1.ENGINEERING MATHEMATICS – IV SYLLABUS

Semester: IV **Year: 2017-18**

Subject Code: 15MAT41	**IA Marks: 20**
Total Contact Hours: 50 hrs	**Hours per week: 4**
VTU Exam Marks: 80	**Exam: 3 Hours**

1. Course Details 1.1 Syllabus

MODULE	Levels	No. of hrs
MODULE-I **Numerical Methods**: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae).	**L2 & L3**	10
MODULE-II **Numerical Methods**: Numerical solution of second order ordinary differential equations, Runge- Kutta method and Milne's method. **Special Functions**: Series solution-Frobenious method. Series solution of Bessel's differential equation leading to $J_n(x)$-Bessel's function of first kind. Basic properties, recurrence relations and Orthogonality. Series solution of Legendre's differential equation leading to $P_n(x)$-Legendre Polynomials. Rodrigue's formula, problems	**L2 & L3**	10
MODULE-III **Complex Variables:** Review of a function of a complex variable, limits, continuity and differentiability. Analytic functions, Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems. **Transformations:** Conformal transformations, discussion of transformations $W = Z^2, W = e^z, W = z + \left(\frac{1}{z}\right)$ $(z \neq 0)$ and bilinear transformations-Problems	**L2 & L3** **L4**	10
MODULE-IV **Probability Distributions:** Random variables(discrete and continuous), Probability mass/density functions. Binomial distribution, Poisson distribution, Exponential and normal distributions, Problems. **Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.	**L3**	10
MODULE-V **Sampling Theory:** Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.	**L3 & L4**	10

Stochastic process: Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability simple problems.		

Question paper pattern:

- The question paper will have **ten** full questions carrying equal marks.
- Each full question consisting of **16** marks.
- There will be **two** full questions (with a **maximum** of **four** sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer **five** full questions, selecting **one** full question from each module.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Life-Long Learning
4. Accomplishment of Complex Problems

Text Books:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.

2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.

Reference books:

1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

2. *B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.*

3. *H. K. Dass and Er. RajnishVerma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition,2011.*

We links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111

2. http://wwww.khanacademy.org/

3. http://www.class-central.com/subject/math

1.2. Prerequisites of the course:

To learn this subject, the student must have the knowledge about differentiation integration, set theory, permutation & combination and probability.

1.3. Overview of the course:

The primary goal of this course is to highlight the essential concepts of i) numerical methods ii) complex variables iii) series solutions of differential equations iv) probability

Many differential equations of interest to engineers are not amenable to analytical solutions and hence we must resort to numerical solutions. Also the rapid development of high speed digital computers and the

Increasing desire for numerical answers to applied problems has led to the enhanced demands in the methods and techniques of numerical analysis.

Complex variables are useful in the study of fluid mechanics, thermodynamics, electric fields, aerodynamics, elasticity etc. Conformal mapping, which preserves angles in magnitude and

sense, is useful in solving boundary value problems in two dimensional potential theory by transforming a complicated region to a simpler region.

The solutions to differential equations with variable co-efficient cannot be expressed as finite linear combination of known elementary functions, however in such cases solutions can be obtained in the form of infinite power series. In series solutions of differential equations with variable co-efficients we use power series method.

Probability is the measure of how frequently the same event occurs in an experiment. The study of probability provides a mathematical frame work to asses the chances of the predictions coming true and is essential in every decision making process.

Probability distribution is the theoretical counter part of frequency distribution, and plays an important role in the theoretical study of populations. Ex: The shoes industry should know the sizes of foot of the population. Sampling aims at gathering the maximum information about the population with the minimum effort, time and cost.

Stochastic process: Stochastic process technique, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability

1.4. Relevance of the course to this program:

Numerical Methods:

Numerical techniques are applicable for determining the motion of a body falling through a viscous fluid arising in a wide variety of engineering contexts.

Complex variables:

In the theory of alternating current, the application of complex impedance involves functions having complex numbers as independent variables. The theory of complex variables has made a significant contribution in the design of aerofoil sections for aircraft and other lifting bodies. The strength of the theory in such applications is its ability to generate mappings which transforms complicated shapes, such as an aerofoil section into a simpler shape.

1.5. Course Outcomes:

1. Use appropriate single step and multi-step numerical methods to solve first and second order ordinary differential equations arising in flow data design problems.
2. Explain the idea of analyticity, potential field's residues and poles of complex potentials in field theory and Electromagnetic theory.
3. Employ Bessel's functions and Legendre's polynomials for tackling problems arising in continuum mechanics, hydrodynamics and heat conduction.
4. Describe random variables and probability distributions using rigorous statistical methods to analyze problems associated with optimization of digital circuits, information, coding theory and stability analysis of systems.
5. Apply the knowledge of joint probability distributions and Markov chains in attempting engineering problems for feasible random events

Complex Integration:

To express a complex function as a Taylor's series is applicable in the field of Control and communications theory

Series Solution of ordinary differential equations and special functions :
Heat equation, wave equation and Laplace's equation with cylindrical symmetry can be solved in terms of Bessel's functions, with spherical symmetry by Legendre's polynomials.

Probability distributions:
Probability distributions are applicable for problems concerning i) Radar detection ii) Number of rounds fired from a gun hitting a target. iii) Defective vehicles in a workshop. iv) Telephone calls. v) Errors made by chance in experimental measurements. vi) Reliability and queuing theory.

Joint Probability: Problems in Economics, Biology or social science needs statistical method analyzing two or more variables in such cases the concept of joint probability required.

Sampling:
It is quite often necessary to draw some valid conclusions concerning a large mass of population which is practically impossible and therefore it is preferred to examine a small part of the population called Sample with the motive of drawing some conclusion about the entire population.

Stochastic Process: Stochastic process can be used to analyze and solve diver's range of problems arising in production and inventory control, resource planning, service systems computer networks and many others.

2. Module wise plan:

Module - 1	**Title : Numerical Methods**	**Planned Hours: 08**

Learning Objectives: At the end of this chapter student should be able to

1. Recall the various formulae
2**.** Apply the appropriate formulas to solve the differential equations with initial conditions.
3. Interpret the one step methods to solve the differential equations with one initial condition and using successive integrations.
4. Interpret the multistep methods to solve the differential equations with more than one initial condition.
5.Apply Milne's and Adams-Bashforth's methods to solve the differential equations with one initial condition after using one step method to get the required number of initial conditions.
6**.** Evaluate the predicted value of y at x_{n+1} and then correct it using the corrector formula.

Lecture no.	**Topics covered**	**Teaching Method**	**PSOs**	**POs Attained**	**COs Attained**	**Ref Book/ Chapter no.**
L1	Numerical solution of ordinary differential equations of first order and first degree. Examples on Taylor's series					

	method	Chalk and Board	1	1, 2, 4, 5, 11	1	T1/32, T2/21
L2	Some more examples on Taylor's series method					
L3	Euler's formula & Modified Euler's formula- examples					
L4	Some more examples on Modified Euler's method					
L5	Runge-Kutta method of fourth order-examples					
L6	Milne's predictor and corrector method-examples					
L7	Some more examples on Milne's method					
L8	Adams-Bashforth predictor and corrector method-examples					

Lesson Plan:

Question Bank :	**COs Attained**
1. Using Taylor's series method, compute the solution of: a) $\frac{dy}{dx} = x+y$, y(0) = 1 at the point x = 0.2 correct to three decimal places. b) $\frac{dy}{dx} = x-y^2$, y(0) = 1 at the point x = 0.1 c)the initial value problem $\frac{dy}{dx} = 2y+3e^x$, y(0)=0, at x = 0.1 and x = 0.2 d) $dy = (xy-1)dx$, y = 2 at x =1 at the point x = 1.02 e) $y' = x^2+y$ in the range $0 \le x \le 0.2$ by taking step size h= 0.1 ,given that y = 10 at x = 0, initially considering terms up to the fourth degree. f) $\frac{dy}{dx} = x^2+y^2$, y(0) = 0 at the point x = 0.4 correct to three decimal places. g) 2. Using Euler's modified method, obtain a solution of the equation a) $\frac{dy}{dx} = x+\lvert\sqrt{y}\rvert$, with initial conditions y =1 at x = 0 , for the range 0<x<0.6 in steps of 0.2. b) $\frac{dy}{dx} = -xy^2$ y = 2 at x = 0 Obtain 'y' at x = 0.2 in two stages of 0.1 each.	**1**

c) $\frac{dy}{dx} = x - y^2$, y(0) = 1 taking h = 0.1, find y(0.2) correct to four decimal places

d) $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$, with y(20) = 5 ,taking h = 0.2. Find y(20.2) and y(20.4)

e) $\frac{dy}{dx} = x^2 + y$, y(0) = 1 taking h = 0.05, find y(0.1) considering the accuracy up to two approximations in each step.

3. Employ Runge-Kutta method of fourth order to solve the equation

a) $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0) = 1 at x = 0.2 taking step length h = 0.2.

b) $10\frac{dy}{dx} = x^2 + y^2$, and y(0)=1 , compute y(0.2) (Take h=0.2)

c) $\frac{dy}{dx} = \frac{y - x}{y + x}$ y(0)=1 , compute y(0.2) (Take h=0.2)

d) $(x + y)\frac{dy}{dx} = 1$ y(0.4) = 1 at x = 0.5

4. Using Milne's method and Adams–Bashforth's predictor- corrector method, solve

a) Given $\frac{dy}{dx} = x - y^2$ and the data

X:	0	0.2	0.4	0.6
Y:	0	0.02	0.0795	0.1762

Find y(0.8)

b) Given that $\frac{dy}{dx} = x^2 + \frac{y}{2}$, and y(1)=2,
y(1.1)=2.2156, y(1.2)=2.4649 and
y(1.3)=2.7514. compute y(1.4) ,correct to three decimal places.

c) Given $\frac{dy}{dx} = 2e^x - y$ and the data

X:	0	0.1	0.2	0.3
Y:	2	2.010	2.040	2.090

Find y(0.4)

d) Given that $\frac{dy}{dx} = x + y^2$ & the data.

Compute y(0.4)

e) Given $\frac{dy}{dx} = x^2 - y$, $y(0) = 1$ and the starting values y(0.1) = 0.90516,

X:	0	0.1	0.2	0.3

1

	Y:	1	1.1	1.231	1.402	Y (0.2)=0.82127, y(0.3) = 0.74918 evaluate y(0.4).	

Module - 2	**Title : Numerical Methods**	**Planned Hours: 12**

Learning Objectives: At the end of this chapter student should be able to

1.	**Recall** the various formulae
2.	**Apply** the appropriate formulas to solve the second order ordinary differential equations with initial conditions.
3.	**Solve** the Bessel differential equation in series, Recurrence relations
4.	**Solve** the Legendre differential equation in series.
5.	**Apply** Rodrigue's formula to evaluate Legendre polynomials.

Lesson Plan:

Lecture no.	**Topics covered**	**Teaching Method**	**PSOs**	**POs attained**	**COs attained**	Ref Book/ Chapter no.
L09	Numerical solution of second order ordinary Differential equations- Runge-Kutta method-examples	Chalk and Board	1	1, 2, 4, 5, 11	1	T1/3 2T2/ 21,5
L10	Milne's method- Examples					
L11	Series solution –Frobenious method					
L12	Series solution of Bessel differential equation leading to $J_n(x)$-Bessel's function of first kind					
L13	Basic properties, and examples					
L14	Some more Examples					
L15	Recurrence relations.					
L16	Orthogonality					
L17	Series solution of Legendre Differential equation leading to $P_n(x)$					
L18	Legendre polynomials					
L19	Examples					
L20	Rodrigue's formula					

Assignment questions:

Assignment questions	COs Attained
1. Using Runge-Kutta method find third approximation to the values a) $y'' = xy'^2 - y^2$ for x = 0.2 correct to four decimal places. Initial conditions are x = 0, y = 1, y' = 0 b) $\frac{d^2y}{dx^2} = x^3\frac{dy}{dx} + x^3y$, given y(0) = 1 , y′ (0) = ½ c) $\frac{d^2y}{dx^2} = x\frac{dy}{dx} - y$ given that y = 1, $\frac{dy}{dx} = 0$ when x = 0 d) $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ given that y = 1, $\frac{dy}{dx} = 0$ when x = 0	**1**
2. The angular displacement of θ of a simple pendulum is given by the equation $\frac{d^2\theta}{dt^2} + \frac{g}{l}\sin\theta = 0$, where l = 98 cm and g = 980 cm/sec^2, if θ = 0 and $\frac{d\theta}{dt} = 4.472$ at t = 0, use Runge-Kutta method to find θ.	
3. Given y″ + xy′ + y = 0, y(0) = 1 , y′(0) = 0, obtain y for x = 0(0.1)0.3 by any method. Further, continue the solution by Milne's method to calculate y (0.4).	1
4. Applying Milne's method compute $y(0.8)$ given that y satisfies the equation $y'' = 2yy'$ and y & y' are governed by the fallowing values x: 0, 0.2, 0.4, 0.6 y: 0, 0.2027, 0.4228, 0.6841 y': 1, 1.041, 1.179, 1.468	
5. Apply Milne's method to compute y (0.4) given the equation $y'' + y' = 2e^x$ And the following table of initial values. x: 0, 0.1, 0.2, 0.3 y: 2, 2.01, 2.04, 2.09 y': 0, 0.2, 0.4, 0.6	**3**

6. Use Frobenius method to solve the equations
   a) $3xy'' + 2y' + y = 0$ b) $4xy'' + 2(1-x)y' - y = 0$
7. Solve Bessel's differential equation leading to $J_n(x)$.
8. Prove
   a) $\frac{d[x^n J_n(x)]}{dx} = x^n J_{n-1}(x)$ b) $\frac{d[x^{-n} J_n(x)]}{dx} = -x^{-n} J_{n+1}(x)$
   c) $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ d) $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$
9. Prove $2nJ_n(x) = x[J_{n+1}(x) + J_{n-1}(x)]$
10. Prove $\frac{d}{dx}[x^n J_n(x)] = x^n J_{n-1}(x)$
11. Prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = \begin{cases} 0 & \alpha \neq \beta \\ \frac{1}{2}[J_{n+1}(\alpha)]^2 & \alpha = \beta \end{cases}$ where α, β are the roots of
    $J_n(x) = 0$
12. Solve the Legendre's differential equation
    $(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + n(n+1)y = 0$
13. Prove the Rodrigue's Formula $P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}\left[(x^2-1)^n\right]$
14. Express the following polynomials in terms of Legendre polynomials
    a) $f(x) = 5x^3 + x$ b) $f(x) = 4x^3 - 2x^2 - 3x + 8$
    c) $f(x) = 2x^3 - x^2 - 3x + 2$ d) $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$
    e) $f(x) = x^3 + 2x^2 - 4x + 5$ f) $f(x) = x^3 - 5x^2 + 6x + 1$
    g) $f(x) = x^3 + 2x^2 - x + 3$ h) $f(x) = x^4 + x^3 + 2x^2 - x - 3$

3

Module : 3	Title : Complex variables	Planned Hours: 12

Learning Objectives: At the end of this chapter student should be able to

1. **Identify** the analytic functions
2. **Apply** the C-R equations to show the complex functions are analytic.
3. **Recall** the properties of analytic functions.
4. **Construct** the analytic functions given real or imaginary part using Milne Thompson method
5. **Evaluate** Complex Line Integrals by using Cauchy's theorem and formula
6. **Study** of Residue, Poles, Cauchy' Residue Theorem
7. **Interpret** the conformal mapping from z-plane to w-plane under some standard transformation
8. Find the Bilinear transformation and the corresponding invariant points

Lesson plan:

Lecture no.	Topics covered	Teaching Method	PSOs	POs attained	COs attained	Ref Book/ Chapter No.
L21	Introduction to function of a complex variable.Limit,continuity,differentiability and analytic function	Chalk and Board	1	1, 2, 4, 5, 11	2	T1/20 T2/13 ,14,16,17
L22	Cauchy-Riemann equations in Cartesian form and polar form					
L23	Properties of analytic functions and construction of analytic function f(z) given its real or imaginary parts					
L24	Line integral of Complex valued functions, Examples					
L25	Cauchy's theorem and related examples.					
L26	Cauchy's integral formula and Generalized Cauchy's integral formula -examples					
L27	Residues, Poles, Cauchy's Residue theorem with proof and problem					
L28	Problems.					
L29	Discuss the conformal transformation $w = z^2$, $w = e^z$ - examples					
L30	Discuss the transformation $w = z + \frac{1}{z}$ Examples					
L31	Bilinear transformations					

L32	Problems					

Question Bank :	**COs Attained**
1. Derive Cauchy – Riemann equations in Cartesian form and Polar form. 2. Define harmonic function. Prove that real and imaginary parts of an analytic function are harmonic in Cartesian and polar form 3. Show that the following functions are harmonic and find their harmonic conjugate. Also find the corresponding analytic function a) $u = e^{2x}(xcosy - ysin2y)$ b) $u = \frac{2\cos x coshy}{cos2x+cosh2y}$ c) $v = \left(r - \frac{1}{r}\right)sin\theta$ d) $v = \frac{-sin\theta}{r}$ e) $v = e^{-x}(xcosy + ysiny)$ f) $u = \frac{1}{r}cos\theta$ g) $v = -sinxsinhy$ h) $u = e^x \text{cosy} + xy$ i) $v = e^{-2y}sinx$ j) $u = (x-1)^3 - 3xy^2 + 3y^2$ 4.Construct analytic function f(z) = u + iv as a function of z using the following data a) $u - v = e^x(cosy - siny)$ b) $u - v = \frac{cosx+sinx-e^{-y}}{2cosx-e^y-e^{-y}}$ when $f\left(\frac{\pi}{2}\right) = 0$ c) $u - v = (x-y)(x^2 + 4xy + y^2)$ d) $u + v = \frac{2sin2x}{e^{2y}-e^{-2y}-2cos2x}$ e) $u + v = \frac{1}{r^2}(cos2\theta - sin2\theta)$ 5.If f(z) = u + iv is an analytic function of z, then prove that a) $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right]\lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$ b) $\left\{\frac{\partial}{\partial x}\lvert f(z)\rvert\right\}^2 + \left\{\frac{\partial}{\partial y}\lvert f(z)\rvert\right\}^2 = \lvert f'(z)\rvert^2$ c) $\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 = \left[\left(\frac{\partial f}{\partial u}\right)^2 + \left(\frac{\partial f}{\partial v}\right)^2\right]\lvert f'(z)\rvert^2$. 6. Show that $v = cosxsinhy$ is harmonic and find its harmonic conjugate. 7. Find the harmonic conjugate of $v = log\sqrt{x+y}$ and find its analytic function. 8. Evaluate $\int_C z\,dz$ where c is the i)straight line from i to i. ii)right half of the unit circle lzl = 1 9. Evaluate $\int_{1-i}^{2+3i}(z^2 + z)dz$ along the line joining the points (1, -1) & (2,3)	**2**

10. Prove that $\int_C \frac{dz}{z-a} = 2\pi i$, where C is the circle: $\lvert z - a \rvert = r$. 11.Prove that $\int_C (z-a)^n dz = 0$, (n, any integer $\neq -1$), where C is the circle : $\lvert z - a \rvert = r$. 12. Evaluate $\int_{1-i}^{2+i}(2x + iy + 1)dz$ along the two paths a) $x = t + 1$, $y = 2t^2 - 1$ b) the straight line joining (1 - i) & (2 + i) 13. Verify Cauchy's theorem for $f(z) = z^2$ taken over the boundary of a square with vertices at ± 1, $\pm i$ in counter clockwise direction. 14. Verify Cauchy's theorem for the function $f(z) = 3z^2 + iz - 4$, where c is the Square having vertices $1 \pm i, -1 \pm i$. 15. Verify Cauchy's theorem for the function $f(z) = ze^{-z}$ over the unit circle with Origin as the centre. 16. Verify Cauchy's theorem for the integral of z^3 taken over the boundary of the Rectangle with vertices -1, 1, 1 + i , -1 + i . 17. Evaluate $\int_C \frac{e^{2z}}{z-2}dz$ where C is the circle C: $\lvert z \rvert = 1$. 18. Evaluate $\int_C \frac{z^2+1}{z-3}dz$ where C is the circle C : $\lvert z - 1 \rvert = 1$ 19. Verify Cauchy's theorem for the function $f(z) = 2 \sin 5z$, where c is the Square with vertices $1 \pm i, -1 \pm i$. 20. Evaluate $\int_C \frac{z^2-z+1}{z-1}\,dz$ where C is the circle a) C : $\lvert z \rvert = 1$ b) C : $\lvert z \rvert = \frac{1}{2}$ 21. Evaluate $\int_C \frac{e^z}{z(1-z)^3}$ where C is a) C : $\lvert z \rvert = \frac{1}{2}$ b) C : $\lvert z - 1 \rvert = \frac{1}{2}$ c) C : $\lvert z \rvert = 2$ 22. Evaluate $\int_C \frac{dz}{z^2-4}$ over a) C : $\lvert z \rvert = 1$ b) C: $\lvert z \rvert = 3$ c) C: $\lvert z + 2 \rvert = 1$	**2**

23. Evaluate $\int_C \frac{e^z}{z-i\pi}dz$ where C is the circle a) C : |z | = 2π b) C : |z | = $\pi/2$ 24.Evaluate $\int_C \frac{e^{2z}}{(z-1)(z-2)}dz$ where C is the circle |z | = 3 25. Evaluate $\int_C \frac{sin\pi z^2+cos\pi z^2}{(z-1)^2(z-2)}dz$ where C is the circle |z | = 3. 26.If $f(z)$ has a simple pole at $z = a$,then $Res\ f(a) = \lim_{z\to a}[(z-a)\ f(z)]$ 27.Find the sum of the residues of $f(z) = \frac{sinz}{zcosz}$ *at its poles inside the circle* $\|z\| = 2$ 28.Determine the poles of the function $f(z) = z^2/(z-1)^2(z+2)$ And the residue at each pole. Hence evaluate $\oint f(z)dz$, *where C is the circle* $\|z\| = 2.5$ 29.Evaluate $\oint \frac{z-3}{z^2+2z+5}dz$ where C is the circle i)$\|z\| = 1$ ii)$\|z+1-i\| = 2$ iii) $\|z+1+i\| = 2$ 30.Evaluate $\oint \frac{sin\pi z^2+cos\pi z^2}{(z-1)^2\,(z-2)}\,dz$ where C is the circle $\|z\| = 3$ 31. Find the transformation of the straight lines parallel to the axes under the Transformation w = z^2. 32.Show that the transformation w = z^2 transforms a) The circle $\|z\| = a$ to a circle $\|w\| = a^2$ b) The first quadrant in the z-plane to the upper half of the w-plane c) The upper half of the z-plane to the entire w-plane. 33. Under the transformation w = z^2, find a) The image of the square region bounded by the lines x = 1,x = 2, y = 1 , y = 2. b) The image of the triangular region bounded by the lines x = 1, y = 1 ,	**2**

x + y = 1.

c) The image of the region bounded by ½ ≤ x ≤ 1 and ½ ≤ y ≤ 1.

34. Show that the transformation $w = e^z$ transforms lines parallel to the

a) y axis into concentric circles centered at the origin in the w- plane.

b) x axis into radial lines in the w-plane .

35.Show that under the transformation $w = e^z$

a) y axis is mapped onto the unit circle at the origin in the w-plane.

b) x axis is mapped onto the positive u-axis in the w-plane .

36. Find & draw the image of the rectangular region $-1 \le x \le 3$, $-\pi \le y \le \pi$ in the z-plane

under the transformation $w = e^z$

37.Find the images of the circles lzl = 1 and lzl = 2 under the conformal transformation

$w = z + \frac{1}{z}$ and sketch the region.

38.Discuss the transformation $w = e^z$ and show that it transforms the region between

the real axis and the line parallel to the real axis at $y = \pi$, into the upper half the

w- Plane.

39. Define bilinear transformation. Find the Bilinear transformation which maps the given

points and the corresponding invariant points.

a) z = 1, i, -1 into w = i, 0, -i b) z = -1,0,1 into w = 0, i, 3i

c) z = 1, i, -1 into w = 0, 1, ∞ d) z = 0,-i ,2i into w = 5i, ∞, -i/3

e) z = 0,-1, ∞ into w = -1,-2-i , i f) z = 2,1,0 into w = 1, 0, i,

g) z = -1,i,1 into w = 1, i, -1 h) z = 1, i, -1 into w = 2,i,-2

i) z = i,1, -1 into w = 1, 0, ∞, j) z = 0, i, ∞ into w = 1, -i, -1

Module - 4	**Title Probability Distributions**	**Planned Hours: 09**

Learning Objectives: At the end of this chapter student should be able to

1.	**Identify** Random variables, Discrete and continuous probability distributions.
2.	**Apply** the concept based on pdf & cdf and evaluate various problems based on it.
3.	**Interpret** mean, variance in Binomial, Poisson, Normal distributions, classify and evaluate and make certain judgments.

Lesson Plan:

Lecture no.	Topics covered	Teaching Method	PSOs	POs attained	COs attained	Ref Book/ Chapter no.
L33	Random variables, Discrete and continuous probability mass/density functions	Chalk and Board	1	1, 2, 4, 5, 11	4	T1/26, T2/22
L34	Examples on Probability functions.					
L35	Binomial distributions, mean and variance and examples					
L36	Poisson distributions, mean and variance and examples					
L37	Exponential distributions, mean and variance and examples					
L38	Normal distributions, mean and variance and examples					
L39	Joint probability distribution for two discrete random variables, examples.					
L40	Expectation, covariance, correlation coefficient.					
L41	Examples					

Question Bank :	**COs Attained**

1. A random variable 'x' has the following function values of 'x'

x	0	1	2	3	4	5	6	7
y	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + 7$

a) Find k b) Evaluate P(x < 6) c) Evaluate P(x ≥ 6) d) P (3< x ≤ 6)

2. A coin is tossed twice. A random variable X represents the number of heads turning up. Find the discrete probability distribution for X. Also find its mean andvariance.

3. Find the value of 'k' such that the following represents a finite probability distribution. Hence find its mean and standard deviation.

x	-3	-2	-1	0	1	2	3
y	k	2k	3k	4k	3k	2k	k

4. Prove that the mean & S. D of the Binomial distribution are np & $\sqrt{npq}$ respectively

5. Prove that the mean & S.D of the Poisson distribution are m & $\sqrt{m}$ respectively.

6. Six coins are tossed. Find the probability of getting

a) Exactly 3 heads b) At least 3 heads c) At least one head

7. A travel agency has 2 cars which it hires daily. The number of demands for a car on each day is distributed as a Poisson variate with mean 1.5. Find the probability that on a particular day a) there was no demand b) a demand is refused.

8. In a consignment of electric lamps 5% are defective. If a random sample of 8 lamps is inspected, what is the probability that one or more lamps are defective?

9. The probability of a shooter hitting a target is1/3. How many times he should shoot so that the probability of hitting the target at least once is more than ¾.

10. Show that mean & standard deviation of exponential distribution are equal.

4

11. Find the mean & standard deviation of normal distribution. 12. The length of telephone conversation has been an exponential distribution & found on an average to be 5 minutes. Find the probability that a random call made from this booth a) ends in less than 5 minutes b) between 5 & 10 minutes. 13. The probability that a man aged 60 will live up to 70 is 0.65. Out of 10 persons aged 60, what is the probability that a) at least 7 of them will live up to 70 b) exactly 9 will live up to 70 c) at most 9 will live up to 70. 14. In a quiz contest of answering 'Yes' or 'No' ,what is the probability of guessing at least 6 answers correctly out of 10 questions asked? Also find the probability of the same if there are 4 options for a correct answer. 15. The probability that a news reader commits no mistake in reading the news is $1/e^3$. Find the probability that on a particular news broadcast he commits i)only 2 mistakes ii) more than 3 mistakes iii)at most 3 mistakes. 16. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals, more than two will get a bad reaction. 17. The marks of 1000 students in an examination follows a normal distribution with mean 70 & standard deviation 5. Find the number of students whose marks will be a) less than 65 b) more than 75 18. In an examination 7% of students score less than 35%, marks & 89% of students score less than 63% marks. Find the mean & standard deviation if the	**4** **5**

marks are normally distributed.

19. In a normal distribution 31% of the items are under 45 and 8% are over 64. find the mean and standard deviation of the distribution.

20. The increase in sales per day in a shop is exponentially distributed with Rs.800 as the average. If sales tax is levied at the rate of 6%, find the probability that the increase in sales tax return from that shop will exceed Rs.30 per day.

21. The joint distribution of two random variables X and Y is as follows.

x \ y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Compute the following.

(a) $E(X)\ and\ E(Y)$ (b) $E(XY)$ (c) $\sigma_X\ and\ \sigma_Y$ (d) $COV(X,Y)$ (e) $\rho($

22. X and Y are independent random variables. X take values 2, 5, 7 with probability 1/2, 1/4, 1/4, respectively. Y takes values 3, 4, 5 with the probability 1/3, 1/3, 1/3

(a) Find the joint probability distribution of X and Y.

c) Show that the covariance of X and Y is equal to zero.

23. Find the joint distribution of X and Y, which are independent random variables with the following respective distributions;

x_i:	1	2
$f(x_i)$:	0.7	0.3

And

y_i:	-2	5	8
$g(y_i)$:	0.3	0.5	0.2

Show that Cov $(X,Y) = 0$.

24. Determine (a) marginal distributions of X and Y (b) Cov(X,Y), for the following joint distribution. Determine whether X and Y are independent.

X \ Y	-3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

25. A fair coin is tossed three times. Let X denote 0 to 1 according as a head or tail occurs on the first toss. Let Y denote the number of heads which occur. (a) Find the marginal distribution of X and Y, (b) Determine the joint distribution of X and Y and Cov(X, Y).	

MODULE:5	Title: SAMPLING THEORY & STOCHASTIC PROCESS	Planned Hours: 09

Learning Objectives: At the end of this chapter student should be able to

1. **Outline** the process of sampling made in daily life.
2. **Distinguish** between standard error, null and alternate hypothesis and Type I,II errors.
3. **Classify** and calculate the above said errors and apply known procedure to solve problems.
4. **Interpret** level of significance for means.
5. **Interpret** and explain confidence limits for means of large and small samples.
6. **Apply** known technique and solve the examples.
7. Interpret and evaluate scientific hypotheses
8. **Outline** the random process that undergoes transitions from one state to another on a state space.

Lesson Plan:

Lecture no.	Topics covered	Teaching Method	PSOs	POs attained	COs attained	Ref Book/ Chapter no.
L42	Introduction to sampling and sampling distribution and simple examples	Chalk and Board	1	1, 2, 4, 5, 11	4	T1/27, T2/23
L43	Standard error, test of hypothesis for mean and proportions and examples					
L44	Confidence limits for means of large and small samples.					
L45	Student's t-distribution with examples.					
L46	Chi-square distribution as test					

	of goodness of fit.					
L47	Introduction to Stochastic process.				5	
L48	Probability vector, stochastic matrices.					
L49	Fixed points, regular stochastic matrices.					
L50	Markov chains, higher transition probability.					

Question Bank :	**COs Attained**
1. Explain the following terms a) Null hypothesis b) Confidence limits c) Type I & Type II errors d) students''t' distribution. e) level of significance.	
2. A die was thrown 9000 times & a throw of 5 or 6 was obtained 3240 times, on the assumption of random throwing, do the data indicate that the die is unbiased.	**4**
3. A random sample of 400 items chosen from an infinite population is found to have a mean of 82 and a standard deviation of 18. Find the 95% confidence limits for the mean of the population from which the sample is drawn.	
4. In a city 'A' 20 % of a random sample of 900 school boys had a certain Slight Physical defect. In another city 'B' 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant?	
4. One type of aircraft is found to develop engine trouble in 5 flights out of total of 100 & another type in 7 flights out of a total 200 flights. Is there a significant difference in the two types of aircrafts so for as engine defects are concerned?	**4**
6. A survey was conducted in a slum locality of 2000 families by selecting a	

sample of size 800. It was revealed that 180 families were illiterates. Find the probable limits of the illiterate families in the population of 2000.

7. In an examination given to students at a large number of different schools the mean grade was 74.5 & S.D grade was 8. At one particular school where 200 students took the examination the mean grade 75.9. Discuss the significance of this result from the view point of a) one tailed test b) two tailed test at both 5 % & 1% level of significance.

8. Random sample of 1000 engineering students from a city A and 800 from city B were taken. It was found that 400 students in each of the sample were from payment quota. Does the data reveal the significant difference between the two cities in respect of payment quota students.

9. A sample of 400 items is taken from a normal population whose mean is 4 & variance 4. If the sample mean is 4.45, Can the samples be regarded as a simple sample .

10. The mean of two large samples of 1000 & 2000 members are 168.75 cms and 170 cms respectively. Can the samples be regarded as drawn from the same population of standard deviation of 6.25 cms

11. Balls are drawn from a bag containing equal number of black & white balls , each ball being replaced before drawing another . In 2250 drawings 1018 black & 1232 white balls have been drawn. Do you suspect some bias on the part of the drawer?

12. A coin is tossed 400 times and it turns up head 216 times. Discuss whether the coin may be an unbiased one at 5% level of significance.

4

13. It is required to test whether the proportion of smokers among students is less than that among the lectures. Among 60 randomly picked students, 2 were smokers. Among 17 randomly picked lectures, 5 were smokers. What would be your conclusion?

14. From a random sample of 10 pigs fed on diet A, The increase in weight in the certain period were 10, 6,16,17,13,12,8,14,15,9 lbs. For another sample of 12 pigs fed on diet B, the increase in the same period were 7,13,22,15,12,14,18,8,21,23,10,17 lbs. Test whether diets A & B differ significantly as regards their effect on increase in weight.(Given $t_{0.05}$ for 20 d.f = 2.09)

15. A group of 10 boys fed on a diet A and another group of 8 boys fed on a different diet B for a period of 6 months recorded the following increases in weights (lbs)

Diet A : 5, 6, 8, 1, 12, 4, 3, 9, 6, 10
Diet B : 2, 3, 6, 8, 10, 1, 2, 8

Test weather diet A and B differ significantly regarding their effect on increases in weight.

16. A group of boys and girls are given an intelligence test. The mean score, S.D score and numbers in each group are as follows.

	Boys	Girls
Mean	124	121
SD	12	10
n	18	14

Is the mean score of boys significantly different from that of girls?
(Given $t_{0.05}$ for 30 d.f = 1.960)

17. Eleven school boys were given a test in drawing. They were given a months further tuition and a second test of equal difficulty was held at the end of it. Do the marks

give evidence that the students have benefitted by extra coaching?

Boys	1	2	3	4	5	6	7	8	9	10	11
Marks Test I	23	20	19	21	18	20	18	17	23	16	19
Marks Test II	24	19	22	18	20	22	20	20	23	20	17

4

18. The nine items of a sample have the following values: 45,47,50,52,48,47,49,53,51
Does the mean of these differ significantly from the assumed mean of 47.5. Apply
student's t- distribution at 5% l.o.s.($t_{0.05}$ for 8 d.f = 2.31)

19. A certain stimulus administrated to each of the 12 patients result at in
the following change in blood pressure, 5,2,8,-1,3,0,6,-2,1,5,0,4. Can it be
concluded that the stimulus will increase blood pressure. Use $t_{0.05}$ for 11 d.f = 2.201

20. A set of five similar coins is tossed 320 times and the result is
Test the hypothesis that the data follows a Binomial distribution.
(x^2 = $_{0.05}$,at d.f 5 11.07.)

No of heads	0	1	2	3	4	5
Frequency	6	27	72	112	71	32

21. Fit a binomial distribution to the data and test for goodness of fit at the level of
significance 0.05

x	0	1	2	3	4	5
f(x)	38	144	342	287	164	25

22. Fit a poission distribution to the data and test for goodness of fit at the level of
Significance 0.05

x	0	1	2	3	4
f(x)	419	352	154	56	19

23. A die is thrown 60 times and the frequency distribution for the number appearing on the face x is given by the following table. Test the hypothesis that the die is unbiased. **5**

x	1	2	3	4	5	6
f(x)	15	6	4	7	11	17

24. In an experiment on pea breeding , the following frequencies of seeds were obtained. Theory predicts that the frequencies should be in proportion 9 : 3: 3: 1 Examine the correspondence between theory and experiment. ($x^2_{0.05}$,at d.f 3= 7.815) **5**

Round and yellow	wrinkled and yellow	Round and green	wrinkled and green	total
315	101	108	32	556

25. Define probability vector .If A = $\begin{bmatrix} a_1 & a_2 \\ b_1 & b_2 \end{bmatrix}$ is a stochastic matrix and V = $[v_1 \quad v_2]$ is a probability vector show that VA is also a probability vector.

26. Define stochastic matrix. Find the unique fixed probability vector of the regular Stochastic matrix A = $\begin{bmatrix} 3/4 & 1/4 \\ 1/2 & 1/2 \end{bmatrix}$

27. Define regular stochastic matrix. Find the unique fixed probability vector of the regular stochastic matrix P = $\begin{bmatrix} 1/2 & 1/4 & 1/4 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}$

28. Show that P = $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is a regular stochastic matrix. Also find the

associate
unique fixed probability vector.

29. Prove that the Markov chain whose transition probability matrix is

$$P = \begin{bmatrix} 0 & \frac{2}{3} & \frac{2}{3} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$$ is irreducible.

30. Assume that a computer system is in one of the three states :busy, idle or undergoing repair denoted by states 0,1,2 . Observing its state at a certain specified time on each day, it is found that the system approximately behaves like a Markov chain with the transition probability matrix $\begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.1 & 0.8 & 0.1 \\ 0.6 & 0 & 0.4 \end{bmatrix}$. **5**

Prove that the chain is irreducible and determine the study state probabilities.

31. A software engineer goes to his office everyday by motorbike or by car. He never goes by bike on two consecutive days. But if he goes by car on a day then he is equally likely to go by car or by bike on the next day. Find the transition probability matrix of the Markov chain. If a car is used on the first day of the week find the prob that after 4 days
a) Bike is used b) Car is used

32. Each year a man trades his car for a new car in 3 brands of the popular company Maruti Udyog limited. If he has a 'standard' he trades it for 'zen'. If he has a 'zen' he trades it for a'Esteem'. If he has a 'Esteem' he is just as likely to trade it for a new 'Esteem' or for a'Zen' or a 'standard' one. In 1996 he bought his first car which was Esteem. Find the probability that he has a) 1998 Esteem b) 1999 Zen

33. A salesman's territory consists of 3 cities A,B,C. He never sells in the same city for 2 consecutive days. If he sells in city A then the next day he sells in next city

B. However if he sells in either B or C, then the next day he is twice as likely to sell in city A as in the other city. In the long run how often does he sell in each of the cities. 34. Define i) probability vector ii) stochastic matrix iii) regular stochastic matrix iv) absorbing state of a Markov chain v) recurrent state of a Markov chain . vi) transient state of a Markov chain 35. A students study habits are as follows .If he studies one night he is 70%sure not to study the next night. On the other hand if he does not study one night he is 60%sure not to study the next night also. Supposing that he studies on Monday night, find the probability that he does not study on Friday night.	

3. Portion for I.A. Test:

I. A. Test No.	Modules
I	I and II or I and IV
II	III and IV or II and IV

Assignments

Assignment Questions Module- 1	COs Attained
1. Using Taylor's series method, compute the solution of: a) $\frac{dy}{dx} = x+y$, y(0) = 1 at the point x = 0.2 correct to three decimal places. b) $\frac{dy}{dx} = 2y+3e^x$, y(0)=0, at x = 0.1 and x = 0.2	1
2. Using Euler's modified method, obtain a solution of the equation a) $\frac{dy}{dx} = x+\lvert\sqrt{y}\rvert$, with initial conditions y =1 at x = 0, for the range 0<x<0.6 in steps of 0.2. b) $\frac{dy}{dx} = -xy^2$ y = 2 at x = 0 Obtain 'y' at x = 0.2 in two stages of 0.1 each.	
3. Employ Runge-Kutta method of fourth order to solve the equation a) $\frac{dy}{dx} = \frac{y-x}{y+x}$ y(0)=1 , compute y(0.2) (Take h=0.2) b) $\frac{dy}{dx} = 3x+\frac{y}{2}$, y(0) = 1 at x = 0.2 taking step length h = 0.2.	
4. Using Milne's method and Adams–Bashforth's predictor- corrector method, solve a) Given $\frac{dy}{dx} = x-y^2$ and the data Find y(0.8)	

X:	0	0.2	0.4	0.6
Y:	0	0.02	0.0795	0.1762

b) Given $\frac{dy}{dx} = x^2-y$, $y(0)=1$ and the starting values y(0.1) = 0.90516, y(0.2)=0.82127, y(0.3) = 0.74918 evaluate y(0.4)
Module 2
1. Using Runge-Kutta method find third approximation to the

values

a) $\frac{d^2y}{dx^2} = x^3\frac{dy}{dx} + x^3y$, given y(0) = 1 , y′ (0) = ½

b) $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$, given that y = 1, $\frac{dy}{dx} = 0$ when x = 0

1

2. Applying Milne's method

a) Compute $y(0.8)$ given that y satisfies the equation $y'' = 2yy'$ and y & y' are governed by the following values

x	0	0.2	0.4	0.6
y	0	0.2027	0.4228	0.6841
y'	1	1.041	1.179	1.468

b) Compute y (0.4) given the equation $y'' + y' = 2e^x$, and the following table of initial values.

x	0	0.1	0.2	0.3
y	2	2.01	2.04	2.09
y'	0	0.2	0.4	0.6

3

3. Show that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}}\sin x$

4. Prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = \begin{cases} 0 & \alpha \neq \beta \\ \frac{1}{2}\left[J_{n+1}(\alpha)\right]^2 & \alpha = \beta \end{cases}$ where α, β are the

roots of $J_n(x) = 0$

5. Express the following polynomials in terms of Legendre polynomials

a) f(x) = $2x^3 - x^2 - 3x + 2$ b) f(x) = $x^4 + 3x^3 - x^2 + 5x - 2$

Module 3

2

1. Show that the following functions are harmonic and find their harmonic conjugate. Also find the corresponding analytic function

a) $u = e^{2x}(xcosy - ysin2y)$ b) $v = e^{-x}(xcosy + ysiny)$

c) $u = \frac{1}{r}cos\theta$ d) $v = \frac{-sin\theta}{r}$

2. Construct analytic function f(z) = u + iv as a function of z using the following data

a) $u - v = e^x(cosy - siny)$ b) $u - v = (x - y)(x^2 + 4xy + y^2)$

3. Show that $v = cosxsinhy$ is harmonic and find its harmonic conjugate.
4. Evaluate $\int_{1-i}^{2+3i}(z^2 + z)dz$ along the line joining the points (1, -1) & (2,3)
5. Evaluate $\int_C \frac{z^2+1}{z-3}dz$ where C is the circle C : $|z - 1| = 1$
6. Find the sum of the residues of $f(z) = \frac{sinz}{zcosz}$ $at\ its\ poles\ inside\ the\ circle\ |z| = 2$
7. Under the transformation $w = z^2$, find the image of the triangular region bounded by the lines x = 1, y = 1, x + y = 1.
8. Find the Bilinear transformation which maps the given points and the corresponding invariant points: a) z = 1, i, -1 into w = i, 0, -i b) z = 1, i, -1 into w = 0, 1, ∞

Module- 4

1. A random variable 'x' has the following function values of 'x'

x	0	1	2	3	4	5	6	7
y	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + 7$

a) Find k b) Evaluate P(x < 6) c) Evaluate P(x ≥ 6)
d) P (3< x ≤ 6)

2. Six coins are tossed. Find the probability of getting a) Exactly 3 heads b) At least 3 heads c) At least one head
3. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals, more than two will get a bad reaction.
4. The increase in sales per day in a shop is exponentially distributed with Rs.800 as the average. If sales tax is levied at the rate of 6%, find the probability that the increase in sales tax return from that shop will exceed Rs.30 per day.
5. In an examination 7% of students score less than 35%, marks & 89% of students score less than 63% marks. Find the mean & standard deviation if the marks are normally distributed.
6. The joint distribution of two random variables X and Y is as follows.

x \ y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Compute the following:
a) $E(X)\ and\ E(Y)$ $(b)\ E(XY)$ (c) $\sigma_X\ and\ \sigma_Y$ $(d)\ COV(X,Y)$ $(e$

Module 5

1. A die was thrown 9000 times & a throw of 5 or 6 was obtained

4

3240 times, on the assumption of random throwing, do the data indicate that the die is unbiased. 5

2. In an examination given to students at a large number of different schools the mean grade was 74.5 & S.D grade was 8. At one particular school where 200 students took the examination the mean grade 75.9. Discuss the significance of this result from the view point of a) one tailed test b) two tailed test at both 5 % & 1% level of significance.
3. Balls are drawn from a bag containing equal number of black & white balls, each ball being replaced before drawing another. In 2250 drawings 1018 black & 1232 white balls have been drawn. Do you suspect some bias on the part of the drawer? 4
4. The nine items of a sample have the following values: 45,47,50,52,48,47,49,53,51 Does the mean of these differ significantly from the assumed mean of 47.5. Apply student's t-distribution at 5% l.o.s.($t_{0.05}$ for 8 d.f = 2.31)
5. A set of five similar coins is tossed 320 times and the result is

No of heads	0	1	2	3	4	5
Frequency	6	2	7	112	7	3

Test the hypothesis that the data follows a Binomial distribution.
($x^2_{0.05}$, at d.f 5 = 11.07.)

6. Assume that a computer system is in one of the three states :busy, idle or undergoing repair denoted by states 0,1,2 . Observing its state at a certain specified time on each day, it is found that the system approximately behaves like a Markov chain with the transition probability matrix

$$\begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.1 & 0.8 & 0.1 \\ 0.6 & 0 & 0.4 \end{bmatrix}.$$

Prove that the chain is irreducible and determine the study state probabilities. 5

2. SOFTWARE ENGINEERING SYLLABUS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER - III

Subject Code	**15CS42**	**IA Marks**	**20**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**80**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

Staff: Prof. K.B.Pawar

CREDITS – 04

Course objectives: This course will enable students to

- Understand software engineering principles in building large programs
- Analyse ethical and professional issues and to explain why they are of concern to software engineers
- Understand the process of requirements gathering and their validation
- Study the System models and design patterns
- Discuss the distinctions between validation testing and defect testing
- Understand software quality parameters

Module -1	**Teaching Hours**	**RBT Levels**
Introduction: Professional Software Development, Software Engineering Ethics. Case Studies.**Software Processes**: Models. Process activities. Coping with Change. The Rational Unified Process.	**10Hours**	**L1, L2**
Module -2		
Agile Software Development: Agile methods . Plan-driven and agile development. Extreme programming. Agile project management. Scaling agile methods. **Requirements Engineering**: Functional and non-functional requirements .The software Requirements Document. Requirements Specification . Requirements Engineering Processes. Requirements Elicitation and Analysis. Requirements validation. Requirements Management.	**10 Hours**	**L2, L3, L4**
Module - 3		
System Models: Context models. Interaction models. Structural models. Behavioural models. Model-driven engineering. **Design and Implementation**: Object-oriented design using the UML. Design patterns. Implementation issues. Open source development	**10 Hours**	**L2, L3, L4, L5**
Module-4		
Software Testing: Development testing, Test-driven development, Release testing, User testing. **Software Evolution**: Evolution processes .Program evolution dynamics. Software maintenance. Legacy system management.	**10 Hours**	**L2, L3, L4, L5**
Module-5		

Project Planning: Software pricing. Plan-driven development. Project scheduling. Agile planning. Estimation techniques. **Quality management** : Software quality. Software standards. Reviews and inspections. Software measurement and metrics.	**10 Hours**	**L2, L3, L4, L5**

Course outcomes:

After studying this course, the students will be able to

Design a system, component, or process to meet desired needs within realistic constraints.
Asses professional and ethical responsibility
function on multi-disciplinary teams
use the techniques, skills, and modern engineering tools necessary for engineering practice
Analyse, design, verify, validate, implement, apply, and maintain software systems.

Graduate Attributes (as per NBA)

1. Project Management and Finance
2. Conduct Investigations of Complex Problems
3. Modern Tool Usage
4. Ethics

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **Ian Sommerville**: Software Engineering, 9th Edition, Pearson Education, 2012.
   (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)

Reference Books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill
2. **PankajJalote**: An Integrated Approach to Software Engineering, Wiley India

SOFTWARE ENGINEERING

MODULE 1

MODULE WISE PLAN

Chapter Number: 01	**No. of Hours: 06**
Unit Title: Overview	

Learning Objectives: At the end of this chapter students will:

1) Express importance of Software Engineering.
2) Produce answers to key questions that provide an introduction to software engineering
3) Incorporate ethical and professional issues that are important for software engineers.
4) Analyze the socio-technical system.
5) Evaluate concept of emergent system properties and activities involved in system engineering

Lesson plan :

Lecture No	**Topics covered**	**Teaching Method**	**Pos Attained**	**PSOs attained**	**Cos attained**	**Reference Book/Chapter No**
L1	Introduction: FAQ's about software engineering, Professional and	Chalk and Board	c,g,b,d,h,j, f,k,e a,b,d,e, l,f,g,k	a,b,c a,b,c	1	T1/1
L2	Socio-Technical systems: Emergent system properties.	Chalk and Board			2	T1/2
L3	Systems Engineering.	Chalk and Board			2,3	T1/2
L4	Organizations, people and computer systems	Chalk and Board			6	T1/2
L5	Legacy systems, Rational Unified process	Chalk and Board			3	T1/2
L7	Critical Systems: A simple safety-critical system.	Chalk & Board			1,2	T1/3
L8	System dependability.	Chalk & Board			3	T1/3
L9	Availability and reliability.	Chalk & Board			3	T1/3
L10	Software Processes: Models, Process iteration.	Chalk & Board			1,2,3	T1/4
L11	Process activities, The Rational Unified Process.	Chalk & Board			3	T1/4

L12	Computer-Aided Software Engineering.	Chalk & Board			1	T1/4

Assignment questions	**Cos attained**
Q1: What is software? What are the attributes of good software?	1
Q2: Explain the term Software Engineering. What are the Key challenges that a software Engineering is facing?	1
Q3: Describe the professional responsibilities of the Software engineer.	5
Q4: Software is a product. Justify this statement	1
Q5: Explain the activities involved in the system design process.	2
Q6: What are the most important dimensions of system dependability?	1,3
Q7: Give reasons why dependability is important in critical systems	1,3
Q8: What are the differences between System Engineering Process and the Software?	3
Q.9: What is System design? Explain its activities with a neat diagram.	1,3
Q.10: What is a Software Process? What are the fundamental process activities?	1,3
Q.11: What are Critical systems? What are the three main types of Critical Systems?	3
Q.12:.Explain Boehm's spiral model of the software process with a neat diagram.	1,3
Q.13: Explain Component- Based Software Engineering with a neat diagram**.**	3
Q.13: What are approaches to improve Reliability of a system?	3

Module -2

Learning Objectives: At the end of this chapter students will:

1..Define the concept of user, system requirements
2.Organize requirements in a software requirements document
3.Express the principal requirements of engineering activities and their relationships.
4.Apply several techniques of requirements elicitation and analysis
5.Analyze the importance of requirements validation and how requirements reviews are used in
6.Analyze the requirement management and its support for other requirements engineering
7.Incorporate interactive, incremental software development approach that leads to faster delivery of more useful software
8.Define the difference between agile and software development methods that rely on documented specifications and designs.
9.Define the principles, practices and limitations of extreme programming
10. Express different types of software maintenance and factors that affect maintenance cost.

Lecture NO	**Topics Covered**	**Teaching Method**	**Pos attained**	**PSOs attained**	**Cos attained**	**Reference Book/Chapter**
L13	Rapid software development: agile	Chalk & Board		a,b,c	1,3,5	T1/17

L14	Extreme programming, rapid application	Chalk & Board	b,d,j,l	a,b,c	1,3,5	T1/17
L15	Software evolution: program evolution	Chalk & Board			4	T1/21
L16	Software requirements	Chalk & Board			3	T1/6
L17	User requirements, system requirements	Chalk & Board	b,c,d,g		1,3	T1/6
L18	Interface specification , the software	Chalk & Board			3	T1/6
L19	Requirements engineering process:	Chalk & Board			1,3	T1/7
L20	Requirements elicitation and analysis	Chalk & Board			3	T1/7
L21	Requirements validation	Chalk & Board			4	T1/7
L22	Requirements management.	Chalk & Board			1,3	T1/7

Assignment Questions:	**Cos attained**
Q.1.Give a brief description of five principles of agile methods	2,3
Q.2.What are the characteristics of the rapid software development	2,3,5
Q.3.Briefly describes the three types of software maintenance.	4
Q.4.Explain the activities involved in re-engineering process	3
Q.5.Explain the re-engineering process	3
Q.6.Explain the spiral model of development and evolution	4
Q.7 what are enduring and volatile requirements also give the classification of volatile requirement with brief explanation	3
Q.8 what are the problems in using natural languages for specifying system requirements?	3
Q.9 why elicitation and analysis is a difficult process? Explain giving reasons	3
Q.10 Explain different types of non functional requirements? Give example of each	2,3
Q11 Explain the structure of software requirements	3
Q.12 What are the requirement validation techniques which can be used in conjunction Individually?	4
Q13 Write a structure of requirement documents suggested by IEEE standards	3

Module - 3

Chapter Number: 4,8,5,11	**No of Hours: 10**
Unit Title: System models, Project management, Software Design and Implementation	

Learning Objectives: At the end of this chapter students will:

1. Analyze the importance of establishing the boundaries of a system model, and its context.

2. Express the concept of behavioral modeling, data modeling and object modeling.
3. Apply some of the notations defined in the UML and these notations may be used to develop system models.
4. Define the principal tasks of the software project managers
5. Analyze the need for project planning in all software projects
6. Construct graphical representations to represent project schedule.
7. Define notation of risk management and some of the risks that can arise in software projects
8.Analyze Importance of architectural design of software
9. Express the decisions that have to be made about the system architecture during the architectural design process.
10. Define the reference architecture that are used to communicate architectural concepts and to asses system architecture.
11. Evaluate software design that may be represented as a set of interacting objects.
12. Construct the representation of these models in the UML

Lecture No	**Topics Covered**	**Teaching Method**	**Pos attained**	**PSOs attained**	**Cos attained**	**Reference Book/Chapter No**
L23	System models: context models.	Chalk & Board	b,c,d,g,l 2,3,4,7,12	a,b,c	1,2,3	T1/8
L24	Behavioral models.	Chalk & Board			1,2,3	T1/8
L25	Data models, object models	Chalk & Board			2,3	T1/8
L26	Structured methods	Chalk & Board			2,3	T1/8
L27	Project management: management activities; planning	Chalk & Board			1,2,3,5	T1/5
L28	Project scheduling	Chalk & Board			1,2,3,5	T1/5
L29	Risk management	Chalk & Board			3	T1/5
L30	Architectural Design: Architectural decisions	Chalk & Board		a,b,c	1,2,3,5	T1/11
L31	System organization	Chalk & Board			1,2,3	T1/11
L32	Modular decomposition styles	Chalk & Board			2,3	T1/11

L33	Control styles	Chalk & Board			1,2,3	T1/11
L34	Object oriented design: objects and	Chalk & Board			1,3	T1/14
L35	An object oriented design process	Chalk & Board			1,3	T1/14
L36	Design evolution	Chalk & Board			3,5	T1/14

Assignment Questions:	**Cos attained**
Q.1.Explain types of system models	1,3
Q.2.Explain the data-flow diagram of an insulin pump	3
Q.3.Based on your experience with a bank ATM, draw a data flow diagram modeling the data processing involved when a customer withdraw cash from a machine	3
Q.4.Draw and explain the state machine model of a simple microwave oven	3
Q.5. what are the possible software risks? Explain briefly the risk management process	2
Q.6.Explain briefly the risk factors	2
Q.7 List the various steps that need to be followed for OOD process	**1**
Q.8 Explain with figure the dataflow model of an invoice processing system	**3**
Q.10 Illustrate with two examples of objects and objects classes	**1,3**
Q.11Discuss in detail event based control model with examples	**1,3**
Q.12what are the advantage and disadvantage of object oriented system	**1**
Q.13Draw and explain sequential diagram for typical weather system	**3**
Q.14what are the advantage and disadvantages of client server model	**1**
Q.15 Explain in detail of centralized control model.	**1,3**

Module-4

Learning Objectives: At the end of this chapter students will:

1. Define the differences between software verification and software validation
2. Express program inspections as a method of discovering defects in programs
3. Define automated static analysis and, clean room development process
4. Define differences between validation testing and defect testing
5.Define the principles of system testing and component testing
6. Analyze the essential characteristic of software tools that support test automation
7.Express different types of software maintenance and factors that affect maintenance cost

Lecture No	**Topics Covered**	**Teaching Method**	**Pos attained**	**PSOs attained**	**Cos attained**	**Reference Book/Chapter**
L37	Verification and Validation: Planning,	Chalk & Board	b,d,l	a,b,c	4	T1/22
L38	Software inspections, automated static	Chalk & Board			4	T1/22

L39	Verification and formal methods	Chalk & Board			4	T1/22
L40	Software testing: system testing	Chalk & Board			4	T1/23
L41	Component testing	Chalk & Board			4	T1/23
L42	Test case design	Chalk & Board			4	T1/23
L43	Test automation	Chalk & Board			4	T1/23
L44	Software evolution: program evolution	Chalk & Board			4	T1/21
L45	Software maintenance	Chalk & Board			4	T1/21
L46	Evolution process	Chalk & Board			4,5	T1/21
L48	Legacy system evolution	Chalk & Board			1,3	T1/21

Assignment Questions:	**Cos attained**
Q.1. Explain integration testing	4
Q.2. Explain the structure of software test plain.	4
Q.3.What are the types of errors discovered through program inspection.	4
Q.4.Write a note on clean room software development process	4
Q.5 Explain the two distinct goals of a software testing	4
Q.6 Write a note on release testing	4
Q.7. Differentiate between release testing and integration testing	4
Q8.Express different types of software maintenance and factors that affect maintenance cost.	

Module-5

Chapter Number: 8	***No of Hours: 06***
Unit Title: Management	

Learning Objectives: At the end of this chapter students will:

1.Evaluate the issues involved in selecting and retaining staff in a software development
2.Define the factors that influence individual motivation and their implications for software
3.Express key issues of team working, including team composition, team cohesiveness, team communications and team organization
4. Define the fundamentals of software cost estimations.
5. Define three metrics that are used for software productivity assessment
6.Define the principals of the COCOMO II model for algorithmic cost estimation

Lesson Plan:

Lecture No	Topics Covered	Teaching method	Pos attained	PSOs attained	Cos attained	Reference Book/Chapter
L49	Managing people: selecting staff	Chalk & Board	f,h,i,j,k	a,b,c	5,6	T1/25
L50	Motivating people, managing people	Chalk & Board			5,6	T1/25
L51	The people capability maturity model	Chalk & Board			5,6	T1/25
L52	Software cost estimation: productivity	Chalk & Board			3,5,6	T1/26
L53	Estimation techniques	Chalk & Board			3,5,6	T1/26
L54	Algorithmic cost modeling, project	Chalk & Board			3,5,6	T1/26
L55	. **Quality management** : Software quality	Chalk & Board			5,6	T1/27
L56	Software standards. Reviews and inspections	Chalk & Board			3,5,6	T1/27
L57	Software measurement and metrics.	Chalk & Board			5,6	T1/27s

Assignment Questions:	**Cos attained**
1. Q.1. Explain integration testing	2
2. Q.2. Explain the structure of software test plain.	3,5
3. Q.3.What are the types of errors discovered through program inspection.	1
4. Q.4.Write a note on clean room software development process	1
5. Q.5 Explain the two distinct goals of a software testing	1,2
6. Q.6 Write a note on release testing	2
7. Q.7. Differentiate between release testing and integration testing	2
8. Q.1.Describe with a block diagram's people-CMM (Capability Maturity Model)	5
9. Q.2.Explain the cost estimation techniques	3,5
10. Q.3.Explain briefly the factors affecting software pricing	3
11. Q.4.What are the environmental factors identified in design study	3,5
12. Q.5.Discuss the factors in people management	5

SOFTWARE ENGINEERING IA PORTION

Tests	Units/Modules	Cos attained
I. A -I	M1 M2	1,2,3,5
I.A-II	M3, M4	1,2,3,4,5
Extra	M4 M5	2,3,5

ASSIGNMENT I

1. What is software? What are the attributes of good software?
2. Explain the term Software Engineering. What are the Key challenges that a software Engineering is facing?
3. Describe the professional responsibilities of the Software engineer.
4. Give a brief description of five principles of agile methods
5. What are the characteristics of the rapid software development
6. Briefly describes the three types of software maintenance.
7. Explain the activities involved in re-engineering process

ASSIGNMENT II

1. Explain briefly the risk factors
2. List the various steps that need to be followed for OOD process
3. Explain with figure the dataflow model of an invoice processing system
4. Illustrate with two examples of objects and objects classes
5. Discuss in detail event based control model with examples
6. what are the advantage and disadvantage of object oriented system
7. Explain briefly the risk factors

ASSIGNMENT III

1. Write a note on release testing
2. Explain integration testing
3. Explain the structure of software test plain.
4. What are the types of errors discovered through program inspection.
5. Write a note on clean room software development process
6. Explain the two distinct goals of a software testing
7. Explain the cost estimation techniques
8. Explain briefly the factors affecting software pricing
9. What are the environmental factors identified in design study
10. Discuss the factors in people management

3. DESIGN AND ANALYSIS OF ALGORITHMS SYLLABUS

Semester: IV **Year: 2017-18**

Subject Code	**15CS43**	**IA Marks**	**20**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**80**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

Course objectives: This course will enable students to

- Understand and analyse the asymptotic performance of algorithms.
  Demonstrate the familiarity with major kinds of algorithms.
- Understand and use of Divide and Conquer method, Greedy Method, Dynamic programming and Backtracking methods in solving problems
- Judge suitable algorithmic design paradigms for real life problems
- Synthesize efficient algorithms in common engineering design situations

Module -1	**Teaching Hours**	**RBT Levels**
Introduction: What is an Algorithm?, Algorithm Specification, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation, Omega notation, Theta notation and Little-oh notation, *Important Problem Types:*Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. *Fundamental Data Structures:* Stacks, Queues, Graphs, Trees, Sets and Dictionaries.	**10Hours**	**L1, L2,**
Module -2		
Divide and Conquer: General method, Binary search, Recurrence equation for Divide and Conquer, Finding the maximum and minimum, Quick sort, Merge sort, Strassen's matrix multiplication, Convex Hull, Closest-pair problem, Advantages and Disadvantages of Divide and Conquer. *Decrease and Conquer Approach*: Topological Sort	**10 Hours**	**L2, L3, L4, L5, L6**
Module – 3		
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines, Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. *Single source shortest paths:*Dijkstra's Algorithm. *Optimal Tree problem:* Huffman Trees and Codes. *Transform and Conquer Approach.*	**10 Hours**	**L2, L3, L4, L5, L6**
Module-4		
Dynamic Programming: General method, Multistage Graphs, *All Pairs Shortest Paths:* Floyd's Algorithm, Optimal Binary Search Trees, 0/1-Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem, Reliability design.	**10 Hours**	**L2, L3, L4, L5, L6**
Module-5		

Backtracking: General method, N-Queens problem, Sum of subsets problem, Graph colouring, Hamiltonian cycles. **Branch and Bound:** General method, Travelling Sales Person problem,0/1 knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution. **NP-Hard and NP-Complete problems:** Basic concepts, non deterministic algorithms, NP - Hard and NP-Complete Classes.	**10 Hours**	**L2, L3, L4, L5, L6**

Course outcomes:

After studying this course, the students will be able to

1. Asses the correctness of algorithms using inductive proofs and loop invariants.
2. Analyse and Compare the asymptotic behaviors of functions obtained by elementary composition of polynomials, exponentials, and logarithmic functions.
3. Describe the relative merits of worst-, average-, and best-case analysis.
4. Describe, apply and analyse the different algorithm design techniques: divide-and-conquer, dynamic programming, greedy paradigm, graph algorithms and their analysis.
5. Judge the applicability of appropriate method for solving real world problems

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Conduct Investigations of Complex Problems
5. Life-Long Learning

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd edition, 2014, Universities Press

2. Introduction to the Design and Analysis of Algorithms, AnanyLevitin:, 3rd Edition, 2012, Pearson

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI

2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education)

DESIGN AND ANALYSIS OF ALGORITHMS COURSE PLAN

1. Prerequisites:

1. Logical Thinking.
2. Knowledge of Discrete Structures.
3. Mathematical knowledge.
4. Little C programming concepts.

2. Course Overview and its relevance to this programme:

Why do we need to study algorithms? If we want to become a computer professional, we need to study algorithms with both practical and theoretical standpoints. From a practical standpoint, we have to know a standard set of important algorithms from different areas of computing and also we should be able to design new algorithms and analyze their efficiency. From a theoretical standpoint, the study of algorithms, sometimes called Algorithmics, has come to be recognized as the cornerstone of computer science.

Algorithmics is more than a branch of computer science. It is the core of computer science and in all fairness can be said to be relevant to most of science, business, and technology.

There are two reasons to study algorithms, First computer programs would not exist without algorithms. And with computer applications becoming common in all aspects of our professional and personal lives, studying algorithms is necessity for all people. Second reason is, they help in developing analytical skills. Algorithms are special kinds of procedures to get the solution to the problems.

A person well trained in computer science knows how to deal with algorithms i.e. how to construct them, manipulate them, understand them, and analyze them. It is the preparation for much more than writing good program. It is general-purpose mental tool that will be a definite aid to understanding other subjects.

It is said that a person does not really understand something until after teaching it to someone else. Similarly a person does not *really* understand something until after teaching it to a *computer* i.e. expressing it as an algorithm. An attempt to formalize things as algorithms leads to a much deeper understanding than if we simply try to comprehend things in the traditional way.

3. Applications:

- This subject is preface for learning any subject.
- Helps to solve different problems.
- We can analyze any type of algorithm.
- It is very easy to find the Space efficiency and time efficiency after going through this subject.
- This subject helps the students to construct a procedure to find solution for any problem.
- We can give explanatory theoretical results for a problem.
- The procedure got by this can be applied in different fields.

4) Model wise plan

Module -1

Module : 01	**No. of Hours:10**
Title: Introduction	

Learning Objectives: The main objectives of this unit are to:

1.	Define an algorithm
2.	Explain Notations of algorithm
3.	Explain the performance analysis
4.	Explain Fundamental sorting and searching algorithm

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L1.	**Introduction:** What is an Algorithm?	Chalk and Board	1,2,3,5,11	1,2	1	T1/1
L2.	Algorithm Specification	Chalk and Board		1,2	1	T1/2
L3.	Performance Analysis: Space complexity, Time complexity	Chalk and Board		1,2	1,2	T1/2
L4.	Asymptotic Notations: Big-Oh notation, Omega notation, Theta notation and Little-oh notation	Chalk and Board		1,2	1,2	T1/2
L5.	Important Problem Types: Sorting,	Chalk and Board		1,2	1	T1/3
L6.	Searching			1,2		
L7.	String processing, Graph Problems	Chalk and Board		1,2	1	T1/3
L8	Combinatorial Problems			1,2		
L9	Fundamental Data Structures: Stacks	Chalk and Board		1,2	1	T1/3
L10	Queues, Graphs, Trees, Sets and Dictionaries	Chalk and Board		1,2	1	T1/3

T/1: Text book No.1 in VTU Syllabus and chapter No.1 in that text book.

Assignment Questions to Practice:

Assignment Questions	COs attained
1. What is an algorithm? Explain the notion of algorithm.(6 marks)	1
2. Explain various asymptotic notations used in analyzing algorithm. Give the examples (10 marks)	1
3. If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then prove the following assertion $t_1(n) + t_1(n) \in O(\max(g_1(n)), (g_1(n)))$ (5 marks)	1
4. What is wrong with the following argument? $\sum_{1 \le k \le n} kn = \sum_{1 \le k \le n} O(n) = O(n^2)$ (5marks) 5. Order the following functions according to their order of growth. $(n-2)!$, $5\lg(n+100)^{10}$, 2^{2n}, $0.001n^4 + 3n^3 + 1$, $\ln^2 n$ (6 marks)	1
6. Explain the important problem types. (6 marks)	1

7. Write the algorithm to search the pattern in a given string. Analyze the algorithm using different case complexity (6 marks)	1,2

Module-2

Module: 02	**No of Hours: 10Hours**
Title: : Divide and Conquer, Decrease and Conquer Approach	

Learning Objectives: The main objectives of this unit are to:

1.	Explain Divide and Conquer Technique
2.	Design of Merge sort Algorithm and Quick sort Algorithm
3.	Design of Binary search algorithm
4.	Explain of Strassen's matrix multiplication, Convex Hull, Closest-pair problem
5.	Explain of Decrease and Conquer Technique
6.	Develop and analyze Topological Sorting algorithm

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/
L11	**Divide and Conquer**: General method, Recurrence equation for Divide	Chalk and Board	1,2,3,5,8,11	2	2,3,4	T2/3
L12	Finding the maximum and minimum			2		
L13	Binary Search	Chalk and Board		2	2,3,4	T1/3
L14	Mergesort	Chalk and Board		2	2,3,4	T1/4
L15	Mergesort, Quicksort	Chalk and Board		2	2,3,4	T1/4
L16	Quicksort	Chalk and Board		2	2,3,4	T1/4
L17	Strassen's matrix multiplication, Convex Hull	Chalk and Board		2	3,4	T1/4
L18	Closest-pair problem	Chalk and		2	3,4	T1/4

		Board				
L19	Advantages and Disadvantages of Divide and Conquer.	Chalk and Board		2	3,4	T1/4
L20	Decrease and Conquer Approach: Topological Sort	Chalk and Board		2	3,4	T1/5

T/2: Text book No.1 in VTU Syllabus and chapter No.2 in that text book.

Assignment Questions to Practice:

Assignment Questions	COs attained
1. Explain the divide and conquer methodology. Suggest a pseudo code for merge sort and analyze its complexities. Trace algorithm to the data set 8, 4, 1, 6, 7, 2, 3, 9. (10 Marks)	1
2. State the merge sort algorithm and analyze its complexity. (8marks)	1,2
3. Using an example for merge sort, sketch the divide-and-conquer technique. State if the merge sort is a stable sorting algorithm. (6 marks)	1
4. Write a quick sort algorithm. Derive a worst-case and average-case complexities for this algorithm (8marks)	1,2
5. Apply quick sort to sort the list 'M, E, R, G, E, S, O, R, T' in alphabetical order. Find the element whose position is unchanged in the sorted list. (8marks)	1,2
6. Compare the stabilities and the time complexities of quick sort and merge sort algorithms.	1,2
7. State and Explain Binary search algorithm and analyze its time complexity. (8 marks)	1,2
8. State the convex hull problem and analyze its complexity. (6marks)	1,2
9. What is Decerease and Conquer method? Implement the two topological sorting algorithms in the language of your choice. Run an experiment to compare their running times. (8 Marks)	1,2
10. Draw the tree of recursive calls made to sort the elements {C,O,M,P,U,T,I, N,G} in alphabetical order using Quick sort method. (10 Marks)	1,2
11.State and Explain Binary search algorithm and analyze its time complexity. (6Marks)	1,2
12.Explain the divide and conquer methodology. Suggest a pseudo code for merge sort and analyze its complexities. Trace algorithm to the data set 8, 4, 1, 6, 7, 2, 3, 9. (10 Marks)	1,2

Module-3

Module : 03	**No of Hours: 10**
Title: The Greedy Method, Transform and Conquer Approach.	

Learning Objectives: The main objectives of this unit are to:

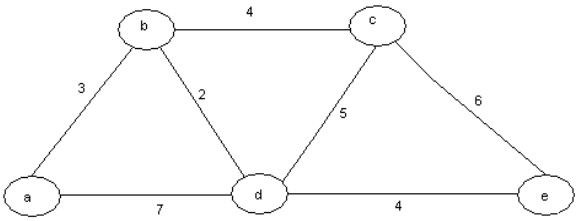
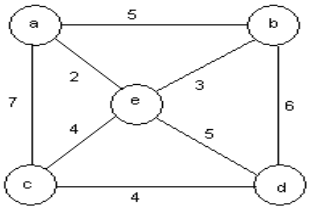
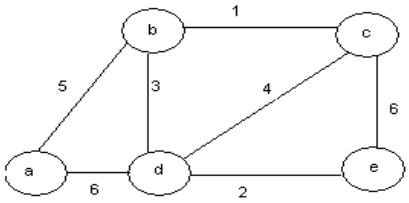
1.	Learn Greedy Techniques
2.	Design and analysis of Knapsack and Job Sequencing problem algorithm
3.	Design and analysis of minimum-cost Spanning tree
4.	Design and analysis of Prim's algorithm.
5.	Design and analysis of Kruskal's algorithm.
6.	Design and analysis the single source shortest path algorithm
7.	Learn Transform and Conquer Approach

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PsOs attained	COs attained	Reference Book/ Chapter No.
L21	The general method.	Chalk and Board	1,2,3, 5,11	2	1,3	T1/9, T2/4
L22	Knapsack Problem	Chalk and Board		2	3,4	T2/4
L23	Job Sequencing with Deadlines.	Chalk and Board		2	3,4	T2/4
L24	Minimum-Cost Spanning Trees, Prim's Algorithm	Chalk and Board		2	3,4	T1/9
L25	Kruskal's Algorithm	Chalk and Board		2	3,4	T1/9
L26	Single Source Shortest Paths	Chalk and Board		2	3,4	T1/9
L27	Huffman Trees and Codes	Chalk and Board		2	3,4	T1/9
L28	Huffman Trees and Codes	Chalk and Board		2	3,4	T1/9
L29	Transform and Conquer Approach	Chalk and Board		2	3,4	T1/10
L30	Transform and Conquer Approach	Chalk and Board		2	3,4	T1/10

T2/4: Text book No.2 in VTU Syllabus and chapter No.4 in that text book.
T1/9, T1/10: Text book No.1 in VTU Syllabus and chapter No.9, chapter No.10 in that text book.

Assignment Questions to Practice:

Assignment Questions:	COs attained
1. Using greedy method trace the following graph to get the shortest path from vertex *a* to all other vertices. [5 marks] 	3,4
2. What are the requirements to be satisfied to apply greedy technique? Explain Prim's algorithm with an example. [7 marks]	3
3. Give an instance of the change making problem for which the greedy algorithm does not yield an optimal solution.	2,3
4. Apply prim's algorithm to the following graph. Include in the priority queue all the vertices not already in the tree. 	3,4
5. Prove the correctness of Kruskal's algorithm	1,2
6. Apply Kruskal's algorithm to find a minimum spanning tree of the following Graph. [6 Marks] 	3,4
7. Explain the Knapsack problem with suitable example.	2,3
8. Explain Job Sequencing with Deadlines.	2,3
9. Explain the Huffman Trees problem.	2,3

Module-4

Module : 04	No of Hours: 10
Title: Dynamic Programming	

Learning Objectives: The main objectives of this unit are to:

1.	Define General method of dynamic programming
2.	Design Warshall's Algorithm
3.	Design Floyd's Algorithm
4.	Design single source shortest paths problem algorithm
5.	Define and develop algorithm for 0/1 Knapsack problem
6.	Define and develop algorithm for traveling salesman problem

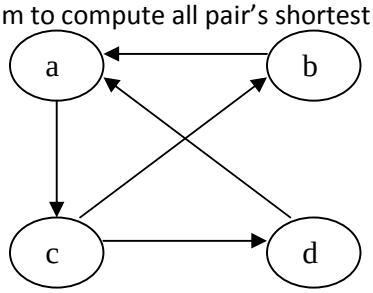
Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapte
L31	The General Method	Chalk and Board	1,2,3,5,11	2	2,3	T1/8
L32	Warshall's Algorithm	Chalk and Board		2	3,4	T1/8
L33	Floyd's Algorithm for the ALL-Pairs Shortest Paths Problem	Chalk and Board		2	3,4	T1/8
L34	Bellman-ford algorithm for Single-Source shortest Paths	Chalk and Board		2	3,4	T2/5
L35	General Weights,0/1 Knapsack	Chalk and Board		2	3,4	T1/8
L36	General Weights,0/1 Knapsack	Chalk and Board		2	3,4	T1/8
L37	The Traveling Salesperson problem	Chalk and Board		2	3,4	T2/5
L38	The Traveling Salesperson problem	Chalk and Board		2	3,4	T2/5
L39	Optimal Binary Search Trees	Chalk and Board		2	3,4	T2/5

L40	Reliability design.	Chalk and Board		2	3,4,5	T1/8

T1/8: Text book No.1 in VTU Syllabus and chapter No.8 in that text book.
T2/5: Text book No.2 in VTU Syllabus and chapter No.5 in that text book.

Assignment Questions to Practice:

Assignment Questions	COs attained
1. Explain how dynamic programming is used to compute all pair of shortest paths for a weighted digraph. Write the Pseudo code for same and derive the time complexity	1,2,3
2. With the help of the Pseudo code, explain Warshall's algorithm to find the transitive closure of a directed graph. Apply it to the following graph. [10 marks] (a) a b c d a 0 0 0 0 b 0 0 1 1 c 0 1 0 0 d 1 0 1 0 (b) a b c d a 0 1 0 0 b 0 0 0 1 c 0 0 0 0 d 1 0 1 0	3,4
3. Explain how dynamic programming is used to compute all pair shortest paths for a weighted digraph. Write the pseudo code for same and derive the time complexity. [10 marks]	3,4
4. Apply Floyd's algorithm to compute all pair's shortest paths for the following graph. [10 marks] 	3,4
5. What does dynamic programming have in common with divide and conquer? What is a principal difference between the two techniques?	3
6. Explain the 0/1 Knapsack problem. How will find solution using dynamic programming Method?	3,4
7. Explain the Traveling Salesperson problem with example.	2,3
8. Explain the optimal binary search problem with suitable example.	2,3

Module-5

Module: 05	**No of Hours: 10**
Title: Backtracking, Branch and Bound, NP-Hard and NP-Complete problems	

Learning Objectives: The main objectives of this unit are to:

1.	Explain Cope with limitations of Algorithm Power
2.	Explain Backtracking methods.
3.	Explain N-Queens problem
4.	Explain Hamiltonian Circuit problem
5.	Explain Subset sum problem
6.	Explain Branch and Bound method.
7.	Define Polynomial, Non-Polynomial and NP-Complete Problems

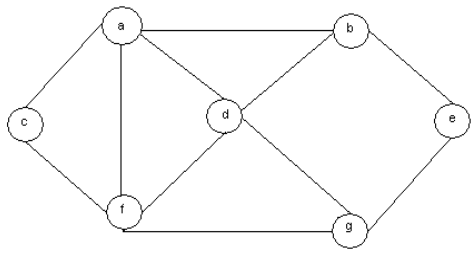
Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter
L41	Backtracking method, N-Queens problem	Chalk and Board	1,2,3,5,8,11	2	3	T1/11
L42	Hamiltonian Circuit problem, Subset sum problem	Chalk and Board		2	3,4	T1/11
L43	Branch and Bound method, Knapsack	Chalk and Board		2	3,4	T1/11
L44	Traveling salesperson problem,	Chalk and Board		2	3,4	T1/11
L45	LC Branch and Bound solution	Chalk and Board		2	3,4	T1/11
L46	FIFO Branch and Bound solution	Chalk and Board		2	3,4,5	T1/11
L47	NP-Hard and NP-Complete problems: Basic concepts	Chalk and Board		2	4,5	T1/10
L48	NP-Hard and NP-Complete problems:	Chalk and Board		2	4,5	T1/10

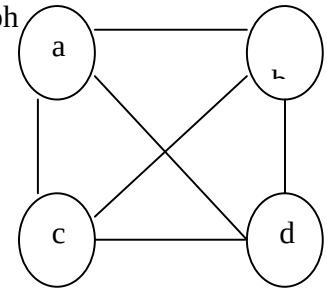
L49	non deterministic algorithms	Chalk and Board		2	4,5	T1/10
L50	NP - Hard and NP-Complete Classes	Chalk and Board		2	4,5	T1/10

T1/11: Text book No.1 in VTU Syllabus and chapter No.11 in that text book.

Assignment Questions to practice:

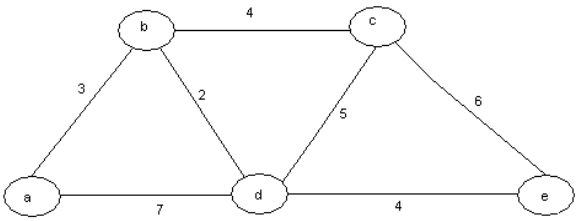
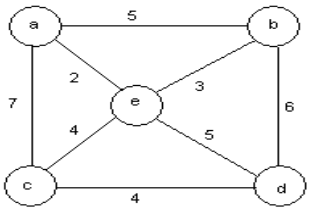
Assignment Questions	COs attained
1. What is backtracking? Explain its usefulness with the help of an algorithm. What are the specific areas of its applications? [10 Marks]	3,4
2. Explain backtracking concept and apply same to n-queen's problem. [8 Marks]	3,4
3. Apply backtracking to the problem of finding a Hamiltonian circuit in the following graph. 	3,4
4. Generate all permutations of { 1,2,3,4 } by backtracking	3,4
5. Apply backtracking to solve the following instance of the subset sum problem: S = { 1,3,4,5 } and d=11.	3,4
6. Solve the following instance of the knapsack problem by the branch and bound algorithm.	3,4

item	weight	value
1	10	$100
2	7	$63
3	8	$56
4	4	$12

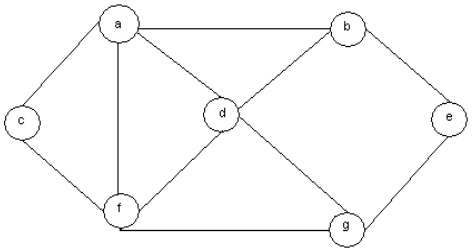
7. Apply the branch and bound algorithm to solve the traveling salesman problem for the following graph 	3,4
8. Apply the nearest neighbor algorithm to the instance defined by the distance matrix below. Start the algorithm at the first city, assuming that the cities are numbered from 1 to 5 0 14 4 10 ∞ 14 0 5 8 7 4 5 0 9 16 ∞ 7 16 32 0	3,4
9. Write a note on P, NP and NP-complete problems [6 marks]	3,4,5

Assignment Questions :

Assignment. 1 Questions	COs attained
1. What is an algorithm? Explain the notion of algorithm.(6 marks)	1
2. Explain various asymptotic notations used in analyzing algorithm. Give the examples . (10 marks)	1
3. Write the algorithm to search the pattern in a given string. Analyze the algorithm using different case complexity (6 marks)	1,2
4. Explain the divide and conquer methodology. Suggest a pseudo code for merge sort and analyze its complexities. Trace algorithm to the data set 8, 4, 1, 6, 7, 2, 3, 9. (10 Marks)	1
5. Draw the tree of recursive calls made to sort the elements {C,O,M,P,U,T,I, N,G} in alphabetical order using Quick sort method. (10 Marks)	1,2

Assignment. 2 Questions:	COs attained
1. Using greedy method trace the following graph to get the shortest path from vertex *a* to all other vertices. [5 marks] 	3,4
2. Apply prim's algorithm to the following graph. Include in the priority queue all the vertices not already in the tree. 	3,4
3. Explain how dynamic programming is used to compute all pair of shortest paths for a weighted digraph. Write the Pseudo code for same and derive the time complexity	1,2,3
4. Explain the 0/1 Knapsack problem. How will find solution using dynamic programming Method?	3,4
5. Explain the Traveling Salesperson problem with example.	2,3

Assignment. 3 Questions	COs attained
1. What is backtracking? Explain its usefulness with the help of an algorithm. What are the specific areas of its applications? [10 Marks]	3,4
2. Explain backtracking concept and apply same to n-queen's problem. [8 Marks]	3,4
3. Apply backtracking to the problem of finding a Hamiltonian circuit in the following graph.	3,4

	
4. Apply backtracking to solve the following instance of the subset sum problem: S = { 1,3,4,5 } and d=11.	3,4
5. Solve the following instance of the knapsack problem by the branch and bound algorithm with capacity W=15 item weight value 1 10 $100 2 7 $63 3 8 $56 4 4 $12	3,4

5) Portion for I. A. Tests:

Test	Units	COs Attained
I	Module 1, Module 2	1, 2
II	Module 3, Module 4 (4 hours)	3, 4, 5
III	Module 4(4 hours), Module 5	3,4, 5

4.MICROPROCESSORS AND MICROCONTROLLERS SYLLABUS

Semester: III **Year: 2017-2018**

Subject Title:	MICROPROCESSORS AND MICROCONTROLLERS	Subject Code:	15CS44
Number of Lecture Hours/Week	04	IA Marks	20
Total Number of Lecture Hours	50	Exam Marks	80
Credits	04	Exam Hours	03

MODULE – 1 **10 Hours**

The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. **Assembly language programming**: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code.
Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7

MODULE - 2 **10 Hours**

x86: Instructions sets description, **Arithmetic and logic instructions and programs**: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment.
Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2

MODULE - 3 **10 Hours**

Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. **Memory and Memory interfacing**: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. **8255 I/O programming**: I/O addresses MAP of x86 PC's, programming and interfacing the 8255.
Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4.

MODULE - 4 **10 Hours**

Microprocessors versus Microcontrollers, ARM Embedded Systems :The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software**, ARM Processor Fundamentals** : Registers , Current Program Status Register , Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions .
Text book 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5

MODULE – 5 **10 Hours**

Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises.

Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2).

Text Books:

1.Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.

2. ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier,Morgan Kaufman publishers, 2008.

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015 7. Architecture, Programming and Interfacing of Low power Processors- ARM
7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

MICROPROCESSORS AND MICROCONTROLLERS COURSE PLAN

1) Prerequisites:

1. The students should have good background on digital Logic Design circuits Basic knowledge of Digital logic circuits.
2. Fundamentals of elementary formal logic.

2) Course overview and its relevance to this programme:

This course will enable students to • Make familiar with importance and applications of microprocessors and microcontrollers • Expose architecture of 8086 microprocessor and ARM processor • Familiarize instruction set of ARM processor.

Applications:

Knowledge of microprocessors and microcontrollers is needed to understand the design, infrastructure of microprocessor and microcontrollers.

Microprocessor based systems are used in instructions, automatic testing product, speed control of motors, traffic light control , light control of furnaces etc.

Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips.

Course Outcomes:

After studying this course, students will be able to
CO1: Differentiate between microprocessors and microcontrollers
CO2: Design and develop assembly language code to solve problems

CO3: Gain the knowledge for interfacing various devices to x86 family and ARM processor
CO4: Demonstrate design of interrupt routines for interfacing devices

MODULE WISE PLAN

Module Number:1	**No. of Hours: 10**

Learning Objectives: The main objectives of this module are to

1.	Introduction to Microprocessor • Evolution of Microprocessor
2.	Assembly language programming
3.	Segmentation and registersin x86.
4.	Assembler directives and addressing modes
5.	Simple programming.

Lesson Plan:

Lecture No.	**Topics Covered**	**Teaching Method**	**POs attained**	**PSOs attained**	**Cos attained**	**Text or Reference Book/Chapter No.**
L1.	Brief history of the x86 family, Inside the 8088/86	PPT Chalk and Board	1,2,3,12	1,2,3	1,2	T1/1
L2.	Introduction to assembly programming	PPT, Chalk and Board			1,2	T1/1,2
L3.	Introduction to Program Segments, The Stack, Flag register	PPT, Chalk and Board			1,2	T1/2
L4.	x86 Addressing Modes Assembly language programming: Directives	PPT, Chalk and Board			1,2	T1/2
L5.	Sample Program	PPT, Chalk and Board			1,2,3	T1/2
L6.	Assembly language programming:	PPT, Chalk			1,2,3	T1/2

	Directives & a Sample Program Assembly Language	and Board				
L7.	More Sample programs	PPT, Chalk and Board			1,2	T1/2
L8.	Control Transfer Instructions, Data Types and Data Definition	PPT, Chalk and Board			1,2	T1/2
L9.	Full Segment Definition, Flowcharts	PPT, Chalk and Board			2	T1/2
L10.	Pseudo code.	PPT, Chalk and Board			2,3	T1/2

Questions for practice:

Questions	COs Attained
1. Briefly describe the history of x86 microprocessors.	1,2
2. With neat block explain the register organization of x86 microprocessor	1,2
3. Explain different addressing modes of x86 microprocessor .	1,2
4. Explain different assembler directives of x86 microprocessor.	1,2
5. What is addressing mode?Explain different addressing modes with example for each.	1,2

MODULE-2

Module Number: 2	**No. of Hours: 10**

Learning Objectives: The main objectives of this module are to

1.	Data Movement Instructions.
2.	Load-Effective Address.
3.	String Data Transfers.
4.	Arithmetic and Logic Instructions

5.	Multiplication and Division
6.	BCD and ASCII conversion, Rotate Instructions
7.	Programming : Bios INT 10H Programming ,DOS Interrupt 21H
8.	Interrupts

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L11.	Instructions sets description Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction,	PPT, Chalk and Board	1,2,3,12	1,2,3	1,2	T1/5
L12.	Instructions sets description Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction,	PPT, Chalk and Board			1,2	T1/5
L13.	Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion	PPT,Chalk and Board			1,2	T1/5
L14.	Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion	PPT, Chalk and Board			1,2	T1/5
L15.	Rotate Instructions. INT 21H,	PPT, Chalk and Board			1,2	T1/5
L16.	INT 10H,	PPT, Chalk and Board			1,2	T1/5
L17.	Programming : Bios INT 10H Programming	PPT, Chalk and Board			1,2	T1/6
L18.	DOS Interrupt 21H.	PPT,			1,2	T1/6

		Chalk and Board				
L19.	8088/86 Interrupts,	PPT, Chalk and Board			2	T1/6
L20.	USB Bus x86 PC and Interrupt Assignment	PPT, Chalk and Board			2,4	T1/6

Questions for practice:

Questions	COs Attained
1. Write a note on Data Movement Instructions:	1,2
2. With examples, explain the PUSH/POP, Load-Effective Address	1,2
3. Explain String Data Transfers, Miscellaneous Data Transfer Instructions.	1,2
4. Explain Segment Override Prefix	1,2
5. Explain Arithmetic and Logic Instructions: Addition, Subtraction and Comparison	1,2
6. Explain Program Control Instructions	1,2
7. Describe Hardware Interrupts: INTR and INTA	1,2
8. Explain Interrupts- INT10H, INT-21H	1,2

MODULE-3

Module Number: 3	**No. of Hours: 10**

Learning Objectives: The main objectives of this MODULE are to

1.	Describe Basic Logic Instructions, Shift and Rotate, String Comparisons.
2.	Memory address decoding
3.	Data integrity in RAM and ROM
4.	Memory Interfacing: Memory Device
5.	Describe Programmable Peripheral Interface 82C55
6.	Initialise 8255 for simple,handshake input output.
7.	Programming and interfacing the 8255

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference

						Book/Chapter No.
L21.	Signed number Arithmetic Operations	PPT, Chalk and Board	1,2,3,12	1,2,3	2,3,4	T1/6
L22.	String operations. Memory and Memory interfacing: Memory address decoding,	PPT, Chalk and Board			2,3,4	T1/6
L23.	data integrity in RAM and ROM	PPT, Chalk and Board			2,3,4	T1/10
L24.	16-bit memory interfacing	PPT, Chalk and Board			2,3,4	T1/10
L25.	16-bit memory interfacing	PPT, Chalk and Board			2,3,4	T1/10
L26.	8255 I/O programming: I/O addresses MAP of x86 PC's	PPT, Chalk and Board			2,3,4	T1/11
L27.	8255 I/O programming: I/O addresses MAP of x86 PC's	PPT, Chalk and Board			2,3,4	T1/11
L28.	programming and interfacing the 8255	PPT, Chalk and Board			2,3,4	T1/11
L29.	programming and interfacing the 8255	PPT, Chalk and Board			2,3,4	T1/11
L30.	programming and interfacing the 8255	PPT, Chalk and Board			2,3,4	T1/11

Questions for practice:

Questions	COs Attained
1. Explain String Data Transfers, Miscellaneous Data Transfer Instructions..	2,3
2. Explain, I/O Port Address Decoding	2,3
3. Briefly explain Basic I/O Interface	2,3,4
4. Discuss modes of operation of 8255 programmable peripheral interfaces	2,4
5. Explain Programmable Peripheral Interface 82C55	2,4
6. Explain 16-bit memory interfacing	2,3,4
7. Explain programming 8255 for interfacing with 8086	2,3,4

MODULE-4

Module Number:4	**No. of Hours: 10**

Learning Objectives: The main objectives of this Module are to

1.	Discussion on how the RISC (reduced instruction set computer) design philosophy was adapted by ARM to create a flexible embedded processor
2.	An example embedded device.
3.	Hardware and software technologies that surround an ARM processor.
4.	An overview of the processor core and describe how data moves between its different parts.
5.	They are implemented along with basic logic functions.
6.	Pipeline, Exceptions,Interrupts

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L31.	Microprocessors versus Microcontrollers	PPT, Chalk and Board	1,2,3,12	1,2,3	1,2	T2/1
L32.	ARM Embedded Systems :The RISC design philosophy,	PPT, Chalk and Board			2,3	T2/1
L33.	The ARM Design Philosophy,	PPT, Chalk and Board			2,3	T2/1
L34.	Embedded	PPT,			3	T2/1

	System Hardware	Chalk and Board				
L35.	Embedded System Software	PPT, Chalk and Board			2,3	T2/1
L36.	ARM Processor Fundamentals : Registers , Current Program Status Register	PPT, Chalk and Board			3,4	T2/2
L37.	Pipeline, Exceptions	PPT, Chalk and Board			2,3	T2/2
L38.	Interrupts, and the Vector Table	PPT, Chalk and Board			3,4	T2/2
L39.	Interrupts, and the Vector Table	PPT, Chalk and Board			2,4	T2/2
L40.	Core Extensions.	PPT, Chalk and Board			2,4	T2/2

Questions for practice:

Questions	COs Attained
1. Explain the ARM instruction set suitable for embedded applications.	2
2. With neat block explain ARM-based embedded device, a microcontroller	2,3
3. *Write a note on memory in ARM Embedded Systems*	2
4. Four typical software components required to control an embedded device.	2,3
5. Explain ARM core dataflow model.	2
6. With neat block explain, Complete ARM register set.	4
7. Write a note on pipelining	2
8. With neat block explain Cache and Tightly Coupled Memory.	2,3,4

MODULE-5

Module Number:5	**No. of Hours: 10**

Learning Objectives: The main objectives of this module are to

1.	A typical computing task consists of a series of steps specified by a sequence of machine instructions that constitute a program.

2.	In this chapter we focus on the processing unit, which executes machine instructions and coordinates the activities of other units.
3.	Pipelining as a means for improvingperformance by overlapping the execution ofmachine instructions
4.	Embedded applications
5.	Microcontrollers for embedded systems

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L41.	Introduction to the ARM Instruction Set : Data Processing Instructions	PPT, Chalk and Board	1,2,3,12	1,2,3	2,3,4	T2/3
L42.	Instruction Set : Data Processing Instructions Branch Instructions,	PPT, Chalk and Board			2,3,4	T2/3
L43.	Software Interrupt Instructions	PPT, Chalk and Board			2,3,4	T2/3
L44.	Program Status Register Instructions coprocessor Instructions	PPT, Chalk and Board			2,3,4	T2/3
L45.	coprocessor Instructions	PPT, Chalk and Board			2,3,4	T2/3
L46.	Loading Constants	PPT, Chalk and Board			2,3,4	T2/3
L47.	Simple programming exercises	PPT, Chalk and Board			2,3,4	T2/3

L48.	Simple programming exercises	PPT, Chalk and Board			2,3,4	T2/3
L49.	Simple programming exercises	PPT, Chalk and Board			2,3,4	T2/3
L50.	Simple programming exercises	PPT, Chalk and Board			2,3,4	T2/3

Questions for practice:

Questions	COs Attained
1. Explain diffetent Data Processing Instructions.	2,3,4
2. With example for each explain, Arithmetic Instructions.	2,3,4
3. With example for each explain ,Comparison Instructions.	2,3,4
4. With example for each explain, Branch Instructions.	2,3,4
5. Explain Multiple-Register Transfer	2,3,4
6. With example for each explain ,Software Interrupt Instruction	2,3,4
7. Explain Loading Constants.	2,3,4

Assignment Questions:

Assignment 1:

6. With neat block explain the register organization of x86 microprocessor	1,2
7. Explain different addressing modes of x86 microprocessor .	1,2
8. What is addressing mode?Explain different addressing modes with example for each.	1,2
1. Explain Arithmetic and Logic Instructions: Addition, Subtraction and Comparison	1,2
1. Explain Interrupts- INT10H, INT-21H	1,2

Assignment 2:

1. With neat block explain, pin configuration of 8255	**2,3,4**
2. Show the address decoding where port A of 8255 has an I/O address of 300H ,then write a program to toggle all bits of PA continuously with ¼ Second delay. Use INT 16H to exit if there is key pressed.	**2,3,4**

3. Explain IBM PC memory map	**2,3,4**
4. Calculate memory cycle time of 20MHZ 8386 system with a) 0ws b) 1ws c) 2ws	**2,3,4**
5. Explain with example Memory address decoding.	**2,3,4**

Assignment 3:

1. Write a note on memory in ARM Embedded Systems	2
2. Four typical software components required to control an embedded device.	2,3
3. With neat block explain, Complete ARM register set.	4
4. List and explain all multiply instructions	2,3,4
5. List and explain single-register transfer Load-store instructions.	2,3,4

IA PORTION

I. A. Test No.	Modules
I	1,2
II	3
III	4,5

5. OBJECT ORIENTED CONCEPTS – SYLLABUS

Subject Title:	OBJECT ORIENTED CONCEPTS	Subject Code:	15CS45
Number of Lecture Hours/Week	04	IA Marks	20
Total Number of Lecture Hours	50	Exam Marks	80
Credits	04	Exam Hours	03
Staff : Prof. Pradeep Deshpande			

Course objectives: This course will enable students to

- Learn fundamental features of object oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Create multi-threaded programs and event handling mechanisms.
- Introduce event driven Graphical User Interface (GUI) programming using applets and swings.

Module -1	**Teaching Hours**
Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. **Class and Objects:** Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors.	10 Hours
Module -2	**Teaching Hours**
Introduction to Java: Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements	10 Hours
Module -3	**Teaching Hours**
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. **Inheritance:** inheritance basics, using super, creating multi level hierarchy, method overriding. **Exception handling:** Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces.	10 Hours
Module -4	**Teaching Hours**
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, readwrite problem, producer consumer	10 Hours

problems. **Event Handling:** Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.	
Module -5	**Teaching Hours**
The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. **Swings:** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.	10 Hours
Course outcomes:	
After studying this course, students will be able to: 1. Explain the object-oriented concepts and JAVA. 2. Develop computer programs to solve real world problems in Java. 3. Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using Applets and swings.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module	
Text Books: **T1.** Sourav Sahay, Object Oriented Programming with C++ ,Oxford University Press,2006 (Chapters 1,2,4) **T2.**Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30)	
Reference Books: R1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 R2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. R3. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. R4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. R5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. R6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.	

OBJECT ORIENTED CONCEPTS COURSE PLAN

1) Prerequisites:

1. Fundamentals of C Programming Concepts.
2. Fundamentals of Computer Concepts.
3. Concepts of Algorithms.
4. Object Oriented-Programming concepts with C++.

2) Course Overview and its relevance to programme:

Object-oriented programming (OOP) is a programming model based on the concept of "objects", which may contain data, in the form of fields, often known as attributes; and code, in the form of procedures, often known as methods. A feature of objects is that an object's procedures can access and often modify the data fields of the object with which they are associated. In OOP, computer programs are designed by making them out of objects that interact with one another. There is significant diversity of OOP languages, but the most popular ones are class-based, meaning that objects are instances of classes, which typically also determine their type.

Java is object oriented programming. Unlike many other computer languages whose influence begins to wane over the years, java has grown stronger with the passage of time, Java leapt to the forefront of Internet programming with its first release. Each subsequent version has solidified that position. Today, java is still the first and choice for developing web-based applications.

One reason for java's success is its agility. Java has rapidly adapted to changes the programming environment and to changes in the way that programmers program. Most importantly, it has not just followed the trends, it has helped create them. Unlike some other languages that have a revision cycle of approximately 10 years, Java's release cycle averages about 1.5 years.

In this course students will learn how to solve the complex problems and to code using Java language. It is easy and user friendly with wide applications.

Applications:

1. It is easy to model a real system as real objects are represented by programming objects in OOP. The objects are processed by their member data and functions. It is easy to analyze the user requirement.
2. The java runtime environment can be used for developing and running enterprise software, including network and web services,
3. Java is used to develop large-scale, multi-tiered, scalable, reliable, and secure network applications.
4. For developing java standalone programs.
5. Used for developing an architecture neutral applications for different operating system and devices.
6. It can be used to build secured client/server applications.

Module wise plan

Module -1

Module : 01	**No. of Hours: 10**
Title: Introduction to Object Oriented Concepts	

Learning Objectives: The main objectives of this module are to:

1	Review concepts of structures, procedure oriented programming.
2	Incorporates OOP's Concepts.
3	Compare OOPs with C Programming language.
4	Explain the concept of classes and objects.

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L1	A Review of structures, Procedure–Oriented Programming system	Chalk and Board	a,b,c,d,e,f,i,l	b,c	1,2	T1, R1
L2	Object Oriented Programming System, Comparison of Object Oriented Language with C,	Chalk and Board		b,c	1,2	T1, R1
L3	Console I/O, variables and reference variables, Function Prototyping.	Chalk and Board		b,c	1,2	T1, R1
L4	Function Overloading	Chalk and Board		b,c	1,2	T1, R1
L5	Introduction to Class and Objects	Chalk and Board		b,c	1,2	T1, R1
L6	member functions and data,	Chalk and Board		b,c	1,2	T1, R1
L7	objects and functions	Chalk and Board		b,c	1,2	T1, R1
L8	objects and arrays	Chalk and		b,c	1,2	T1, R1

		Board				
L9	Namespaces, Nested classes	Chalk and Board		b,c	1,2	T1, R1
L10	Constructors, Destructors.	Chalk and Board		b,c	1,2	T1, R1

T1: Text book No.1 in VTU Syllabus. R1: Reference Book No.1 in VTU Syllabus.

Assignment Questions:

Assignment Questions	COs attained
Q1) What are the differences between procedure oriented programming and object oriented programming?	1,2
Q2) What is function prototyping? Explain briefly.	1,2
Q3) Briefly describe Function Overloading.	1,2
Q4) Define Class? How it differs from structure?	1,2
Q5) How to declare data members and member functions in a class?	1,2
Q6) Write a simple program in java to create a class called Student and appropriate functions to read. display and calculate results.	1,2
Q7) What is array? How to define arrays in java?	1,2
Q8) What is Nested class?	1,2
Q9) What is Constructor? How it differs from normal function?	1,2
Q10) Write a program to illustrate constructors in java.	1,2

Module -2

Module : 02	**No. of Hours: 10**
Title: Introduction to Java	

Learning Objectives: The main objectives of this module are to:

1	Incorporates the Java Features and Java Applications.
2	Incorporates Concepts of JDK, Java Data Types, variables, arrays, Control Statements of Java, operators in java.
3	Write Simple Java Programs for above concepts.

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L11	Introduction to Java, Java's magic	Chalk and	a,b,c,d,e,i,l	b,c	1,2	T2, R6

		Board				
L12	Byte code, Java Development Kit (JDK)	Chalk and Board		b,c	1,2	T2, R6
L13	Java Buzzwords	Chalk and Board		b,c	1,2	T2, R6
L14	Object-oriented programming	Chalk and Board		b,c	1,2	T2, R6
L15	Data types	Chalk and Board		b,c	1,2	T2, R6
L16	variables and arrays	Chalk and Board		b,c	1,2	T2, R6
L17	Operators	Chalk and Board		b,c	1,2	T2, R6
L18	Control Statements	Chalk and Board		b,c	1,2	T2, R6
L19	Simple Java programs	Chalk and Board		b,c	1,2	T2, R6
L20	Simple Java programs	Chalk and Board		b,c	1,2	T2, R6

T2: Text book No.2 in VTU Syllabus. R6: Reference Book No.6 in VTU Syllabus.

Assignment Questions:	**COs attained**
Q1) What is bytecode? How it makes java.	1,2
Q2) Explain Java Development Kit (JDK).	1,2
Q3) Explain java buzz words.	1,2
Q4) Write short notes on i) Polymorphism ii) Encapsulation iii) inheritance	1,2
Q5) With a simple program explain how to build and execute a java program.	1,2
Q6) With example define? i) >>> ii) << iii) ^	1,2
Q7) What are the different data types available in Java?	1,2
Q8) What are short-circuited logical operators? Give examples? variables and arrays	1,2

Q9) Describe the following control construct with examples? i) break ii) continue	1,2
Q10) Write a java program using nested if to display season for a given month number.	1,2

Module -3

Module : 03	**No. of Hours: 10**
Title: Classes, Inheritance, Exceptions, Packages and Interfaces	

Learning Objectives: The main objectives of this module are to:

1	Define the concept of Classes and objects.
2	Implementing the concept of inheritance.
3	Handling exceptions in java.
4	Creation of packages and interfaces.

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	COs attained	PSOs attained	Reference Book/ Chapter No.
L21	Fundamentals of classes	Chalk and Board	a,b,c,d,e,j,l	a,c,e,f	1,2	T2, R4
L22	Declaring objects	Chalk and Board		a,c,e,f	1,2	T2, R4
L23	Constructors	Chalk and Board		a,c,e,f	1,2	T2, R4
L24	this keyword, garbage collection.	Chalk and Board		a,c,e,f	1,2	T2, R4
L25	inheritance basics	Chalk and Board		a,c,e,f	1,2	T2, R4
L26	using super, method overriding.	Chalk and Board		a,c,e,f	1,2	T2, R4
L27	creating multi level hierarchy	Chalk and Board		a,c,e,f	1,2	T2, R4
L28	Exception handling in Java	Chalk and Board		a,c,e,f	1,2	T2, R4
L29	Packages, Access Protection	Chalk and Board		a,c,e,f	1,2	T2, R4

L30	Importing Packages, Interfaces	Chalk and Board		a,c,e,f	1,2	T2, R4

T2: Text book No.2 in VTU Syllabus. R4: Reference Book No.4 in VTU Syllabus.

Assignment Questions:	**COs attained**
Q1) What is class? How to declare objects for class? Explain wit an example?	1,2
Q2) How overriding is different from overloading? Explain with example?	1,2
Q3) What is the importance of this keyword in java?	1,2
Q4) Write short notes on garbage collection.	1,2
Q5) What is inheritance? Explain its types.	1,2
Q6) What is exception? Write the general syntax for exception in java.	1,2
Q7) How is access protection provided for variables and methods in Java?	1,2
Q8) What is package? How to create and import packages in java?	1,2
Q9) What are the interfaces? What are their benefits? Give the general form of a class that implements interfaces?	1,2

Module -4

Module : 04	**No. of Hours: 10**
Title: Multi Threaded Programming, Event Handling	

Learning Objectives: The main objectives of this module are to:

1	Define thread and multithreaded programming.
2	Implementation of Synchronization and its problems.
3	Discuss the event handling mechanism in java.

Lesson Plan:

Lecture No.	**Topics Covered**	**Teaching Method**	**POs attained**	**PSOs attained**	**COs attained**	**Reference Book/ Chapter No.**
L31	Multi Threaded Programming: What are threads?	Chalk and Board	a,b,c,d,e,g,l	b,c	1,2	T2, R4
L32	How to make the classes threadable : Extending threads, Implementing	Chalk and Board		b,c	1,2	T2,

	runnable					
L33	Synchronization	Chalk and Board		b,c	1,2	T2, R4
L34	Changing state of the thread; Bounded buffer problems	Chalk and Board		b,c	1,2	T2, R4
L35	Read-write problem, producer consumer problems	Chalk and Board		b,c	1,2	T2, R4
L36	**Event Handling:** Two event handling mechanisms; The delegation event model;	Chalk and Board		b,c	1,2	T2, R4
L37	Event classes; Sources of events	Chalk and Board		b,c	1,2	T2, R4
L38	Event listener interfaces	Chalk and Board		b,c	1,2	T2, R4
L39	Using the delegation event model	Chalk and Board		b,c	1,2	T2, R4
L40	Adapter classes; Inner classes.	Chalk and Board		b,c	1,2	T2, R4

T2: Text book No.2 in VTU Syllabus. R4: Reference Book No.4 in VTU Syllabus.

Assignment Questions:	**COs attained**
Q1) What are threads? What are the advantages of threads?	1,2
Q2) With an example explain how to create threads by extending Thread class..	1,2
Q3) With an example explain how to create threads by Implementing runnable .	1,2
Q4) What is synchronization? When do we use it? Changing state of the thread;	1,2
Q5) Explain the different states of the threads.,	1,2
Q6) Write short note on i) Bounded buffer problems ii) Read-write problem iii) producer consumer problems	1,2
Q7) Explain about the Delegation Event Model.	1,2
Q8) Explain about the i) FocusEvent. ii) MouseEvent.	1,2
Q9) Explain about the adapter classes with suitable program.	1,2

Q10) What is the use of inner classes in Applet program? Explain with suitable example?	1,2

Module -5

Module : 05	**No. of Hours: 10**
Title: The Applet Class	

Learning Objectives: The main objectives of this module are to:

1	Discuss basics of applet and types.
2	Implement applet programs to improve functionality of browser.
3	Write different programs using swings to design front end for a browser.

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L41	Introduction, Two types of Applets, Applet basics; Applet Architecture	Chalk and Board	a,b,c,d,e, g,l	b,c	2,3	T2, R5
L42	An Applet skeleton; Simple Applet display methods	Chalk and Board		b,c	2,3	T2, R5
L43	Requesting repainting, Using the Status Window; The HTML APPLET tag	Chalk and Board		b,c	2,3	T2, R5
L44	Passing parameters to Applets, getDocumentbase() and getCodebase(); ApletContext and showDocument()	Chalk and Board		b,c	2,3	T2, R5
L45	The AudioClip Interface; The AppletStub Interface;Output to the Console. **Swings:** Swings: The origins of Swing	Chalk and Board		b,c	2,3	T2, R5
L46	Components and	Chalk and		b,c	2,3	T2, R5

	Containers; The Swing Packages	Board				
L47	A simple Swing Application; Create a Swing Applet;	Chalk and Board		b,c	2,3	T2, R5
L48	Jlabel and ImageIcon; JTextField;	Chalk and Board		b,c	2,3	T2, R5
L49	The Swing Buttons, JTabbedpane, JScrollPane	Chalk and Board		b,c	2,3	T2, R5
L50	JList, JComboBox, JTable.	Chalk and Board		b,c	2,3	T2, R5

T2: Text book No.2 in VTU Syllabus. R5: Reference Book No.5 in VTU Syllabus.

Assignment Questions:	**COs attained**
Q1) What is an applet? Explain two types of Applets.	2,3
Q2) Explain Applet skeleton.	2,3
Q3) Explain different forms of repaint method.	2,3
Q4) Write an applet program to read parameters name, age and display appropriate message to the browser.	2,3
Q5) Write short notes on i) status window ii) HTML APPLET tag	2,3
Q6) Explain about the two key swing features.	2,3
Q7) Write a simple Swing based Applet Program.	2,3
Q8) Explain about the JLabel and ImageIcon with example.	2,3
Q9) Write an Applet program to demonstrate the JTextField.	2,3
Q10) Explain the swing Buttons.	2,3
Q11) Explain about the JTabbedPane with suitable example.	2,3
Q12) Explain about the Container JScrollPane with suitable example.	2,3
Q13) Explain about the JTree class with suitable example.	2,3
Q14) Write an Applet Program to demonstrate the JTable.	2,3

ASSIGNMENT QUESTIONS
ASSIGNMENT 1

Q1) What are the differences between procedure oriented programming and object oriented programming?	1,2
Q2) What is function prototyping? Explain briefly. Briefly describe Function Overloading.	1,2
Q3) Define Class? How it differs from structure? How to declare data members and	1,2

member functions in a class? What is Constructor? How it differs from normal function?	
Q4) Write a simple program in java to create a class called Student and appropriate functions to read. display and calculate results.	1,2
Q5) What is array? How to define arrays in java?	1,2
Q7) What is bytecode? How it makes java. Explain Java Development Kit (JDK).	1,2
Q8) Explain java buzz words.	1,2
Q9) Write short notes on i) Polymorphism ii) Encapsulation iii) inheritance iv) break v) continue	1,2
Q10) With a simple program explain how to build and execute a java program.	1,2

ASSIGNMENT 2

Q1) How overriding is different from overloading? Explain with example?	1,2
Q2) Write short notes on garbage collection and this keyword	1,2
Q3) What is inheritance? Explain the two uses of super keyword.	1,2
Q4) What is exception? Write the general syntax for exception in java.	1,2
Q5) What is package? How to create and import packages in java?	1,2
Q6) What are the interfaces? What are their benefits? Give the general form of a class that implements interfaces?	1,2
Q7) With an example explain how to create threads by extending Thread class and by Implementing runnable	1,2
Q8) What is synchronization? When do we use it? Changing state of the thread;	1,2
Q9) Explain about the Delegation Event Model. Explain about the i) FocusEvent. ii) MouseEvent.	1,2
Q10) Explain about the i) adapter classes ii) inner classes with suitable program.	1,2

ASSIGNMENT 3

Q1) What is an applet? Explain two types of Applets. Explain Applet skeleton.	2,3
Q2) Explain different forms of repaint method.	2,3
Q3) Write an applet program to read parameters name, age and display appropriate message to the browser.	2,3
Q4) Write short notes on i) status window ii) HTML APPLET tag	2,3
Q5) Write a simple Swing based Applet Program.	2,3
Q6) Explain about the i) JLabel and ImageIcon ii) JTextField iii) the swing Buttons **iv)** JTabbedPane **v)** JScrollPane	2,3
Q7) Write an Applet Program to demonstrate the JTable.	2,3

6. DATA COMMUNICATION SYLLABUS

DATA COMMUNICATION

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – IV

Subject Code	15CS46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Explain with the basics of data communication and various types of computer networks;
- Illustrate TCP/IP protocol suite and switching criteria.
- Demonstrate Medium Access Control protocols for reliable and noisy channels.
- Expose wireless and wired LANs along with IP version.

Contents	Teaching Hours
Module 1	
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, **Networks Models**: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer-1:** Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, **Digital Transmission**: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).	**10 Hours**
Module 2	
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, **Analog Transmission**: Digital to analog conversion, **Bandwidth Utilization**: Multiplexing and Spread Spectrum, **Switching**: Introduction, Circuit Switched Networks and Packet switching.	**10 Hours**
Module 3	
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, **Data link control**: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).	**10 Hours**
Module 4	
Media Access control: Random Access, Controlled Access and Channelization, **Wired LANs Ethernet**: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, **Wireless LANs:** Introduction, IEEE 802.11 Project and Bluetooth.	**10 Hours**
Module 5	
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, **Network layer Protocols** : Internet Protocol, ICMPv4,Mobile IP, **Next generation IP**: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.	**10 Hours**

Course Outcomes: After studying this course, students will be able to

- Illustrate basic computer network technology.
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP functions of each layer.
- Make out the different types of network devices and their functions within a network

• Demonstrate the skills of subnetting and routing mechanisms.
Graduate Attributes
1. Engineering Knowledge 2. Design Development of solution(Partly) 3. Modern Tool Usage 4. Problem Analysis
Question paper pattern:
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.
Text Book:
Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)
Reference Books:
1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004. 2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007. 3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007. 4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

DATA COMMUNICATION

1. Prerequisites:

1. Basic understanding of concepts of Data and communications.
2. Basic knowledge of Computer Networks like LAN, WAN, MAN is an advantage.
3. Basic knowledge of analog and digital signals

2. Course Overview and its relevance to this programme:

Data communication and networking is fastest growing technologies today. This course covers the basics of Data Communications and networking: Protocols, Standards, reference Models. The focus is mainly on Physical and Data Link layers Concepts, with brief touch to network layer concepts. The course highlights various Analog & Digital Modulation techniques. It also covers the concept of Multiplexing and Spread spectrum for multiple signal transmission. It discusses several bandwidth utilization techniques, switching and different error coding techniques.

The data link layer discussion is split into two parts: Data Link Control (which deals with framing and flow control protocols) and multiple access control (which deals with medium

access control techniques). The discussions are made about standard DLC protocols (HDLC,PPP) and different Medium access control protocols. The course provides an insight into Wired and Wireless LANs, WIMAX, Cellular telephony, and satellite networks.

Course outcomes

1. Illustrate basic computer network technology.
2. Identify the different types of network topologies and protocols.
3. Enumerate the layers of the OSI model and TCP/IP functions of each layer.
4. Make out the different types of network devices and their functions within a network
5. Demonstrate the skills of sub netting and routing mechanisms.
6. Explain the different wireless technologies like WIMAX, Cellular telephony and Satellite networks

3. Applications:

- Designing the networks for organization, universities, public and private communications And other requirements
- For developing network related programs using net simulators or on real time platforms.
- Design networks for all types of communications in electronic media.

4) Module wise plan

Module -1

Module - 1	**No. of Hours: 10**
Title: Introduction: Networks Models, Introduction to Physical Layer-1, Digital Transmission	

Learning Objectives: The main objectives of this Module are to:

1.	Define the basic concepts of Networking with real Examples.
2.	Express the broad definition of Data Communication & Different types Network Topologies like Mesh, Star, Bus, Ring, and Hybrid Topologies
3.	Define Internet, Protocol & Key elements of protocol and Different standards for Data communication
4.	Study different layers in the OSI model and TCP/IP model
5.	Define concepts of Analog & Digital Data and Analog & Digital Signals
6.	Define different types of Transmission Impairments i.e. Attenuation, Distortion and Noise.
7.	Compute theoretical Data rate using- Nyquist Bit rate & Shannon Channel Capacity
8.	Discuss performance factors i) Latency ii) Bandwidth iii) Throughput
9.	Explain Line Coding characteristics and different Line Coding techniques.

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Text Book/ Chapter No.

L1.	**Introduction:**Data Communications	Chalk & Board,PPT	1, 2, 3, 12	1	1	T/1
L2.	Networks, Network Types	Chalk & Board,PPT		1,2	1,2	T/1
L3.	Internet History, Standards and Administration	Chalk & Board,PPt		1,2,3	1	T/1
L4.	**Networks Models :** Protocol Layering,	Chalk & Board,PPT		1,2	1,2	T/2
L5.	TCP / IP Protocol Suite.	Chalk & Board		1,2	3	T/2
L6	The OSI model,	Chalk & Board, PPT		1	3	T/2
L7	**Introduction to Physical Layer-1:** Data and Signals.	Chalk & Board,PPT		1	3	T/3
L8	Digital Signals, Transmission Impairments.	Chalk & Board,PPT		1	4	T/3
L9	Data Rate limits, Performance.	Chalk & Board,PPT		1	4	T/3
L10	**Digital Transmission:** Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).	Chalk & Board,PPT		1	4	T/4

Questions for practice:

Questions	**COs attained**
Q1. What is Data Communication? Explain the following w.r.t data communications: Fundamental characteristics of Data Communication, Components of Data Communications.	1
Q2. What is a Computer Network? Explain important network criteria.	2
Q3. Differentiate between the following. 1. LAN, WAN and MAN 2. Simplex, Half Duplex and Full Duplex 3. Point-to-point and Multipoint connections	2
Q4. Explain different topologies of computer networks.	2
Q5. Explain the functions of each layer in the 1. OSI Reference Model 2. TCP/IP Reference Model	3
Q6. Define and explain the term: Bandwidth of a signal, Bandwidth of a channel,	4

Bit- Rate, Bit-Length, SNR, Decibel.	
Q7. Briefly explain the types of transmission impairments. How they can be Overcome?	4
Q8. List the factors on which data rate of transmitted signal depends. Explain the following theoretical formula for data rate calculations- 1. Nyquist data rate for noiseless channel 2. Shannon's Capacity for Noisy channel.	4
Q9. Define line coding? List the important characteristics of line coding. Explain the different types of line coding techniques with example waveforms for digital signal 0011001.	4
Q10. A file contains 3 million bytes how long does it take to download this file using i) 100 kbps channel ii)10 Mbps channel	4
Q11. What is the theoretical capacity of the channel in each of the following cases? i) Bandwidth: 20 KHz $SNR_{dB} = 40$ ii) Bandwidth: 200 KHz $SNR_{dB} = 6$ iii)Bandwidth 1MHz $SNR_{dB} = 40$	4

MODULE-2

Module: 02	**No of Hours: 10 Hours**
Title: : Physical Layer-2, Analog Transmission, Bandwidth Utilization, Switching	

Learning Objectives: The main objectives of this Module are to:

1.	Define different Modulation techniques:PCM
2.	Demonstrate different types of Transmission modes i) Parallel ii) Serial
3.	Express Digital to Analog Conversion techniques
4.	Discuss different multiplexing techniques such as TDM, FDM & WDM
5.	Define Spread spectrum technique. Explain different Spread spectrum techniques.
6.	Define Switching. Differentiate between Circuit and Packet Switching

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Text Book/ Chapter
L11	**Physical Layer-2:**Analog to digital conversion (only PCM)	Chalk and Board,PPT	1,2,3,4,5,12	1	4	T/4
L12	PCM Continued	Chalk and Board & PPT		1	4	T/4
L13	Transmission Modes,	Chalk and Board,PPT		1,3	4	T/4

L14	Analog Transmission: Digital to analog conversion	Chalk and Board,PPT		1	4	T/5
L15	**Bandwidth Utilization:** Multiplexing	Chalk and Board & PPT		1	4	T/6
L16	TDM,FDM,WDM	Chalk and Board & PPT		1,3	4	T/6
L17	Spread Spectrum	Chalk and Board,PPT		1,3	4	T/6
L18	**Switching:** Introduction	Chalk and Board,PPT		1,3	4	T/6
L19	Circuit Switched Networks And Packet switching.	Chalk and Board,PPT		1,3	4	T2/4
L20	Packet switching Networks	Chalk and Board,PPT		1,3	4	T/6

Questions for practice:

Questions:	**COs attained**
Q1.Explain different components of PCM (or Digitizer).	4
Q2. Write a note on Digital -to -Analog Conversion.	4
Q3. A speech of 4kHz bandwidth is encoded using 8-bit PCM. Find the data rate of the Signal and the amount of memory required to store 5 min speech.	4
Q4. Explain different transmission modes.	4
Q5. Define Multiplexing. Explain with neat diagrams multiplexing and Demultiplexing Of TDM, FDM and WDM.	4
Q6. Differentiate with neat diagram between Synchronous TDM and Statistical TDM.	4
Q7. Explain different data rate management techniques in Synchronous TDM.	4
Q8. Write a note on: Analog Hierarchy and Digital Hierarchy.	4
Q9. What is spread spectrum? Explain the principles of spread spectrum techniques. Explain FHSS and DSSS techniques for spread spectrum.	4
Q10. Differentiate between: i) Circuit and Packet Switching ii) Datagram and Virtual Circuits	4

MODULE-3

Module : 03	**No of Hours: 10**
Title: Error Detection and Correction, Data link control, Data link layer protocols	

Learning Objectives: The main objectives of this Module are to:

1	Define concepts of error detection and correction
2	Study different Error coding techniques- Block coding, Cyclic coding
3	Evaluate performances of different error coding techniques
4	Define concept of framing, Fixed Size Framing And Variable Size Framing.
5	Define concepts of flow & Error controls
6	Develop protocols for noiseless channels: Simplest Protocol & Stop & Wait Protocol.
7	Develop protocols for noisy channels: Stop & Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ.
8	Define frame format of HDLC.
9	Define frame format of PPP & Transition Phase

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L21	**Error Detection and Correction:** Introduction, Block coding,	Chalk and Board,PPT	c,e,j,k	1,3	4	T/10
L22	Cyclic codes, checksum	Chalk and Board,PPT		1,3	4	T/10
L23	Checksum, Forward Error Correction	Chalk and Board & PPT		1,2,3	4	T/10
L24	Checksum Examples	Chalk and Board & PPT		1	4	T/10
L25	**Data link control:** DLC services,	Chalk and Board, PPT		1	4	T/11
L26	**Data link layer protocols:** Noiseless Protocols.	Chalk and Board & PPT		1	4	T/11
L27	Noisy Protocols	Chalk and Board &		1,2	4	T/11

		PPT				
L28	Noisy Protocols Continued…	Chalk and Board & PPT		1,2	4	T/11
L29	HDLC	Chalk and Board,PPT		1	4	T/11
L30	Point to Point protocol (Framing, Transition phases only).	Chalk and Board,PPT		1,2	4	T/11

Questions for practice:

Questions	**Cos attained**
Q1. Differentiate between the following: 1. Single-bit error and Burst error 2. Error detection and error correction 3. Forward error correction and retransmission	4
Q2.What is Block coding? Explain error detection and correction in Block coding.	4
Q3. Define Hamming Distance and Minimum Hamming Distance (dmin). With the help of geometrical concept for dmin in Error detection and Error correction, Obtain the Expression for the number of errors detectable and correctable in a code.	4
Q4.What are Linear Block Codes (LBCs)? Explain with examples the following LBCs: 1. Simple Parity check code 2. 2D Parity check code	4
Q5.Define CRC. Give the steps for CRC calculation. Find the CRC for the data word 1001 Using generator polynomial $g(x) = x^3+x^2+1$. Explain how CRC can be used For Error detection and correction using above example. Draw the hardware Circuit to Implement divisor.	4
Q6.Explain the performance analysis and advantages of cyclic code.	4
Q7.Explain the internet checksum algorithm with example. Discuss its performance.	4
Q8.Differentiate between-Character oriented and Bit-oriented protocols.	4
Q9.Explain Bit-stuffing and Byte stuffing with examples.	4
Q10. Explain *Simplest* and *Stop-and-wait* protocol for Noiseless Channel.	4
Q11. Explain in detail with flow diagram and Algorithm: 1. GO-Back-N ARQ. 2. Stop & Wait ARQ 3. Selective Repeat ARQ Compare the performance of the three.	4

Q12. Define piggybacking and its usefulness.	4
Q13. Explain the two transfer modes in HDLC (NRM and ABM).	4
Q14. Explain HDLC frame Format with Example.	4
Q15. Explain PPP frame format & also Explain PPP Transition phases	4

MODULE-4

Module : 04	**No of Hours: 10**
Title: Media Access control, Wired LANs Ethernet, Wireless LANs	

Learning Objectives: The main objectives of this Module are to:

1	Study different accessing methods - random access, controlled access & Channelization.
2	Discuss random access techniques such as ALOHA, CSMA, CSMA/CD, CSMA/CA
3	Discuss controlled access techniques such as Polling, Reservation, and Token Ring.
4	Discuss channelization techniques such as FDMA, TDMA, CDMA.
5	Define about IEEE 802.3 Medium standards.
6	Express different types of Ethernet Standards such as Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Ten-Gigabit Ethernet and their Physical implementations.
7	Develop architecture of 802.11: Basic Service Set (BSS) & Extended Service Set(ESS).
8	Explain addressing mechanism in 802.11
9	Explain Hidden & Exposed Station Problem.
10	Study Physical Layer of IEEE 802.11- FHSS, DSSS, Infrared, TFDM.
11	Explain architecture of Bluetooth.

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L31	**MAC:** Random Access- Pure ALOHA & Slotted ALOHA	Chalk and Board, PPT	1,2,3,4,5,12	1,2	4	T/12
L32	Random Access: CSMA/CD & CSMA/CA	Chalk and Board, PPT		1,2	4	T/12
L33	Controlled Access: Reservation, Poling, Token Ring.	Chalk and , Board & PPT		1,2	4	T/12
L34	Channelization: FDMA, TDMA, CDMA.	Chalk Board, PPT		1,2	4	T/12
L35	**Wired LANs Ethernet:**	Chalk and		1,2	4	T/13

	Ethernet Protocol, Standard Ethernet	Board, PPT				
L36	Fast Ethernet, Gigabit Ethernet,10 Gigabit Ethernet	Chalk and Board, PPT		1,2	4	T/13
L37	**Wireless LANs:** Introduction	Chalk and Board & PPT		1,2,3	6	T/15
L38	IEEE 802.11	Chalk, Board,PPT		1,3	6	T/15
L39	IEEE 802.11 contd.	Chalk and Board,PPT		1,3	6	T/15
L40	Bluetooth	Chalk and Board, PPT		1,3	6	T/15

Questions for practice:

Questions:	**Cos attained**
Q1. Explain different types of Multiple access Protocols with example.	4
Q2. Explain w.r.t ALOHA and Slotted ALOHA- 1. Principle of working 2. Vulnerable time 3. Throughput.	4
Q3. Explain the principle of CSMA. What is its Vulnerable time? Discuss different Persistence methods.	4
Q4. Explain with flow diagram CSMA/CD. Discuss Minimum Frame size, throughput and energy levels in CSMA/CD.	4
Q5. Why CSMA/CD is not possible in Wireless Networks? Explain with flow diagram, the working of CSMA/CA.	4
Q6. What is controlled access? Explain the different techniques: Reservation, Polling and Token Passing.	4
Q7. What is channelization? Explain in principles of TDMA, FDMA and CDMA.	4
Q8. Explain the two services supported by IEEE 802.11 standard (BSS and ESS).	5,6
Q9. Explain IEEE 802.11 MAC layer. Discuss the DCF,PCF in the 802.11 MAC layer.	5,6
Q10. Explain the in IEEE 802.11. 1. MAC layer frame format 2. Addressing mechanism	5,6
Q11. Explain different physical layer implementations of IEEE 802.11.	5,6
Q12. Write a note on Bluetooth	5,6

MODULE-5

Module: 05	**No of Hours: 10**
Title: Other wireless Networks, Network layer Protocols, Next generation IP.	

Learning Objectives: The main objectives of this Module are to:

1	Explains about WIMAX Technology
2	Explains about Cellular Telephony
3	Explains about Satellite networks
4	Define about Network layer basics and logical addressing
5	Explain IPv4 packets structure and Addressing
6	Explain IPv6 packets structure and Addressing
7	Compare - IPv4 and IPv6

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	*POs attained	*PSOs attained	COs attained	Reference Book/ Chapter
L41	**Other wireless Networks:** WIMAX	Chalk and Board & PPT	2,3,5,6, 9,11,12	3	6	T/16
L42	Cellular Telephony	Chalk and Board & PPT		3	6	T/16
L43	Satellite networks	Chalk and Board & PPT		3	6	T/16
L44	**Network layer Protocols:** Internet Protocol	Chalk and Board		1,3	5,6	T/19
L45	ICMPv4	Chalk and Board,PPT		1,3	5,6	T/19
L46	Mobile IP	Chalk and Board, PPT		1,3	5,6	T/19
L47	**Next generation IP:** IPv6 addressing,	Chalk and Board & PPT		1,3	5,6	T/22
L48	The IPv6 Protocol,	Chalk and Board & PPT		1,3	5,6	T/22
L49	The ICMPv6 Protocol	Chalk and Board & PPT		1,3	5,6	T/22
L50	Transition from IPv4 to IPv6.	Chalk and Board & PPT		1,3	5,6	T/22

Questions for practice:

Questions:	Cos attained
Q1.Explain with neat figure WIMAX Technology	6
Q2.Write a note on cellular telephony.	6
Q3.Write a note on satellite networks	6
Q4. Explain what do you mean by logical addressing..	5,6
Q5. Explain 1. IPv4 packet format. 2. IPv6 packet format. 3. IPv4 addressing 4. IPv6 addressing	5,6
Q6. Diffenetiate between IPv4 and IPv6 headers	5,6
Q7. Explain ICMP6 protocol.	
Q8. Explain how the migration can be done from IPv4 to IPv6.	

ASSIGNMENT QUESTIONS:

ASSIGNMENT - I

Questions	COs attained
Q.1. Explain with neat diagram – TCP/IP Reference model for Computer networks	1,3
Q.2. Explain the performance criteria for Computer networks	1
Q.3. Explain factors limiting data rates in computer networks. Explain- Nyquist Rate and Shannon's Channel Capacity	1,
Q.4. Draw the line coding waveforms for- 1010011 using- NRZL, NRZI, RZManchester, Diff. Manchester and AMI coding	1,2
Q.5. Explain PCM encoder and decoder. Discuss SNR in PCM.	2,3,5
Q.6. Explain different data rate management techniques in synchronous TDM. Design the data rate management scheme for data rates-10 khz, 20 khz,8 khz signals.	2,3
Q.7. What are the important goals od Spread spectrum?. Explain DSSS and FHSS techniques.	2,3
Q.8. Differentiate between: Circuit and Packet switching techniques. Discuss the tradeoffs.	2,3

ASSIGNMENT - II

Questions	COs attained
Q.1. Explain the significance of dmin. Explain with geometrical interpretation the error detection and correction capability of a code based on dmin.	1,2,4
Q.2. If Data is 1001 and Generator is 1100, Explain how CRC technique is used to detect error.	2,4
Q.3. Explain Stop and Wait protocol for noisy channels	2,4
Q.4. Explain PPP frame format and Transition Diagram	2,4

Q.5. Explain HDLC frame format.	2,4
Q.6. Explain Standard Ethernet frame format.	2,4
Q.7. Explain with example- how CDMA works	2,4,
Q.8. What is CSMA/CD?. Explain different persistent technologies of CSMA.	

ASSIGNMENT - III

Questions	COs attained
Q.1. Explain 802.11 addressing schemes.	2,4,5
Q.2. Explain the architecture of blue-tooth.	2,4
Q.3. Explain IPv4 packet format.	2,3,5
Q.4. List the advantages of IPv6 over IPv4. Explain Basic Header format in IPv6. Explain the concept of Extension Header in IPv6.	2,3,5
Q.5. Explain ICMPv4 Message formats	2,3,4
Q.6. Explain the stages in Mobile IP	5
Q.7. Explain transition from IPv4 to IPv6.	2,3,5
Q.8, Explain different features of 1G, 2G, 3G and 4G cellular telephony.	6

Portion for I. A. Test:

I.A. TEST	MODULES	COs
I IA Test	Modules 1,2	1,2,3
II IA Test	Modules 3,4	2,3,4
III IA Test	Module 5	3,5,6

7. DESIGN AND ANALYSIS OF ALGORITHM LABORATORY

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY
[As per Ch sed Credit System (CBCS) scheme]
(Effecti n the academic year 2016 -2017)
SEMESTER – IV

Subject Code	15CSL47	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Design and implement various algorithms in JAVA
- Employ various design strategies for problem solving.
- Measure and compare the performance of different algorithms.

Description

Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment.Netbeans/Eclipse IDE tool can be used for development and demonstration.

Experiments

1	A	Create a Java class called *Student*with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create *n*Student objects and print the USN, Name, Branch, and Phoneof these objects with suitable headings.
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
2	A	Design a superclass called *Staff* with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely *Teaching* (domain, publications), *Technical* (skills), and *Contract* (period). Write a Java program to read and display at least 3 *staff* objects of all three categories.
	B	Write a Java class called *Customer* to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as "/".
3	A	Write a Java program to read two integers *a* and*b*. Compute *a*/*b* and print, when *b* is not zero. Raise an exception when *b* is equal to zero.
	B	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number andprints; third thread will print the value of cube of the number.
4		Sort a given set of *n* integer elements using **Quick Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000 and record the time taken to sort. Plot a graph of the time taken versus *n*on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

5	Sort a given set of *n* integer elements using **Merge Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000, and record the time taken to sort. Plot a graph of the time taken versus *n*on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6	Implement in Java, the **0/1 Knapsack** problem using (a) Dynamic Programming method (b) Greedy method.
7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using **Dijkstra's algorithm**. Write the program in Java.
8	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Kruskal'salgorithm**. Use Union-Find algorithms in your program.
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Prim's algorithm**.
10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using **Floyd's algorithm**. (b) Implement **Travelling Sales Person problem** using Dynamic programming.
11	Design and implement in Java to find a **subset** of a given set S = {S1, S2,.....,Sn} of *n* positive integers whose SUM is equal to a given positive integer *d*. For example, if S ={1, 2, 5, 6, 8} and *d*= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.
12	Design and implement in Java to find all **Hamiltonian Cycles** in a connected undirected Graph G of *n* vertices using backtracking principle.

Course Outcomes: The students should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such assorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structuresto solve real-world problems.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

All laboratory experiments (Twelve problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot.
To generate the data set use random number generator function.
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80). Change of experiment is allowed only once and marks allotted to the procedure

8.MICROPROCESSOR AND MICROCONTROLER LABORATORY

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – IV

Subject Code	15CSL48	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM. To give the knowledge and practical exposure on connectivity and execute of interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

Description

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element "X" in a list of 'n' 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.

5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

8. a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
   b. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.
9. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
10. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
11. Design and develop an assembly language program to
    a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
    b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
13. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: After studying this course, students will be able to

- Learn 80x86 instruction sets and gins the knowledge of how assembly language works.
- Design and implement programs written in 80x86 assembly language
- Know functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

9. VTU QUESTION PAPERS

ENGINEERING MATHEMATICS – IV

CBCS Scheme

USN | | | | | | | | | | 15MAT41

Fourth Semester B.E. Degree Examination, June/July 2017
Engineering Mathematics–IV

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer FIVE full questions, choosing one full question from each module.***
2. ***Use of statistical tables are permitted.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Find by Taylor's series method the value of y at x = 0.1 from $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$ (upto 4th degree term). **(05 Marks)**

b. The following table gives the solution of $5xy' + y^2 - 2 = 0$. Find the value of y at x = 4.5 using Milne's predictor and corrector formulae. **(05 Marks)**

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

c. Using Euler's modified method. Obtain a solution of the equation $\frac{dy}{dx} = x + |\sqrt{y}|$, with initial conditions y = 1 at x = 0, for the range $0 \le x \le 0.4$ in steps of 0.2. **(06 Marks)**

OR

2 a. Using modified Euler's method find y(20.2) and y(20.4) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with $y(20) = 5$ taking h = 0.2. **(05 Marks)**

b. Given $\frac{dy}{dx} = x^2(1 + y)$ and y(1) = 1, y(1.1) = 1.233, y(1.2) =1.548, y(1.3) = 1.979. Evaluate y(1.4) by Adams-Bashforth method. **(05 Marks)**

c. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at x = 0.2 by taking h = 0.2 **(06 Marks)**

Module-2

3 a. Obtain the solution of the equation $2\frac{d^2y}{dx^2} = ux + \frac{dy}{dx}$ by computing the value of the dependent variable corresponding to the value 1.4 of the independent variable by applying Milne's method using the following data: **(05 Marks)**

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y'	2	2.3178	2.6725	3.0657

b. Express $f(x) = 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomials. **(05 Marks)**

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$ **(06 Marks)**

1 of 3

OR

4 a. By Runge-Kutta method solve $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for x = 0.2. Correct to four decimal places using the initial conditions y = 1 and $y' = 0$ at x = 0, h = 0.2. **(05 Marks)**

b. Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$ **(05 Marks)**

c. Prove the Rodrigues formula,

$$\rho_n(x) = \frac{1}{2^n n!}\frac{d^n(x^2-1)^n}{dx^n}$$ **(06 Marks)**

Module-3

5 a. State and prove Cauchy's-Riemann equation in polar form. **(05 Marks)**

b. Discuss the transformation $W = e^z$. **(05 Marks)**

c. Evaluate $\int_C \left\{\frac{\sin(\pi z^2) + \cos(\pi z^2)}{(z-1)^2(z-2)}\right\} dz$

using Cauchy's residue theorem where 'C' is the circle $|z| = 3$ **(06 Marks)**

OR

6 a. Find the analytic function whose real part is, $\frac{\sin 2x}{\cosh 2y - \cos 2x}$. **(05 Marks)**

b. State and prove Cauchy's integral formula. **(05 Marks)**

c. Find the bilinear transformation which maps $z = \infty$, i, 0 into $\omega = -1, -i, 1$. Also find the fixed points of the transformation. **(06 Marks)**

Module-4

7 a. Find the mean and standard deviation of Poisson distribution. **(05 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D of 60 hours. Estimate the number of bulbs likely to burn for,

(i) more than 2150 hours.
(ii) less than 1950 hours
(iii) more than 1920 hours and less than 2160 hours.

[A(1.833) = 0.4664, A(1.5) = 0.4332, A(2) = 0.4772] **(05 Marks)**

c. The joint probability distribution of two random variables x and y is as follows:

x/y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Determine:

(i) Marginal distribution of x and y.
(ii) Covariance of x and y
(iii) Correlaiton of x and y. **(06 Marks)**

OR

8 a. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured what is the probability that, (i) Exactly 2 are defective (ii) at least 2 are defective (iii) none of them are defective. **(05 Marks)**

b. Derive the expressions for mean and variance of binomial distribution. **(05 Marks)**

c. A random variable X take the values -3, -2, -1, 0, 1, 2, 3 such that $P(x = 0) = P(x < 0)$ and $P(x = -3) = P(x = -2) = P(x = -1) = P(x = 1) = P(x = 2) = P(x = 3)$. Find the probability distribution. **(06 Marks)**

Module-5

9 a. In 324 throws of a six faced 'die' an odd number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one? **(05 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results:

Horse A:	28	30	32	33	33	29	34
Horse B:	29	30	30	24	27	29	

Test whether you can discriminate between the two horses.($t_{0.05}$=2.2 and $t_{0.02}$=2.72 for 11 d.f) **(05 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix, $A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$ **(06 Marks)**

OR

10 a. Define the terms: (i) Null hypothesis (ii) Type–I and Type–II error (iii) Confidence limits. **(05 Marks)**

b. Prove that the Markov chain whose t.p.m $P = \begin{bmatrix} 0 & 1/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector. **(05 Marks)**

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball find the probabilities that after three throws (i) A has the ball. (ii) B has the ball. (iii) C has the ball. **(06 Marks)**

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SOFTWARE ENGINEERING

CBCS Scheme

USN 2 BL 15 CS 05 0 15CS42

Fourth Semester B.E. Degree Examination, June/July 2017
Software Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. What are the fundamental activities of software engineering? **(04 Marks)**
b. With neat diagram, explain the water-fall model of software development process. **(06 Marks)**
c. With a diagram, explain the rational unified process. **(06 Marks)**

OR

2 a. What is requirement specification? Explain various ways of writing system requirements. **(06 Marks)**
b. Why the understanding of requirements from stake holders is difficult task? Explain. **(05 Marks)**
c Explain the different checks to be carried out during requirement validation process. **(05 Marks)**

Module-2

3 a. Draw a context model for patient information system. How the interactions are modeled? **(06 Marks)**
b. Explain the terms class diagram, generalization and aggregation. **(06 Marks)**
c. What is model Driven engineering? State the three types of abstract system models produced. **(04 Marks)**

OR

4 a. What are the things to be done for a design of object oriented system? How the objects are identified? **(05 Marks)**
b. What is design pattern? Explain four elements of design pattern. **(06 Marks)**
c. What is software reuse? State the general models of open source licenses. **(05 Marks)**

Module-3

5 a. State the two goals and three levels of granularity of software testing process. **(05 Marks)**
b. What is test driven development? State the benefits of test driven developments. **(05 Marks)**
c. Explain the six stages of acceptance testing process. **(06 Marks)**

OR

6 a. With neat diagram, show the software evolution process and explain the 'Lehman's Law' concern to system change. **(10 Marks)**
b. What is software maintenance? State the activities of re-engineering process. **(06 Marks)**

1 of 2

Module-4

7	a.	Explain the factors to be considered for approval of change.	**(05 Marks)**
	b.	Explain the features provided by version management systems.	**(05 Marks)**
	c.	What is configuration management? State the four activities of configuration management.	**(06 Marks)**

OR

8	a.	What is system building? State the features available in the system building tools.	**(10 Marks)**
	b.	Explain the factors to be considered for release planning of system.	**(06 Marks)**

Module-5

9	a.	Explain the ways of coping with change and reduction of rework cost.	**(06 Marks)**
	b.	Explain the practices involved in the extreme programming.	**(10 Marks)**

OR

10	a.	State the principles of agile methods.	**(05 Marks)**
	b.	How the agile methods are scaled? State the coping of agile methods for large system engineering.	**(05 Marks)**
	c.	Write a note on pair programming.	**(06 Marks)**

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06IS51

Fifth Semester B.E. Degree Examination, Dec.09/Jan.10

Software Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What are the attributes of a good software? Explain. (06 Marks)
b. Mention the different stages in a system development. Explain any four phases. (10 Marks)
c. Define and distinguish between the system reliability and availability. (04 Marks)

2 a. What is process iteration? Explain Boehm's spiral model. (10 Marks)
b. With an example, explain the functional and non-functional requirements. (10 Marks)

3 a. Explain the need for requirements elicitation and analysis. Explain the different process activities involved. (10 Marks)
b. Why risk management is important in project management? Explain different stages in risk management. (10 Marks)

4 a. What is data flow model? With an example, show the notations used in data flow model. (10 Marks)
b. Explain the terms :
i) Domain requirements (03 Marks)
ii) User requirements (03 Marks)
iii) System requirements. (04 Marks)

PART – B

5 a. Explain why it is necessary to design the system architecture. What are the system factors affected by system architecture? Explain. (10 Marks)
b. Distinguish between an object and an object class. Give example. (06 Marks)
c. What are concurrent objects? Explain different kinds of concurrent object implementations. (04 Marks)

6 a. What is rapid delivery and deployment of new systems? Explain its importance. (10 Marks)
b. What are the different types of software maintenance? What are the key factors that distinguish development and maintenance? (10 Marks)

7 a. Distinguish between software inspection and testing. What are the advantages of inspection over testing? (08 Marks)
b. Explain with illustrations :
i) Integration testing (06 Marks)
ii) Release testing (06 Marks)

8 a. Explain Maslow's human-needs hierarchy of motivating people. (10 Marks)
b. What are the factors affecting software pricing? What are the two types of metrics used? Explain. (10 Marks)

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06IS51

Fifth Semester B.E. Degree Examination, June-July 2009
Software Engineering

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions choosing at least two from each part.*

Part A

1 a. What are the attributes of good software and what are the key challenges facing software engineering? **(10 Marks)**

b. Explain how both the waterfall model of the software process and the prototyping model can be accommodated in the spiral process model. **(05 Marks)**

c. Name the components of a design method. **(05 Marks)**

2 a. Describe four different types of non-functional requirement, which may be placed, on the system. Give examples of each of these types of requirements. **(10 Marks)**

b. During the requirement validation process, what are the different types of checks to be carried out on the requirements in the requirements document. Also what are the requirements validation techniques, which can be used in conjunction or individually? **(10 Marks)**

3 a. Based on your experience with a bank ATM, draw a data flow diagram modeling the data processing involved when a customer withdraws cash from a machine. **(10 Marks)**

b. Draw and explain the state machine model of a simple microwave oven. **(10 Marks)**

4 a. Table below sets out a number of activities, durations and dependencies. Draw an activity chart and a bar chart showing the project schedule. **(16 Marks)**

Task	Duration (days)	Dependencies
T_1	10	
T_2	15	T_1
T_3	10	T_1, T_2
T_4	20	
T_5	10	
T_6	15	T_3, T_4
T_7	20	T_3
T_8	35	T_7
T_9	15	T_6
T_{10}	5	T_5, T_9
T_{11}	10	T_9
T_{12}	20	T_{10}
T_{13}	35	T_3, T_4
T_{14}	10	T_8, T_9
T_{15}	20	T_{12}, T_{14}
T_{16}	10	T_{15}

Table Q4 (a)

b. What is the critical distinction between a milestone and a deliverable? **(04 Marks)**

Part B

5 a. What are the advantages and disadvantages of a shared repository model? **(10 Marks)**

b Explain with figure the data-flow model of an invoice processing system. **(10 Marks)**

1 of 2

6	a.	List the various steps that need to be followed for object oriented design process.	(05 Marks)
	b.	What are the advantages and disadvantages of object oriented systems?	(05 Marks)
	c.	What are advantages and drawbacks of inheritance?	(05 Marks)
	d.	Explain about concurrent objects.	(05 Marks)
7	a.	What are the characteristics of rapid software development?	(05 Marks)
	b.	What is software prototyping? Give the benefits of software prototyping.	(05 Marks)
	c.	What is the objective of evolutionary prototyping? Give its advantages and the problems that are encountered.	(05 Marks)
	d.	What is an Agile method? Discuss the various principles used in Agile method.	(05 Marks)
8	a.	What are the various types of software maintenance?	(04 Marks)
	b.	Differentiate between Black Box testing and White Box testing.	(06 Marks)
	c.	Name and explain the factors affecting the productivity of software.	(05 Marks)
	d.	Name the various estimation techniques in software systems.	(05 Marks)

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DESIGN AND ANALYSIS OF ALGORITHM

CBCS Scheme

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15CS43

Fourth Semester B.E. Degree Examination, June/July 2017
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define algorithm. Explain asymptotic notations, Big O, big Omega, big theta notations. **(08 Marks)**

b. Explain general plan of mathematical analysis of nonrecursive algorithms with example. **(08 Marks)**

OR

2 a. Define time and space complexity. Explain important problem types. **(08 Marks)**

b. Illustrate mathematical analysis of recursive algorithm for towers of hanoii. **(08 Marks)**

Module-2

3 a. Explain concept of divide and conquer. Write merge sort algorithm. **(08 Marks)**

b. Write a recursive algorithm for binary search and also bring out its efficiency. **(08 Marks)**

OR

4 a. Illustrate the tracing of quick sort algorithm for the following set of numbers:
25, 10, 72, 18, 40, 11, 64, 58, 32, 9 **(08 Marks)**

b. List out the advantages and disadvantages of divide and conquer method and illustrate the topological sorting for the following graph.

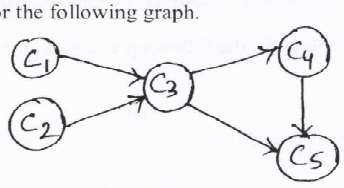

Fig.Q4(b) **(08 Marks)**

Module-3

5 a. Explain Greedy criterion. Write a Prim's algorithm to find minimum cost spanning tree. **(08 Marks)**

b. Sort the given list of numbers using heap sort: 2, 9, 7, 6, 5, 8. **(08 Marks)**

OR

6 a. Write an algorithm to find single source shortest path. **(08 Marks)**

b. Construct a Huffman tree and resulting code word for the following:

Character	A	B	C	D	-
Probability	0.35	0.1	0.2	0.2	0.15

Encode the words DAD and ADD. **(08 Marks)**

1 of 2

15CS43

Module-4

7 a. Explain the concept of dynamic programming, with example. **(08 Marks)**

b. Trace the following graph using Warshall's algorithm.

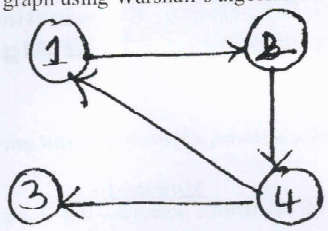

Fig.Q7(b) **(08 Marks)**

OR

8 a. Explain Multistage graphs with example. Write multistage graph algorithm to forward approach. **(08 Marks)**

b. Solve the following instance of Knapsack problem using dynamic programming. Knapsack capacity is 5.

Item	Weight	Value
1	2	$12
2	1	$10
3	3	$20
4	2	$15

(08 Marks)

Module-5

9 a. Explain backtracking concept. Illustrate N queens problem using backtracking to solve 4-Queens problem. **(08 Marks)**

b. Solve subset sum problem for the following example, s = {3, 5, 6, 7} and d = 15. Construct a state space tree. **(08 Marks)**

OR

10 a. Explain the concept of branch and bound and solve assignment problem for the following and obtain optimal solution.

Person	Job1	Job2	Job3	Job4
a	9	2	7	8
b	6	4	3	7
c	5	8	1	8
d	7	6	9	4

(08 Marks)

b. Explain LC Branch and Bound and FIFO branch and bound. **(08 Marks)**

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2 of 2

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10CS43

Fourth Semester B.E. Degree Examination, June/July 2013
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is an algorithm? What are the properties of an algorithm? Explain with an example. **(08 Marks)**

b. Explain brute force method for algorithm design and analysis. Explain the brute force string matching algorithm with its efficiency. **(08 Marks)**

c. Express using asymptotic notation i) n! ii) $6 * 2^n + n^2$. **(04 Marks)**

2 a. Explain divide and conquer technique. Write the algorithm for binary search and find average case efficiency. **(10 Marks)**

b. What is stable algorithm? Is quick sort stable? Explain with example. **(06 Marks)**

c. Give an algorithm for merge sort. **(04 Marks)**

3 a. Explain the concept of greedy technique for Prim's algorithm. Obtain minimum cost spanning tree for the graph below Prim's algorithm. **(09 Marks)**

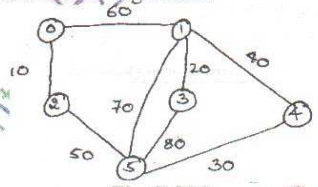

Fig.Q.3(a)

b. Solve the following single source shortest path problem assuming vertex 5 as the source. **(09 Marks)**

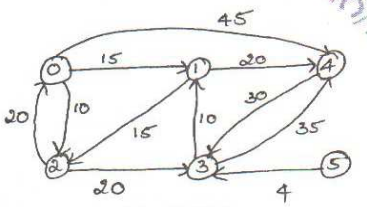

Fig.Q.3(b)

c. Define the following: i) Optimal solution; ii) Feasible solution. **(02 Marks)**

4 a. Using Floyd's algorithm solve the all pair shortest problem for the graph whose weight matrix is given below:

$$\begin{bmatrix} 0 & \infty & 3 & \infty \\ 2 & 0 & \infty & \infty \\ \infty & 7 & 0 & 1 \\ 6 & \infty & \infty & 0 \end{bmatrix}$$

(07 Marks)

b. Using dynamic programming, solve the following knapsack instance.
N = 4 M = 5
$(W_1, W_2, W_3, W_4) = (2, 1, 3, 2)$
$(P_1, P_2, P_3, P_4) = (12, 10, 20, 15)$. (05 Marks)

c. Outline an exhaustic search algorithm to solve traveling salesman problem. (08 Marks)

PART – B

5 a. Write and explain DFS and BFS algorithm with example. (08 Marks)

b. Obtain topologies sorting for the given diagraph using source removal method. (05 Marks)

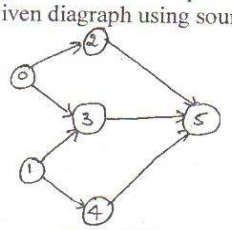

Fig.Q.5(b)

c. Explain Horspool's string matching algorithm for a text that comprises letters and space (denoted by hyphen) i.e "JIM-SAW-ME-IN-BARBER-SHOP" with pattern "BARBER". Explain its working along with a neat table and algorithm to find shift table. (07 Marks)

6 a. Define the following:
i) Class P
ii) Class NP
iii) NP complete problem
iv) NP hard problem. (08 Marks)

b. Write the decision tree to sort the elements using selection sort and find the lower bound. (08 Marks)

c. What is numeric analysis? (02 Marks)

d. Brief overflow and underflow in numeric analysis algorithms. (02 Marks)

7 a. What is back tracking? Apply back tracking problem to solve the instance of the sum of subset problem: S = {3, 5, 6, 7} and d = 15. (07 Marks)

b. With the help of a state space tree, solve the following instance of the knapsack problem by the branch-and-bound algorithm. (06 Marks)

Item	Weight	Value
1	4	40
2	7	42
3	5	25
4	3	12
Knapsack	Capacity	W = 10

c. Explain how backtracking is used for solving 4-queen's problem. Show the state space table. (07 Marks)

8 a. What is prefix computation problem? Give the algorithms for prefix computation which uses: i) n processors; ii) n/logn processors.
Obtain the time complexities of these algorithms. (10 Marks)

b. What is super linear speed up? Obtain the maximum speed up when P = 10 and various values of f = 0.5, 0.1, 0.01. (05 Marks)

c. What are the different ways of resolving read and write conflicts? (05 Marks)

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10CS43

Fourth Semester B.E. Degree Examination, December 2012
Design and Analysis of Algorithm

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define asymptotic notations. **(03 Marks)**

b. Algorithm X(int N)

```
{
  int P ;
  for i ← 1 to N
    {
      printf ("\n % d\ t * \t % d = %d", N, i, P);
        P = P + N ;
    } }
```

i) What does this algorithm compute?
ii) What is the basic operation?
iii) How many times the basic operation is executed?
iv) What is the efficiency class of this algorithm? **(04 Marks)**

c. Solve the following recurrence relations.

$$f(n) = \begin{cases} f(n-1)+n & n>0 \\ 0 & n=0 \end{cases}$$

$x(n) = 3x(n-1)$ for $n > 1, x(1) = 4$

$x(n) = x(n \mid 2)+n$ for $n > 1, x(1) = 1\ n = 2^k$. **(08 Marks)**

d. Sort the list E X A M P L E by bubble sort, Is there any possibility that bubble sort can be stopped earlier? **(05 Marks)**

2 a. Discuss how quick sort works to sort an array. Trace quick sort algorithm for the following data set 65, 70, 75, 80, 85, 60, 55, 50, 45. Also derive the worst case complexity of quick sort. **(09 Marks)**

b. Write the recursive algorithm for merge sort. **(04 Marks)**

c. Consider the following set of 14 elements in an array list, -15, -6, 0, 7, 9, 23, 54, 82, 101, 112, 125, 131, 142, 151 when binary search is applied on these elements, find the elements which required maximum number of comparisons. Also determine average number of key comparisons for successful search and unsuccessful search. **(04 Marks)**

d. Derive the time complexity for defective chess board. **(03 Marks**

3 a. Solve the following instance of knapsack problem, using greedy algorithm

Item	1	2	3	4
Weight	4	7	5	3
Profit	40	42	25	12

Knapsack weight M = 10. **(05 Marks)**

b. Using Prim's algorithm, determine minimum cost spanning tree for the following graph

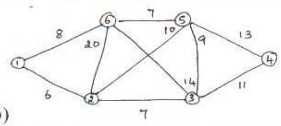

Fig. Q3(b)

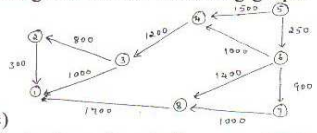

Fig. Q3(c)

How Knapsack and Prim's algorithms guarantee the elimination of cycles? **(07 Marks)**

c. In the above graph Fig. Q3(C), determine the shortest distances from source vertex 5 to all the remaining vertices, using Dijikstra's algorithm. **(08 Marks)**

1 of 2

2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

4 a. Solve the following traveling sales person problem, using dynamic programming

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$ starting city 1 **(10 Marks)**

b. Write Warshall- Floyd algorithm. **(03 Marks)**

c. Generate the transitive closure of the graph given below. **(07 Marks)**

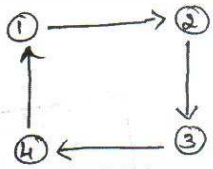

Fig. Q4(c)

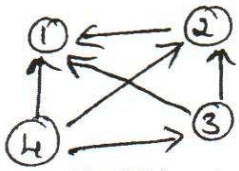

Fig. Q5(c)

PART – B

5 a. Match the pattern BAOBAB in the text BESS – KNEW – ABOUT – BAOBAS, using
i) Horspool's algorithm
ii) Boyer Moore algorithm. **(08 Marks)**

b. Write a BFS algorithm to check the connectivity of a given graph. **(05 Marks)**

c. Apply source elimination based algorithm to represent vertices in topological ordering for the digraph given in Fig. Q5(c). **(04 Marks)**

d. Apply distribution counting algorithm to sort the elements b, c, ,d c, b, a, a, b. **(03 Marks)**

6 a. What are decision trees? Explain with example, how decision trees are used in sorting algorithms. **(10 Marks)**

b. Explain the concepts of P, NP, and NP – complete problems. **(10 Marks)**

7 a. Draw the state – space tree to generate solutions to 4 – Queen's problem. **(04 Marks)**

b. Apply backtracking method to solve subset sum problem for the instance n = 6, d = 30. S = {5, 10, 12, 13, 15, 18} **(06 Marks)**

c. What is branch – and - bound algorithm? How it is different from backtracking? **(05 Marks)**

d. Write the steps and apply nearest neighbour approximation algorithm on the TSP problem with the starting vertex a, and calculate the accuracy ratio of approximation. **(05 Marks)**

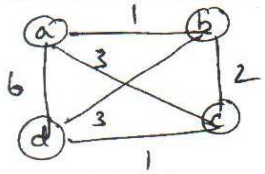

Fig. 7(d)

8 a. What are the different computation models? Discuss in detail. **(10 Marks)**

b. Let the input to the prefix computation problem be 5, 12, 8, 6, 3, 9, 11, 12, 5, 6, 7, 10, 4, 3, 5 and let ⊕ stand for addition. Solve the problem using work optimal algorithm. **(10 Marks)**

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MICROPROCESSOR AND MICROCONTROLLER

CBCS Scheme

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15CS44

Fourth Semester B.E. Degree Examination, June/July 2017
Microprocessors and Microcontrollers

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain execution unit (EU) and Bus interface unit (BIU) of 8086 µp with a neat diagram. **(08 Marks)**

b. Explain the different addressing modes used in 8086 µp with suitable example. **(08 Marks)**

OR

2 a. Explain all bits of flag register of 8086µp with a neat diagram. Show the setting and resetting of flag bits with a suitable example. **(06 Marks)**

b. Write an assembly level program (ALP) to add two bytes of data stored at data 1 and data 2 and save the result in sum with comments. Indentify all the directives found in the program. **(06 Marks)**

c. Show the memory dump for the following data section or data segment. **(04 Marks)**

```
                .DATA
                ORG   0010H
DATA 1   DB     25
DATA 2   DB     10001001B
DATA 3   DB     12H
                ORG   0020H
DATA 4   DB     '2591'
                ORG   0030H
DATA 5   DW     9, 2, 7, 0CH, 00100000B, 5
                ORG   0040H
DATA 6   DW     4 DUP (00H)
```

Module-2

3 a. Explain Rotate instructions with suitable example. **(06 Marks)**

b. With a suitable program show how a packed BCD value is converted to ASCII value. **(04 Marks)**

c. Assume that there is a class of five people. With following grades: 69, 87, 96, 45, 75. Write an ALP to find the highest grade. **(06 Marks)**

OR

4 a. Write on ALP that adds the following two multiword numbers and saves the result:
Data 1 = 548FB9963CE7H and
Data 2 = 3FCD4FA23B8DH **(08 Marks)**

b. Write an ALP to perform the following :
i) Clear the screen
ii) Set the cursor at row 8 and column 5 of the screen.
iii) Prompt "There is a message for you from VTU : to read it enter Y. If the user enters 'Y' or 'y' then the message "Hello! All the best for your exams" will appear on the screen. If the user enters any other key, then the prompt "No more messages for you" should appear on the next line. **(08 Marks)**

1 of 2

Module-3

5 a. Explain handling of overflow problem arised in addition of signed numbers with a suitable example. **(06 Marks)**

b. Explain XLAT instruction with example. **(04 Marks)**

c. Explain 74138 decoder configuration to enable the memory address F0000H to F7FFFH to connect four 8k RAMS. **(06 Marks)**

OR

6 a. Briefly explain the control word format of 8255 in I/O mode and BSR mode. Find the control word if PA = out, PB = in, PC0 – PC3 = in and PC4 – PC7 = out. Use port addresses of 300H – 303H for the 8255 chip. Then get data from port B and send it to port A. **(08 Marks)**

b. Assume that we have 4 bytes of hexadecimal data: 25H, 62H, 3FH and 52H.
i) Find the checksum byte
ii) Perform the checksum operation to ensure data integrity.
iii) If the second byte 62H had been changed to 22H. Show how checksum detects the error. **(08 Marks)**

Module-4

7 a. Differentiate between RISC and CISC processors. **(06 Marks)**

b. Explain ARM core data flow model with a neat diagram. **(06 Marks)**

c. Discuss briefly how coprocessors can be attached to ARM processor. **(04 Marks)**

OR

8 a. Explain the architecture of a typical embedded device based on ARM core with a neat diagram. **(08 Marks)**

b. Explain the concept of pipeline and interrupts used in ARM processor. **(08 Marks)**

Module-5

9 a. Explain the following instructions of ARM processor with suitable example.
i) MLA ii) QADD iii) SMULL iv) LSL. **(08 Marks)**

b. Write an ALP to copy a block of data (Block 1) to another block (Block 2) using ARM instructions. **(08 Marks)**

OR

10 a. Write an ALP using ARM instructions that calls subroutine fact to find factorial of a given number. **(08 Marks)**

b. Write short notes on memory access and branch instructions of ARM controller. **(08 Marks)**

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10CS45

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Microprocessors

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Discuss the development of Intel 86 family of microprocessors. Briefly indicate the additional features introduced at each stage of development from 8086 to Pentium IV. **(06 Marks)**

b. Explain with a neat sketch the memory map of a personal computer system. **(06 Marks)**

c. With a neat sketch explain architecture of 8086. **(08 Marks)**

2 a. Discuss the following Addressing modes of 8086 with example.
i) Register indirect ii) Immediate iii) Base plus index. **(06 Marks)**

b. What are the different program memory addressing modes? Explain with example. **(06 Marks)**

c. Calculate the physical address for the following instructions. Assume
DS = 1000H, SS = 7000H, ES = 4000H, BP = 0100H, SI = 0020H, DI = 0200H, BX = 0700H, Values = 0500H.
i) MOV AX, [BX] [SI]
ii) ADD AL, [BP + 40H]
iii) MOV CX, Values [BX] [DI]
iv) MOV ES : [1000H], 20H. **(08 Marks)**

3 a. Explain the following assembler directives with example.
i) ASSUME ii) PUBLIC AND EXTRN
iii) MACRO AND ENDM iv) MODEL. **(10 Marks)**

b. Write the instruction template (format) for the following instructions.
i) MOV AX, DX ii) MOV DX, [BP] 0200H iii) MOV AL, [BX] [DI] **(06 Marks)**

c. What is meant by segment override prefix? Explain with an illustration. **(04 Marks)**

4 a. Explain the working of following 8086 instructions.
i) DAA ii) IMUL iii) REPE CMPSB iv) LOOP. **(08 Marks)**

b. Differentiate between 'short', 'near' and 'far' jump instruction with example. **(06 Marks)**

c. Explain with an example, how parameters can be passed to subroutine, using stack. **(06 Marks)**

PART – B

5 a. Differentiate between 'Macros' and Procedures' with an example for each. **(08 Marks)**

b. Write an ALP to compute the factorial of a given 8-bit number using recursion. **(06 Marks)**

c. Write an ALP to sort a given set of N numbers in ascending order using bubble sort. **(06 Marks)**

6 a. Illustrate with a neat diagram, the working of 8086 in minimum mode. **(10 Marks)**

b. Explain the memory read bus cycle of 8086 in minimum mode with a neat diagram. **(10 Marks)**

7 a. Interface four 8KB RAMs starting with an address of 40000H using 3:8 Decoder. Clearly mention the decoding logic and memory map. **(10 Marks)**

b. Differentiate between memory mapped I/O and I/O mapped I/O. **(06 Marks)**

c. Write a note on Interrupt driven I/O. **(04 Marks)**

8 a. With a neat sketch explain the functioning of 8255 PPI. **(10 Marks)**

b. Discuss the control word format of 8255 PPI with a sketch. **(10 Marks)**

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10CS45

Fourth Semester B.E. Degree Examination, Dec.2014/Jan. 2015
Microprocessors

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Write any four differences between read mode and protected mode memory system. **(04 Marks)**

b. Explain real mode memory system of a personal computer system. **(06 Marks)**

c. Explain briefly the programming model of 8086 through core – 2 microprocessor. **(10 Marks)**

2 a. What is paging? Explain the paging mechanism used in 80386 through core – 2 microprocessors. **(08 Marks)**

b. Explain with examples, the various data related addressing modes. **(08 Marks)**

c. For DS = 1200h, DI = 2024h, ARRAY = 0012h, BX = 1012 h, find the physical address for the following instructions. i) MOV AL, ARRAY [BX] ii) MOV AL, ARRAY [BX] [DI]. **(04 Marks)**

3 a. Describe the operation of the following instructions with examples :
i) LEA ii) XLAT iii) DAA iv) IMUL **(08 Marks)**

b. Write the machine code for the following instructions :
i) MOV BP, SP
ii) MOV WORD PTR [BX + 000h], 1234h. **(08 Marks)**

c. Explain the following assembler directives, with examples :
i) EXTRN ii) PTR. **(04 Marks)**

4 a. With format explain rotate instructions. Give examples to rotate right by 2 – bit and rotate left by 4 – bits. **(06 Marks)**

b. Explain the following statements to control the flow of the program, with examples :
i) •IF – •ENDIF
ii) •REPEAT – •UNTIL
iii) •WHILE – •ENDW. **(06 Marks)**

c. Explain the sequence of operation that takes place during the execution of CALL and RET instructions. Mention the differences between :
i) near and far procedures
ii) procedures and macros. **(08 Marks)**

PART – B

5 a. Write an 8086 ALP to find the factorial of a given number using recursive procedures. **(06 Marks)**

b. Write a mixed ALP with 'C' to perform a simple calculator operations. **(10 Marks)**

c. Write an 8086 ALP to convert the given binary number into its equivalent unpacked decimal and ASCII. **(04 Marks)**

1 of 2

6 a. Explain the following pin functions of 8086 microprocessor :
i) READY ii) INTR iii) $\overline{TEST}$ iv) NMI. (08 Marks)
b. With a neat diagram, explain the minimum mode system of 8086 microprocessor. (07 Marks)
c. Explain the timing diagram of read operation in 8086 microprocessor. (05 Marks)

7 a. How 8086 microprocessor selects 8 – bit or 16 – bit data from odd or even memory banks? (04 Marks)
b. Interface 8K × 8 ROM and 4K × 8 RAM to 8086 microprocessor. Assume that the starting address for ROM is 40000 h and that for RAM is 44000 h. (10 Marks)
c. Mention the differences between memory mapped I/O and Isolated I/O. (06 Marks)

8 a. With a neat block diagram, explain 82C55 PPI. Write the control words for
i) PORT A input, PORT B output and PORTC output.
ii) PORT A output, PORT B input, and PORTC input in simple I/O mode. (08 Marks)
b. With a neat diagram, explain 8254 PIT. (06 Marks)
c. Explain briefly the interrupt vector table of 8086 microprocessor. (06 Marks)

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OBJECT ORIENTED CONCEPTS

CBCS Scheme

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15CS45

Fourth Semester B.E. Degree Examination, June/July 2017
Object Oriented Concepts

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. How do name space helps in preventing pollution of the global namespace. **(04 Marks)**
b. What is function polymorphism? Write a program in C++ using overloaded function area to find area of circle, triangle and rectangle. **(06 Marks)**
c. Explain how one can bridge two classes using friend function. Write a C++ program to find the sum of two numbers using bridge friend function add(). **(06 Marks)**

OR

2 a. Can you overload constructor and destructor? Justify with suitable program. **(06 Marks)**
b. What is reference variable? Explain. Also write a program in C++ to swap two int values and display the values before and after swapping. **(05 Marks)**
c. What are static member of a class? Write a C++ program to count the number of objects created. **(05 Marks)**

Module-2

3 a. How "compile once and run anywhere" is implemented in JAVA? Discuss. **(04 Marks)**
b. Write a program to calculate the average among the elements {8, 6, 2, 7} using for each in Java. How for each is different from for loop? **(06 Marks)**
c. Explain type conversion, with an example. **(06 Marks)**

OR

4 a. List and explain the java buzzwords. **(08 Marks)**
b. Explain the concepts of arrays in Java with examples. Also write a program that creates and initializes a four integer elements array. Find the sum and average of its values. **(08 Marks)**

Module-3

5 a. Briefly explain the role of interfaces while implementing multiple inheritances in Java. **(06 Marks)**
b. Compare and contrast method overloading and method overriding with suitable examples. **(06 Marks)**
c. When constructors are called in the class hierarchy? **(04 Marks)**

OR

6 a. With example, give two uses of super. **(05 Marks)**
b. Define exception. Write a program which contains one method which will throw IllegalAcessException and use proper exception handlers so that exception should be printed. **(06 Marks)**
c. Define package. What are the steps involved in creating user defined package with an example. **(05 Marks)**

1 of 2

15CS45

Module-4

7	a.	How synchronization can be achieved for threads in Java? Explain with syntax.	**(06 Marks)**
	b.	Explain the adaptor class with an example.	**(04 Marks)**
	c.	With the syntax explain the use of isAlive( ) and Join( ) methods.	**(06 Marks)**

OR

8	a.	What are the differences between suspending and stopping the threads?	**(05 Marks)**
	b.	Discuss delegation event model with suitable examples.	**(06 Marks)**
	c.	Explain inner class with example.	**(05 Marks)**

Module-5

9	a.	What are the two types of applets? Explain the skeleton of an apple. Enlist applet tags.	**(06 Marks)**
	b.	Write steps to create JTable, also write a program to demonstrate the same.	**(05 Marks)**
	c.	Explain the applet architecture and demonstrate how to pass parameters for font size and font name in applets.	**(05 Marks)**

OR

10	a.	Explain briefly the components and containers used in swings.	**(05 Marks)**
	b.	Explain JLabel and ImageIcon with program.	**(06 Marks)**
	c.	What are applets? Explain different stages in the lifecycle of an applet.	**(05 Marks)**

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10CS36

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Object Oriented Programming with C++

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain the terms encapsulation, polymorphism and inheritance in object oriented programming. **(06 Marks)**

b. Explain the different types of argument passing techniques, with example. **(06 Marks)**

c. What is function overloading? Write a C++ program to define three overloaded functions area( ) to find area of rectangle, area of rectangular box and area of circle. **(08 Marks)**

2 a. What is a constructor? How is a constructor different from member function? Illustrate with an example. **(06 Marks)**

b. What are static data members? Explain with an example? What is the use of static data members? **(06 Marks)**

c. Write a class 'rectangle' containing two data items 'length' and 'breadth' and four functions setdata( ), getdata( ), displaydata( ) and area( ) to set the length and breadth, to get the user inputs, to display and to find the area of the rectangle respectively. Also write a main program which declares the objects and uses the member functions of the class. **(08 Marks)**

3 a. Define friend function? Explain what are the rules to be used while using a friend function? Illustrate with an example. **(10 Marks)**

b. What is operator overloading? Write a C++ program to add two complex numbers by overloading the + operator. Also overload >> and << operators for reading and displaying the complex numbers. **(10 Marks)**

4 a. Explain and write a C++ program, the process when the base class is derived by the following visibility modes : i) public ii) private iii) protected **(10 Marks)**

b. What is inheritance? Explain different types of inheritance. Explain the inheriting multiple base classes with an example. **(10 Marks)**

PART – B

5 a. Explain with an example, the order of invocation of constructors and destructors and passing arguments to base class constructors in multilevel inheritance. **(10 Marks)**

b. What are the ambiguities that arise in multiple inheritance? How to overcome this? Explain with example. **(10 Marks)**

6 a. What are virtual functions? What is the need of virtual function? How is early binding different form late biding? **(06 Marks)**

b. How to inherit a virtual attribute? Explain with example. **(06 Marks)**

c. What is pure virtual function? Write a C++ program to create a class called NUMBER with an integer data member and member function to set the value for this data member. Derive three classes from this base class called HEXADECIMAL, DECIMAL and OCTAL. Include a member function DISPLAY( ) in all these three derived classes to display the value of base class data member in hexadecimal, decimal and octal respectively. Use the concept of pure virtual function. **(08 Marks)**

7 a. Define the concept of iostream provided in C++. Explain in detail IO stream class hierarchy. (06 Marks)

b. Write a C++ program to define a class called phonebook with data members name, area code, prefix and number and member functions readdata( ) which reads the values of the data members from the keyboard and writedata( ) which displays the values of the data members. Enter the data for atleast five phone numbers and store details in binary file phone and read the stored details and display on the screen. (08 Marks)

c. Explain the following member functions : setf( ), unsetf( ) and fill( ). (06 Marks)

8 a. What is exception handling? Write a C++ program to demonstrate the "try", "throw" and "catch" keywords for implementing exception handling. (10 Marks)

b. Explain the following with respect to STL :
i) Containers
ii) Types of containers
iii) Iterators. (10 Marks)

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10CS36

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014

Object Oriented Programming with C++

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain various features of object oriented programming. (08 Marks)
b. What is inline function? Explain with an example. Mention its advantages. (06 Marks)
c. What is function overloading? Write a program to swap two integer and two float number using function overloading. (06 Marks)

2 a. What is class? Write a program to create a class called employee which consists name, desg, ecode and salary as a data member and read, write as a function member, using this class to read and print 10 employee information. (08 Marks)
b. What is constructor? Mention its types. Explain parameterized constructor with an example. (06 Marks)
c. Explain three access specifiers. (06 Marks)

3 a. Why friend function is required? Write a program to add two complex number using friend function. (08 Marks)
b. Explain generic function with an example. (06 Marks)
c. Write a program to overload ++ operator. (06 Marks)

4 a. Mention types of inheritance. Explain multiple and multilevel inheritance with example. (08 Marks)
b. What is function overriding? Give an example. (06 Marks)
c. Write a program to illustrate protected members in base class inheritance. (06 Marks)

PART – B

5 a. Explain the order of invocation of constructor and destructor with an example. (10 Marks)
b. Explain with an example virtual base class. (05 Marks)
c. Explain passing parameter to base class. (05 Marks)

6 a. Difference between early binding and late binding. (06 Marks)
b. What is virtual function? Explain with an example. (08 Marks)
c. Explain the abstract class with an example. (06 Marks)

7 a. What are the flags that associated with the file operation? (06 Marks)
b. Explain the following functions:
i) setfill( ) ii) width( ) iii) precision( ) iv) setiosflags( ) (08 Marks)
c. Mention the name of file movement pointer. Explain each. (06 Marks)

8 a. Explain C++ exception handling function with example. (08 Marks)
b. What is vector? Explain function of a vector. (06 Marks)
c. Write a program to create a list and sorting the elements of the list. (06 Marks)

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DATA COMMUNICATION

CBCS Scheme

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15CS46

Fourth Semester B.E. Degree Examination, June/July 2017
Data Communication

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. What is data communication? With a neat diagram, explain the four basic topologies. **(05 Marks)**
b. Explain TCP/IP protocol suite with Encapsulation and decapsulation concepts. **(08 Marks)**
c. Explain different characteristics of periodic analog signal. Find the phase in degree and radian of a sine wave with offset $1/4$ cycle with respect to time '0' (zero). **(03 Marks)**

OR

2 a. Draw line code of the sequence 010011 using NRZ, NRZ-L, NRZ-I, Manchester, RZ and differential Manchester schemes. **(06 Marks)**
b. Explain digital signal transmissions methods. **(06 Marks)**
c. What is noiseless channel? Find out maximum bit rate in noiseless channel with bandwidth of 3000 Hz transmitting a signal with two signal level. **(04 Marks)**

Module-2

3 a. Explain PCM and quantization process with steps and example. **(08 Marks)**
b. Explain amplitude shift keying modulation process. **(04 Marks)**
c. Find out bit rate if available bandwidth is 100 kHz which spans from 200 to 300 kHz. Consider ASK with d = 1, r = 1. **(04 Marks)**

OR

4 a. What is multiplexing? define synchronous TDM with data rate management strategies. **(08 Marks)**
b. What is spread spectrum? Explain FHSS and bandwidth sharing. **(08 Marks)**

Module-3

5 a. How does datawords and codewords is represented in block coding and also explain how can errors be selected and corrected by using block coding. **(10 Marks)**
b. Find the code word using CRC given data is 1101 and generator is 1100. **(06 Marks)**

OR

6 a. With a neat diagram, explain any two protocols of noisy channel. **(12 Marks)**
b. Explain the frame format of HDLC protocol. **(04 Marks)**

Module-4

7 a. What is channelization? List and explain the channelization protocols. **(12 Marks)**
b. Describe Gigabit Ethernet. **(04 Marks)**

OR

8 a. Describe pure ALOHA and slotted ALOHA. **(06 Marks)**
b. Explain Carrier Sense Multiple Access with Collision Detection (CSMA/CD) **(06 Marks)**
c. Define Bluetooth and its architecture. **(04 Marks)**

Module-5

9 a. Explain satellite networks and its categories. **(12 Marks)**
b. Write a short note on Fixed WiMAX. **(04 Marks)**

OR

10 a. Explain mobile IP with phases. **(12 Marks)**
b. Write a short note on IPV6 addressing. **(04 Marks)**

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