Advance DSP concepts	08

Lectures	**=**	**60**
Practical/Tutorials	**=**	**60**
Total	**=**	**120**

Detailed Syllabus

1. Discrete Time Signals & System   **05 Hrs.**
Discrete–time signals, Discrete–time systems, Analysis of discrete-time LTI systems, Discrete-time systems described by differential equations, Implementation of discrete-time systems, Correlation of discrete-time systems

2. Z-Transform   **04 Hrs.**
Definition and Properties of Z-transform, Rational Z-transforms, Inverse Z-transform, one-sided Z-transform, Analysis of LTI systems in Z-domain

3. Application of Z-Transform   **02 Hrs.**
Time domain analysis, frequency response - graphical interpretation, application: digital audio effects

4. Frequency Analysis of Signals and Systems   **05 Hrs.**

Frequency analysis: Continuous time signals and Discrete-time signals, Properties of the Fourier transform for discrete-time signals, Frequency domain characteristics of LTI systems, LTI system as a frequency selective filter, Inverse systems and deconvolution

5. Discrete Fourier Transform   08 Hrs.
Frequency domain sampling, Properties of DFT, Linear filtering method based on DFT, Frequency analysis of signals using DFT, FFT algorithm, Applications of FFT, Goertzel algorithm, Quantisation effects in the computation of DFT

6. Implementation of Discrete Time Systems   08 Hrs.
Frequency domain sampling, Properties of DFT, Linear filtering method based on DFT, Frequency analysis of signals using DFT, FFT algorithm, Applications of FFT, Goertzel algorithm, Quantisation effects in the computation of DFT

7. Design of Digital Filters   08 Hrs.
Design of FIR filters, Design of IIR filters from analog filters, frequency transformations, Design of digital filters based on least-squares method digital filters from analogue filters, Properties of FIR digital filters, Design of FIR filters using windows, Comparison of IIR and FIR filters, and Linear phase filters.

8. Introduction to DSP co-processors   04 Hrs.
TMS 320C40/50, Analog Devices

9. Applications   08 Hrs.
Image processing, Speech, Audio, Telecommunication, Graphics, image enhancement, 3- D rendering , Navigation, GPS , Correlation, machine vision, Frequency domain filtering.

10. Advance DSP concepts   08 Hrs.
Multirate signal processing, adaptive signal processing, finite word length effect

RECOMMENDED BOOKS (*)

MAIN READING

1. J.G. Proakis, "Introduction to Digital Signal Processing", PHI
2. N.G.Palan, "Digital Signal Processing",Tech-Max Publications
3. S Sallivahanan, "Digital Signal Processing" , Tata McGraw-Hill.
4. Ashok Ambardar, "Analog and Digital Signal Processing" , Thompson Learning

SUPPLEMENTARY READING

1. S.K.Mitra, "Digital Signal Processing", Tata McGraw-Hill.
2. Oppenhiem and Schaffer, "Discrete Time Signal Processing".
3. E.C.Ifeachor, B.W.Jervis, "Digital Signal Processing", Pearson Education
4. L.C.Ludeman, John Wiley, "Fundamentals of Digital Signal Processing".

(*) Latest edition of the books need to be procured.

CE1.1-R4: DIGITAL SIGNAL PROCESSING

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

Time: 3 Hours   **Total Marks: 100**

1.

a) Find frequency response $H(e^{jw})$ of the linear time-invariant system, whose input and output satisfy the difference equation:

$$y[n] – 0.5y[n\text{-}1] = x[n] + 2x[n\text{-}1] + x[n\text{-}2].$$

b) For $X(e^{jw}) = 1/(1\text{-}ae^{-jw})$, with $-1 < a < 0$, determine and sketch the following as a function of w:
(i) $\text{Re}\{X(e^{jw})\}$ (ii) $\text{Im}\{X(e^{jw})\}$ (iii) $|X(e^{jw})|$ (iv) $\text{angle}\{X(e^{jw})\}$

c) Consider an LTI system that is stable and for which $H(z)$-the z-transform of the impulse response is given by $H(z)= 3/(1+0.33z^{-1})$.
If x[n], the input to the system is a unit step sequence.
  (i) Find the output y[n] by evaluating the discrete convolution of x[n] and h[n].
  (ii) Find the output y[n] by computing the inverse transform of Y(z).

d) Prove following properties of Z-transform:
(i) Multiplication by an exponential sequence (ii) Time Shifting

e) Explain the relationship between DTFT and Z-transform.

f) What is an IIR filter? Compare its characteristics with an FIR filter.

g) A high pass filter satisfying the following specifications is to be designed.
$$|H(e^{jw})| < 0.04 \qquad 0 \leq |w| \leq 0.2\pi$$
$$0.995 < |H(e^{jw})| < 1.005 \quad 0.3\pi \leq |w| \leq \pi$$

State the specifications that should be used to design the prototype continuous time filter, if the discrete time filter is designed by applying bilinear transformation with T = 2 ms to the prototype continuous time filter.

(7 x 4)

2.

a) Consider the DT signal below which is only nonzero for three values of n:

$$x[n] = 4\delta[n] + 2\delta[n-1] + \delta[n-2]$$

(i) Compute and plot the autocorrelation, $r_{xx}[\ell]$, of $x[n]$.

(ii) x(n) is pass through a DT linear system characterized by a difference equation
   y(n)= 2x[n-2]+ x(n-6), Compute and plot the cross correlation between x(n) and y(n).

b) Design direct form-II realization of the transfer function:

$$H(z) = \frac{3+3.6z^{-1} +0.6z^{-2}}{1+0.1z^{-1} -0.2z^{-2}} .$$

c) Consider the following system, the pole-zero plot for *H*(z) is shown below.
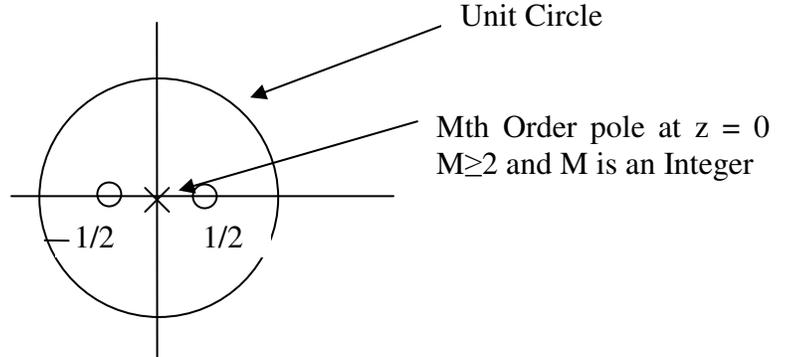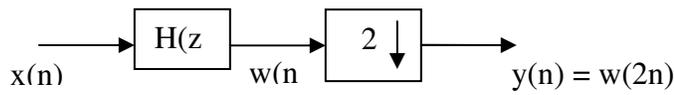
(i) Determine h(n), the impulse response of *H(z)*.
(ii) In the following system, Determine whether *G(z)* can be chosen so that y(n) = v(n) for any input x(n).
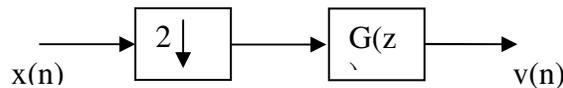
(6+6+6)

3.

a) For a given Linear time invariant system, determine the system function and the impulse response of the system shown below:
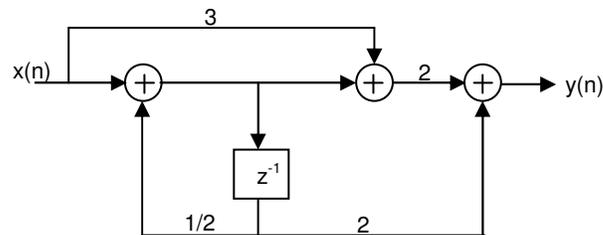
b) Determine the z-transform and its ROC of the following sequence:
   (i) $x[n] = n^2 u[n]$
   (ii) $\cos w_0 n \, u[n]$

c) The even part of a real sequence x[n] is defined by $x_e[n] = \dfrac{x[n] + x[-n]}{2}$

If x[n] is a real finite-length sequence defined such that x[n]=0 for n < 0 and n ≥ N. Let X[k] denote the N-point DFT of x[n].
(i) Find the DFT of $x_e[n]$. Is it equal to Re{X[k]}?
(ii) What is the inverse DFT of Re{X[k]} in terms of x[n]?

(6+6+6)

4.

a) Consider two finite-length sequences x[n] and h[n] for which x[n] = 0 outside the interval 0 ≤ n ≤ 49 and h[n] = 0 outside the interval 0 ≤ n ≤ 9.

(i) What is the maximum possible number of nonzero values in the linear convolution of x[n] and h[n]?
(ii) The 50 point circular convolution of x[n] and h[n] is

   x[n] ⑤⓪ h[n] = 10,   0 ≤ n ≤ 49.
   The first 5 points of the linear convolution of x[n] and h[n] are
       x[n] * h[n] = 5,   0 ≤ n ≤ 4.
   Determine as many points as possible of the linear convolution of x[n] * h[n].

b) Two four-point sequences x[n] and h[n] are as follows:

$$x[n] = \cos\left(\frac{\pi n}{2}\right), \quad n = 0, 1, 2, 3.$$

$$h[n] = 2^n, \quad n = 0, 1, 2, 3.$$

   i) Calculate the four-point DFT X[k].
   ii) Calculate the four-point DFT H[k].
   iii) Calculate y[n] = x[n] ④ h[n] by doing the circular convolution directly.
   iv) Calculate y[n] of part (iii) by multiplying the DFTs of x[n] and h[n] and performing
      an inverse DFT.

c) Determine the signal x[n] with z-transform:
   $X(z)=3/(1-(10/3)z^{-1}+z^{-2})$ if X(z) converges on the unit circle.

(8+6+4)

5.

a) Determine the input-output relationship, the system function, and plot the pole-zero pattern for the discrete time system shown:
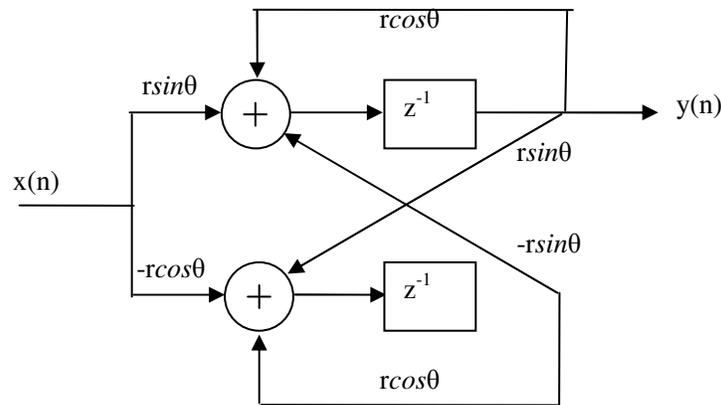
b) i) Determine a parallel and a cascade realization of the system

$$H(z) = \frac{1 + z^{-1}}{(1 - z^{-1})(1 - 0.8e^{j\pi/4}z^{-1})(1 - 0.8e^{-j\pi/4}z^{-1})}$$

   ii) Determine the type 1 and type 2 state-space descriptions of the system in part (i).

c) Consider an FIR lattice filter with coefficients $K_1=0.65$, $K_2 = -0.34$ and $K_3=0.8$.
   i) Find its impulse response by tracing a unit impulse input through the lattice structure.
   ii) Draw the equivalent direct-form structure.

(8+4+6)

6.

a) A digital low-pass filter is required to meet the following specifications:
      Passband ripple: ≤ 1 dB, Passband edge: 4 kHz, Stopband attenuation: ≥ 40 dB
      Stopband edge: 6 kHz, Sample rate: 24 kHz

The filter is to be designed by performing a bilinear transformation on an analog system function. To meet the specifications in the digital implementation what should be the order of Buttorworth, Chebychev and Elliptic analog designs.

b) The impulse response of an analog filter is shown as below:
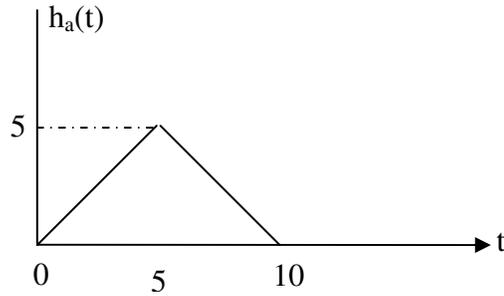
i) Let $h(n) = h_a(nT)$, where $T = 1$, be the impulse response of a discrete-time filter. Determine the system function $H(z)$ and the frequency response $H(w)$ for this FIR filter.

ii) The FIR filter with unit sample response $h(n)$ given above is to be approximated by a second-order IIR filter of the form

$$G(z) = \frac{b_0 z^{-1}}{1 - a_1 z^{-1} - a_2 z^{-2}}$$

Use the least-squares inverse design procedure to determine the coefficients b_0, a_1 and a_2.

c) Explain: Autoregressive-moving average (ARMA) model in random process.

(7+7+4)

7.

a) Explain: Short time Spectrum Analysis in Speech Processing
   Or Video Compression using Wavelet transform
b) Using the in-place radix-2 decimation-in-time and radix-2 decimation-in-frequency algorithms, compute the 8-point DFT of the sequence

$$x(n) = \left\{ \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0 \right\}$$

Follow exactly the corresponding signal flow graphs and keep track of all intermediate quantities by putting them on the diagrams.
c) Using the radix-4 decimation-in-time algorithm, compute the 16-point DFT of the sequence,

$$x(n) = \cos \frac{\pi}{2} n \qquad 0 \le n \le 15.$$

(6+6+6)

C Level R4   105

CE1.2-R4: MACHINE LEARNING

Objective of the Course

The intent of this course is to present a broad introduction to Machine Learning, the study of computing systems that improve their performance with experience; including discussions of each of the major approaches. The primary focus of the course will be on understanding the underlying algorithms used in various learning systems.

At the end of the course, the student will understand:
- Concept Learning and the General-to-Specific Ordering
- Decision Tree Learning
- Artificial Neural Networks
- Bayesian Learning
- Computational Learning Theory
- Evaluation of learning algorithm

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction	04
2.	Inductive Classification	06
3.	Ensemble Learning	08
4.	Experimental Evaluation of Learning Algorithms	08
5.	Rule Learning: Propositional and First-Order	10
6.	Artificial Neural Networks	08
7.	Support Vector Machines	08
8.	Bayesian Learning	08

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Introduction   **04 Hrs.**
Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

2. Inductive Classification   **06 Hrs.**
The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. The importance of inductive bias.

3. Ensemble Learning   **08 Hrs.**
Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles

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4. Experimental Evaluation of Learning Algorithms   08 Hrs.

Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing

5. Rule Learning: Propositional and First-Order   10 Hrs.

Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain. First-order Horn-clause induction (Inductive Logic Programming) and Foil. Learning recursive rules. Inverse resolution, Golem, and Progol.

6. Artificial Neural Networks   08 Hrs.

Neurons and biological motivation. Linear threshold units. Perceptons: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Over fitting, learning network structure, recurrent networks.

7. Support Vector Machines   08 Hrs.

Maximum margin linear separators. Quadractic programming solution to finding maximum margin separators. Kernels for learning non-linear functions.

8. Bayesian Learning   08 Hrs.

Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies.

RECOMMENDED BOOKS

MAIN READING

1. TOM Mitchell, "Machine Learning", McGraw Hill, 1997, ISBN 0070428077
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.

SUPPLEMENTARY READING

1. Christopher M.Bishop,Springer, "Pattern Recognition and Machine Learning", 2006.
2. Richard O.Duda, Peter E.Hart & David G.Stork, "Pattern Classification", Second Edition, Wiley & Sons, 2001.
3. Trevor Hastie, Robert Tibshirani and Jerome Friedma, "The Elements of Statistical Learning", Springer, 2001.

(*) Latest edition of the books need to be procured.

CE1.2-R4: MACHINE LEARNING

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

1.
 a) Define learning system, what is goal of Machine Learning?
 b) What is tree pruning? Explain with example.
 c) Explain the terms: Bagging, Boosting.
 d) What is Neural Network? Define various layers of Neural Network.
 e) What is significance of maximum margin linear separators in support vector machine?
 f) Explain term unsupervised learning? List types of unsupervised learning.
 g) Write Naive Bayes learning algorithm.

 (7X4)

2.
 a) What is Hopfield network? Discuss various features of it.
 b) Explain Recursive induction of decision tree with example.
 c) What is rough set? How it differs from fuzzy set?

 (6+6+6)

3.
 a) What is a perception? How we can compare it with neuron? Explain how perceptions are used to solve classification problem?
 b) Explain K-Nearest-neighbor algorithm with example.
 c) Write a PROLOG program to find the nth element of a list and to find the union of two lists.

 (8+6+4)

4.
 a) Given the following sentences:
   1. John likes all kinds of food.
   2. Apples are food.
   3. Chicken is food.
   4. Anything anyone eats and isn't killed by is food.
   5. Bill eats peanuts and is still alive.
   6. Sue eats everything Bill eats.
   Convert these statements into formulas in propositional logic and then clause form. Using resolutions prove that John likes peanuts.
 b) What is clustering? Explain K-means partition clustering method with example.
 c) Explain various types of cuts in PROLOG.

 (6+8+4)

5.
 a) Write a short note on inverse learning.
 b) Describe models of learnability. Explain concept of probably approximately correct (PAC) learning with explain.
 c) How to measuring the accuracy of learned hypotheses? Compare various learning algorithms.

 (4+8+6)

6.
  a) What is horn clause? Convert the following sentences in First order predicate
      logic and then horn clause.
      1. Everyone is loyal to someone.
      2. All men are mortal.
  b) What is PROLOG? Explain structure of prolog program with example.
  c) What is difference between predicate and propositional logic?

                                                                    (10+6+2)

7.
  a) How the resolution is done in propositional logic?
  b) Write short note on Version spaces and the candidate elimination algorithm with
      example.
  c) Explain Certainty factor in context of Bayes' theorem

                                                                    (4+8+6)

CE1.3-R4: CYBER FORENSICS AND LAW

Objective of the Course

The aim of this course is to introduce students to reveal and track the legal and illegal activities on the net. Cyber Forensics has been in the popular mainstream for some time, and has matured into an Information-Technology (IT) capability that is very common among modern information security programs. The goal of cyber forensics is to support the elements of troubleshooting, monitoring, recovery, and the protection of sensitive data in the cyberspace. Moreover, in the event of a crime being committed, Cyber Forensics is also an approach for collecting, analyzing, and archiving data as evidence in a court of law. Although scalable to many IT domains, especially modern corporate architectures, Cyber Forensics can be challenging when being applied to non-traditional environments, which do not comprise of current ITs or are designed with technologies that do not provide adequate data storage or audit capabilities. In addition, further complexity is introduced if the environments are designed using proprietary solutions and protocols, thus limiting the ease of which modern forensic methods can be utilized.

At the end of the course, the student will understand:
- Understand the basics and principles of Cyber Forensics and Law
- Able to do step-by-step through the basics of investigation and introduce the tools and procedures required to legally seize and forensically evaluate a suspect machine
- Understand rules of evidence, chain of custody, standard operating procedures, and the manipulation of technology to conceal illegal activities and how cyber forensics can uncover them

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction	06
2.	Cyber Forensics Tools and Utilities	08
3.	Concealment Techniques	06
4.	Hardware: Model System Platforms	04
5.	Software: Operating Systems, Network Traffic and Applications	10
6.	Standard Operating Procedures: Digital Forensic Laboratory Accreditation Standards	10
7.	Acquiring Data, Duplicating Data, and Recovering Deleted Files	08
8.	Forensic Discovery and Analysis Using Back Track	05
9.	Privacy and Cyber Forensics	03

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Introduction   06 Hrs.

History of Forensics, Rules of Computer Forensics, Technology Abuses Affecting Corporate and Personal Securities, Defining Cyber Forensics, Cyber Forensics Investigation Process, Dividing Force Behind implementing Corporate Cyber. Overview of cyber crimes.

2. Cyber Forensics Tools and Utilities   08 Hrs.
Introduction, Cyber Forensics Tools, Tool Review, Coroner's Toolkit, EnCase Forensic, i2 Analyst's Notebook, LogLogic's LX2000, Mandiant First Response, NetWitness, ProDiscover Incident Resoinsem Sleuth Kit and Autopsy Browser, Additional Tools for the Investigers, SafeBack, GetTime, FileList, FileCnvt, Getfree, Swap Files, Temporary Files

3. Concealment Techniques   06 Hrs.
Spoliation, Secret Key Cryptography, Public Key Cryptography, Hash Function, Spoofing, Internet Protocol, Transmission Control Protocol, Hijacked Session Attacks, Polymorphism, Steganography, Reversing the Steganographic process, Counter- or Anti Forensics, Cloaking Techniques: Data hide and seek, Renaming Files, Manipulating File Systems, and Data Hiding on NTFS

4. Hardware: Model System Platforms   04 Hrs.
Introduction, Computers, Power Supply, Hard Drive, Laptops, Tablets, External Storage, Servers, I-Pods, PDAs, Digital appliances such as washing machines, microwave ovens.

5. Software: Operating Systems, Network Traffic and Applications   10 Hrs.
Introduction, NIST, Using Data from Operating Systems, BIOS, Volatile Data, Using Data From Network Traffic, Network Forensics Analysis Tools, Collecting Network Traffic Data, Examining Collected data, Identify an Event of Internet, Examine data sources, Data Source Value, Examination and Analysis Tolls, Attackers Identification, e-mail, Web Usage, Interactive Communication, Security Applications.

6. Standard Operating Procedures: Digital Forensic Laboratory
   Accreditation Standards   10 Hrs.
Digital Forensic Laboratory accreditation Standards, Laboratory Manager Checklist, Digital Forensics Examiner Checklist, Technician or Assistant Checklist, Budget Checklist, Training and Testing Checklist, Evidence Control Checklist, Quality Assurance Checklist, Equipment Checklist, Health and Safety Checklist, Laboratory Facilities Checklist

7. Acquiring Data, Duplicating Data, and Recovering Deleted Files   08 Hrs.
Recovering Deleted Files and Deleted Partitions: Deleting Files, Recycle Bin, Data Recovery in Linux, Recovering Delete Files, Deleted File recovery Tools, Recovering Deleted Partitions, Deleted Partition Recovery Tools, Data Acquisition and Duplication.

8. Forensic Discovery and Analysis Using Backtrack   05 Hrs.
Digital Forensics, Acquiring Images, Forensic Analysis, File Carving.

9. Privacy and Cyber Forensics   03 Hrs.
Law Relating and Privacy, Common Law Privacy, Privacy: Common Law Privacy, Constitutional Law; Legal Liability for Mistakes.

RECOMMENDED BOOKS (*)

MAIN READING

1. Albert J.Marcella, Jr. Doug Menendez, "Cyber Forensics", Second Edition, Auerbach Publications.
2. Anthony Reyes & Jack Wiles, "Cybercrime and Digital Forensics", Syngress.

SUPPLEMENTARY READING

1. Dan Farmer & Wietse Venema, "Forensics Discovery", Addision-Wesley, Professional Computing Series
2. Jonathan Rosenoer, "Cyber Law:The law of the interner", Springer Verlag, 1996

(*) Latest edition of the books need to be procured.

CE1.3-R4: CYBER FORENSICS AND LAW

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a)   Define cyber forensic .What is the importance of cyber forensics?
b)   What is need of cyber forensic tools?
c)   What does term steganography means? List four steganography tools.
d)   How to define digital forensic examination and analysis tools using abstraction layers?
e)   Explain the points related to quality assurance of digital forensic laboratory.
f)   How does deleted recovery file tools work? Name some of them.
g)   What is digital evidence computer forensics?

(7X4)

2.
a)   What is criminal justice in India and implications on cyber crime?
b)   How internet traffic been measured? What is traffic index?
c)   How to collect data from network traffic?

(6+6+6)

3.
a)   Distinguish between cyber crime and conventional crime.
b)   How to trace an attacker using deterministic edge router marking?
c)   Explain types of law enforcement computer forensic technology

(4+8+6)

4.
a)   Explain Prodiscover Incident Response in brief
b)   How to define digital forensic examination and analysis tools using abstraction layers?
c)   Explain the points related to quality assurance of digital forensic laboratory.

(5+7+6)

5.
a)   Difference between secret key algorithm and public key algorithm
b)   How to secure your emails using SSL?
c)   How does a deleted recovery partition tool work? name some of them

(6+7+5)

6.
a)   Explain Cloaking Techniques in detail
b)   Differentiate between Block based Carving and Characteristic Based Carving.
c)   What are the mode and manner of committing cyber crime?

(7+4+7)

7.
a)   Explain the following terms :
   1)   Spoofing
   2)   TCP
   3)   IP
b)   How does deleted recovery file tools work?
c)   What is the use of computer forensics in law enforcement?

(6+6+6)

CE1.4-R4: PROJECT MANAGEMENT

Objective of the Course

The course aims to provide an understanding management issues process during software project management. It provides holistic views of different aspect of development process necessary for the management of the project which includes various activities , resources, quality, cost and system configuration etc. This course will be supported by appropriate software package.

At the end of the course, the student will understand:
- Introduction to Software Project Management System
- Overview of Project Planning
- Project Estimation
- Project Scheduling
- Organization and Team Structure
- Risk Analysis and Management
- Resource Allocation
- Project Tracking and Configuration Management
- Project Contract Management
- Software Quality Assurance

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introduction to Software Project management System	06
2.	Overview of Project Planning	08
3.	Project Estimation	06
4.	Project Scheduling	06
5.	Organization and Team Structure	06
6.	Risk Analysis and Management	04
7.	Resource Allocation	06
8.	Project Tracking and Configuration management	06
9.	Project Contract management	06
10.	Software Quality assurance	06

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Introduction to Software Project Management System   **06 Hrs.**
Software Development as a project, stakeholders in software project, software product, processes, quality and cost, objectives, issues and problems relating to software projects.

2. Overview of Project Planning   **08 Hrs.**
Steps in project planning, defining scope and objectives, deliverables and other products, alternatives in planning,

3. Project Estimation   06 Hrs.

Project Size Estimation Metric: LOC, FP, Feature Point. Estimation Technique: Empirical, Heuristics and analytical. COCOMO Model, Halstead, Putnam and SLIM models for Time and Effort Estimation. Staffing Level Estimation: Effect on schedule change on cost and Jensen model.

4. Project Scheduling   06 Hrs.

Work Breakdown structure, Activity Network: Network planning model, Activity –on-arrow network, precedence network, Forward and Backward pass, Critical Path, Stack and float, Gantt Chart, PERT Charts.

5. Organization and Team Structure   06 Hrs.

Overview of Organization structure and Team Structure, Organizational Behavior, Recruitment and Placement, Staffing, Motivation and Group Behavior. Individual and Group Decision making, Leadership and Leader style, Forms of Organizational Structure

6. Risk Analysis and Management   04 Hrs.

Risk Identification, Nature and Categories of Risk in software Development, Risk Assessment; Risk Mitigation, Monitoring and Management(RMM), RMM Plan, Risk Containment, Evaluating Scheduling Risk using PERT.

7. Resource Allocation   06 Hrs.

Nature of Project Resources, Identifying resource requirement for Activities, Allocating and Scheduling Resources, Cost of Resources, Standard, Plan and Actual Cost, Cost variance, Time cost trade off.

8. Project Tracking and Configuration Management   06 Hrs.

Measurement of Physical and Financial progress, Earned value analysis, Status reports and Milestone reports. Necessity of configuration management, Configuration Management Activity, Change control, Source code Control System (SCCS).

9. Project Contract Management   06 Hrs.

Outsourcing of products and services, Types of contract, Stages in contract placement, Terms and Condition of contract, Contract monitoring and Acceptance Testing.

10. Software Quality Assurance   06 Hrs.

Quality Control, Assurance, Movements, SQA-Software Quality Assurance Activities, Approaches To SQA, Reliability, ISO 9000 And 9001, CMM Levels, Quality Audit. (CMMI Levels may be included as CMM is replaced with CMMI)

RECOMMENDED BOOKS (*)

MAIN READING
1. Bob Hughes and Mike Cotterell, "Software Project Management", 3rd Edition, 2002, Mc Graw-Hill.
2. Pankaj Jalote, "Software Project management in Practice", 2002, POearson Education, Asia.

SUPPLEMENTARY READING

1. Roger S. Pressman, "Software Engineering: A Practical Approach", 5th Edition, 2001, McGraw-Hill.
2. Ian Sommerville, "Software Engineering", Addison Wesley.
3. Rajib Mall, "Fundamentals of Software Engineering", Prectice Hall of India.

(*) Latest edition of the books need to be procured.

Many research papers will be required for reading this course. In addition, the student should obtain one or more books on UML for reference. Pretty nearly any UML book will do, but the following list would constitute the author's recommendations.

1. **The Unified Modeling Language Reference Manual**, by James Rumbaugh et al, Addison-Wesley (note: a primary reference, 1st ed. available very cheap on internet)
2. **The Unified Modeling Language User Guide**, by Grady Booch et al, Addison-Wesley
3. **The Unified Software Development Process**, by Ivar Jacobson et al, Addison-Wesley
4. **Object-Oriented Software Engineering**, Bernd Bruegge and Allen Dutoit, Pearson/Prentice Hall
5. **UML Toolkit**, Hans-Erik Eriksson and Magnus Penker, Wiley.
6. **Using UML: Software Engineering with Objects and Components**, Perdita Stevens with Rob Pooley, Addison-Wesley, ISBN 0-201-64860-1 (used in last year's Advanced Software Engineering course)
7. **UML Pocket Reference**, Dan Pilone, O'Reilly (or UML in a Nutshell, same publisher)

CE1.4-R4: PROJECT MANAGEMENT

Model Question Paper

NOTE:

1. Answer question 1 and any FOUR questions from 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a) Give reasons of why software project is different from and harder to manage than other engineering discipline projects.
b) Discuss how software quality can be achieved during software development.
c) What is the relationship between software configuration management and software maintenance?
d) Discuss merits and demerits of ISO 9001 and SEI CMM certification.
e) Explain why software reliability always takes precedence over efficiency.
f) Describe the software project management best practices.
g) What are the five software configuration management tasks? Define and discuss each of them.

(7x4)

2.
a) What are the four attributes which all software products should have? Explain each of them in brief. Suggest three other attributes which may be significant.
b) Why is it important to develop the cost and schedule estimates during planning before software requirement analysis or design conducted?
c) "Many people believe that the only way in which the order of magnitude and improvements in software quality and productivity will be achieved is through component based development". Is this statement true? Explain.

(7+5+6)

3.
a) What is the difference between a revision and a version? What do you mean by version control? Why is version control required? How can version control be achieved?
b) Discuss the problems associated with the implementation of a successful quality assurance plan in a software development organization. Is it possible to assess quality of software before the programs are actually developed?
c) Project managers normally use PERT charts for doing resource allocation, whereas GANTT charts are used for monitoring and controlling the progress of the project. Justify the statement.

(6+6+6)

4.
a) In which units the productivity of a software development team can be measured? List three important factors that affect the production of a software development team.
b) Can there be more than one critical path in a project schedule? Why is it important for the project manager to identify the critical paths in a project schedule?
c) Name the risk based software development process model? What are its advantages and disadvantages? What is early risk resolution? Why 80% of risks resolution should be completed by the end of the elaboration phase in a modern software project?

(6+6+6)

5.

a) Explain the need for software measures. What is a Function Point? What are the advantages and disadvantages of FP based metrics. How the software size for the application can be estimated in function points? Also using FP count, how the efforts can be estimated provided various productivity means are given.

b) What are the fundamental tasks that must be included in SQA planning?

c) Is it true that "High quality software process should lead to high quality software products"? Justify. Can all software projects be managed with the help of evolutionary model of software development?

(8+4+6)

6.

a) Which are the four primary functions, which software project managers perform? What are the attributes of a successful software project manager?

b) What is the meaning of earned value analysis? How to perform it? What is error tracking as a project tracking and control approach?

c) What is the software configuration? Why does one has to manage it? What are the five software configuration management tasks? Define and discuss each of them.

(8+4+6)

7.

a) Many software projects are so large that a no. of software development teams must be formed. Recommend a management structure for coordinating multiple teams. What are the potential problems that can arise?

b) What is the critical distinction between a milestones and deliverables? Explain with an example.

c) Why is Project Management important to the software development process?

d) Suppose an organization assessed at Level 3 of SEI CMM, what can you infer about the current quality practices at the organization? What does the organization has to do to reach SEI CMM Level 4?

e) Is it true that a software product can always be developed faster by having a larger development team of competent software engineers? Justify your answer.

(4+4+4+4+2)

CE1.5-R4: MOBILE COMPUTING

Objective of the Course

This course is designed for students interested in the broad area of mobile computing techniques and technologies. It exposes students to mobile computing framework, supporting communication and networking techniques and implementation issues. Broadly the material is organized as introductory concepts, communication infrastructure, networking issues, data management, programming support and security. The lecture material is supplemented by practicals and tutorials.

Outline of Course

S. No.	Topic	Minimum number of hours
1.	Introductory Framework	03
2.	Wide-Area Mobile Communication Access	07
3.	Local-Area Mobile Communication Access	07
4.	Mobile Network Layer	08
5.	Mobile Transport Layer	06
6.	Mobile Data bases	09
7.	Mobile Server and Management	06
8.	Mobile Operating Systems	04
9.	Programming and Language support	05
10.	Security in Mobile Computing	05

Lectures	**=**	**60**	
Practical/Tutorials	**=**	**60**	
Total	**=**	**120**	

Detailed Syllabus

1. Introductory Framework   03 Hrs.
Concept of mobile computing, basic architecture. mobile devices, limitations of mobile devices.

2. Wide Area Mobile Communication Access   07Hrs.
GSM architecture and operations - radio interfaces, handover, security; General Packet Radio Service (GPRS); CDMA Systems - WCDMA, IMT-2000, UMTS,

3. Local Area Mobile Communication Access   07 Hrs.
Basic MAC protocol CSMA/CA, Infrastructure and ad hoc network topologies, MACA, MACAW; use of PCF, IEEE 802.11 standards, Hiperlan; IrDA; Blue Tooth, ZigBee.

4. Mobile Network Layer   08 Hrs.
Routing algorithms - DSR, AODV, TORA, CGSR. Mobile IP- basic concept, handover management, location management, registration, tunneling, route optimization, dynamic host configuration.

5. Mobile Transport Layer   06 Hrs.
Limitations of TCP in mobile wireless systems, TCP fixes – Snooping, Indirect TCP; TCP variants - Fast retransmit/recovery, TCP - Reno, TCP-freeze, TCP- Transaction oriented, Explicit notification.

6. Mobile Databases   09 Hrs.

Basic concepts - Hoarding and caching, cache invalidation, client - server computing architecture, transaction models, query processing, data recovery. Data dissemination - communication asymmetry, data delivery mechanisms, broadcast disks, selective tuning and indexing; synchronization protocols.

7. Mobile Server and Management   06 Hrs.

Mobile agents, gateways, service discovery,   device management, mobile file system.

8. Mobile Operating Systems   04 Hrs.

Basic concepts; requirements, Symbian OS, Palm OS.

9. Programming and Language Support   05 Hrs.

WAP architectures, WML, X HTML - MP, XML, J2ME.

10. Security in Mobile Computing   05 Hrs.

Information security, techniques and algorithms, protocols, trust, security models and frame works.

RECOMMENDED BOOKS (*)

MAIN READING

1. Raj Kamal, "Mobile Computing", Oxford University Press.
2. A.K. Talukder and R.R. Yavagal, "Mobile Computing : Applications and Service Technology, Creation", Tata-McGraw Hill.

SUPPLEMENTARY READING

1. W. Stallings, "Wireless Communications and Networks", Pearson Education.
2. P. Nicopolitidis, M.S. Obaidat, G. Papadimitriou and A.S. Pomportsis, "Wireless Networks", Wiley (Singapore Edition).

(*) Latest edition of the books need to be procured.

CE1.5-R4: MOBILE COMPUTING

Model Question Paper

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

TOTAL TIME: 3 HOURS   **TOTAL MARKS: 100**

1.
a)   What is handoff? Which are the types of handoff present in GSM technology? Which device does handle that handoff?
b)   List the reasons to get registration denial from foreign agent.
c)   How does Universal Telecommunication Systems (UMTS) provide interoperability and global roaming?
d)   What is Push-data-in-air technology?
e)   What are the limitations of IP addressing scheme to provide mobility?
f)   List and brief security concern in Mobile Transaction.
g)   What are the transactions take place in Kangaroo algorithm?

(7 X 4)

2.
a)   Write and explain registration request packet format in Mobile IP.
b)   What are the differences between Wireless and Mobile Technology?
c)   Explain GPRS network operation and available data services in GPRS.

(6+6+6)

3.
a)   What are the major security concerns in mobile transaction?
b)   Write short note on: UMTS
c)   Which are the groups of services supported by the GSM?

(3+10+5)

4.
a)   What are the characteristics of 3rd and 4th Generation network?
b)   By taking suitable network diagram, explain steps of Destination Sequence distance Vector Algorithms
c)   In satellite communication, explain LEO, GEO, and MEO.

(5+5+8)

5.
a)   What are the differences between FDMA, TDMA and CDMA?
b)   How does WAP integrated with HTTP gateway?
c)   What are the needs to have Mobile DBMS? Explain ACID properties of transaction with respect to Mobile Host.

(6+6+6)

6.
a)   Describe briefly History of Mobile Technology.
b)   List and Explain layers of Bluetooth protocol stack.
c)   What kind of tables is maintained by foreign agent during registration process of Mobile node?

(4+10+4)

7.
a)   Describe issues related Naming, Routing and Mobility management of Mobile node?
b)   What are the components Cellular technologies (GSM)? Explain the functionality of each components of Cellular Technology.

(9+9)