Sample Question Bank

Application of Mathematics in Engineering-II(Comp/IT/AIDS)

Module-1: Linear Algebra (Theory of Matrices)

Short questions for 2 marks

1. Find the product of eigen values for matrix

$$A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}.$$

2. Find the eigen values of adjA where

$$A=\begin{bmatrix} 2 & 3 \\ 0 & 1 \end{bmatrix}$$

3. The sum of eigen values of a 3x3 matrix is 6 and the product of the eigenvalues is also 6. If one of the eigenvalues is 1, find the other two eigenvalues.

4. If $A=\begin{bmatrix} 2 & 4 \\ 0 & 3 \end{bmatrix}$, then find the eigenvalues of $6A^{-1}+A^3+2I$

5. Find the characteristic root of $A'^2-3A'+4I$ where $A=\begin{bmatrix} 2 & 0 \\ 5 & 3 \end{bmatrix}$

6. Corresponding to which eigenvalue $(2,3,-2,-3)'$ is an eigenvector of

$$\begin{bmatrix} 1 & -4 & -1 & -4 \\ 2 & 0 & 5 & -4 \\ -1 & 1 & -2 & 3 \\ -1 & 4 & -1 & 6 \end{bmatrix}$$

Questions for 4 ,6 ,8 marks

1. If $A=\begin{bmatrix} 123 & 231 & 312 \\ 231 & 312 & 123 \\ 312 & 123 & 231 \end{bmatrix}$, prove that

(i) one of the eigenvalues of A is 666 (ii) If A is non-singular, then one of the eigenvalues of A is negative.

2. Show that the following matrix is diagonalisable. Also find the diagonal form and a diagonalising matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

3. Find the eigenvalues and eigenvector (or bases for eigenspaces) of $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$

4. Find the eigenvalues and eigenvector of $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$

5. Find the characteristic equation of the matrix A and verify that it satisfies Cayley-Hamilton theorem. Hence find A^{-1} and A^4 ,where A is $\begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$.

6. Find the characteristic equation of the matrix A and find the matrix represented by $A^6 - 6A^5 + 9A^4 + 4A^3 - 12A^2 + 2A - I$, where $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$

7. Show that the following matrices are diagonalisable. Also find the diagonal form and a diagonalising matrix

(i) $\begin{bmatrix} -17 & 18 & -6 \\ -18 & 19 & -6 \\ -9 & 9 & 2 \end{bmatrix}$ (ii) $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$

8. Prove that characteristic root of $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ are of unit modulus.

9. Find the characteristic equation of following matrices and

obtain the inverse $\begin{bmatrix} 1 & 2 & 4 \\ -1 & 0 & 3 \\ 3 & 1 & -2 \end{bmatrix}$

10. Given $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$, find the eigenvalues of A. Also find eigenvalues of $4A^{-1}$ and eigenvector of $A^2 - 4I$.

11. By using Cayley-Hamilton theorem find A^{-1} and A^{-2} where $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

12. Find the eigenvalues and bases for eigenspaces of $\begin{bmatrix} 1/3 & 2/3 & 2/3 \\ 2/3 & 1/3 & -2/3 \\ 2/3 & -2/3 & 1/3 \end{bmatrix}$

13. Find the eigenvalues and eigenvector of $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{bmatrix}$

14. Find the eigenvalues and eigenvector of $\begin{bmatrix} -3 & -9 & -12 \\ 1 & 3 & 4 \\ 0 & 0 & 1 \end{bmatrix}$

15. Find the eigenvalues and bases for eigenspaces of $\begin{bmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{bmatrix}$

Module-2: Complex Integration

Short Questions for 2 marks

1. If f(a)=$\int_c \frac{4z^2+z+5}{z-a} dz$ where c is an ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$ then evaluate f(i) .

2. Find the value of the integral $\int_0^{1+i} (x^2 - iy)\, dz$ along the path y = x .

3. Evaluate $\int_0^{1+i} (x^2 + iy)(dz)$ along the path y = 0 where x varies from 0 to 1.

4. Evaluate using Cauchy's Integral formula $\oint_C \frac{dz}{z^3(z+4)}$ where C is the circle $|z| = 2$.

5. Evaluate $\int_C \frac{Z+6}{z^2-4} dz$, where C is the circle $|z| = 1$.

6. Evaluate $\int_0^{1+i} z\, dz$ along $y = x$.

7. Find the residue at the pole z =-1 of $f(z) = \frac{1}{(z+1)(z-2)^2}$.

8. If $f(z)$ is analytic inside and on closed curve C of simply connected region R and if $z = 2$ be any point within C, then find $\int_C \frac{f(z)}{z-2} dz$.

9. Evaluate $\int_c \frac{7z-1}{(z-3)(z+5)} dz$, where c is the circle $|z|$ =1.

10. Identify the type of singularity of the function $f(z) = \frac{sinhz}{z^7}$

Questions for 4,6,8 marks

1. Obtain Laurent 's series for $\frac{2}{(z-2)(z-3)}$ $in\ the\ region$: $2 < |z| < 3$.

2. Evaluate $\oint_C \frac{sin\pi z^2 + cos\pi z^2}{(z-2)(z-3)} dz$ where C is the circle $|z|$ =4.

3. Evaluate using Cauchy's Residue Theorem, where C is a curve $|z-1|=3$ for $\int_C \frac{2z+1}{(z-1)^2(z-3)} dz$

4. Evaluate the given complex integral $\int_0^{3+i} (\bar{z})^2 dz$ along a parabola $x = 3y^2$.

5. Evaluate: $\int_c \frac{z^2}{(z-1)^2(z-2)} dz$; $c\ is\ |z| = 2.5$

6. Expand: f(z)=$\frac{7z-2}{z(z+1)(z-2)}$ $about\ z = -1, for\ 1 < |z+1| < 3$ as a Laurent's Series .

7. Evaluate $\int_c \frac{sin\,\pi z^2 + cos\,\pi z^2}{(z-1)(z-2)} dz$; c is $|z| = 3$

8. Obtain Laurent's series expansions of f(x) = $\frac{z-1}{z^2-2z-3}$; $|z| > 3$

9. Evaluate $\int_C (xy + y^2)dx + x^2 dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.

10. Find Laurent's series for $f(z) = \frac{4z+3}{z(z-3)(z+2)}$ valid for
(i) $2 < |z| < 3$ (ii) $|z| > 3$

11. Evaluate $\int_C \frac{z^2+3}{z^2-1} dz$ where C is circle $|z-1| = 1$.

12. Find all possible Laurent's expansion $\frac{z}{(z-1)(z-2)}$ about z = **-2.**

13. Using Cauchy's Residue theorem evaluate $\int_c \frac{sinsin\,3z}{z+\frac{\pi}{2}} dz$.

14. Evaluate $\int_C \frac{z^2-3z+2}{(z-3)(z-4)} dz$, C: $|z| = 3.5$.

15. Evaluate the following integral using Cauchy-Residue theorem.

$I = \int_C \frac{z^2+3z}{\left(z+\frac{1}{4}\right)^2(z-2)} dz$ where C is the circle $\left|z-\frac{1}{2}\right| = 1$.

Module-3: Linear Algebra: Vector Spaces

Vector Spaces

Q1 State and prove Cauchy-Schwarz inequality in R^2.

Q2 Verify Cauchy-Schwartz inequality for the vectors $u=(2,1,1)$ and $v=(2,0,1)$

Q3 For real values of a, b and θ, show that $(a\cos\theta + b\sin\theta)^2 \leq a^2+b^2$ using Cauchy-Schwarz inequality.

Q4 Let $V=F(-\infty,\infty)$ be the set of all real valued functions defined on $(-\infty,\infty)$. For any f and g and for any scalar k, we define (i) $f=g$ if and only if $f(x)=g(x)$ for all x.
(ii) $(f+g)(x) = f(x)+g(x)$
(iii) $(kf)(x) = kf(x)$.
Then is V a vector space?

Q5 Examine whether the set of 2x2 matrices defined as $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ with usual addition of matrices and scalar multiplication is a vector space.

Q6 Show that any plane passing through the origin is a sub-space of R^3.

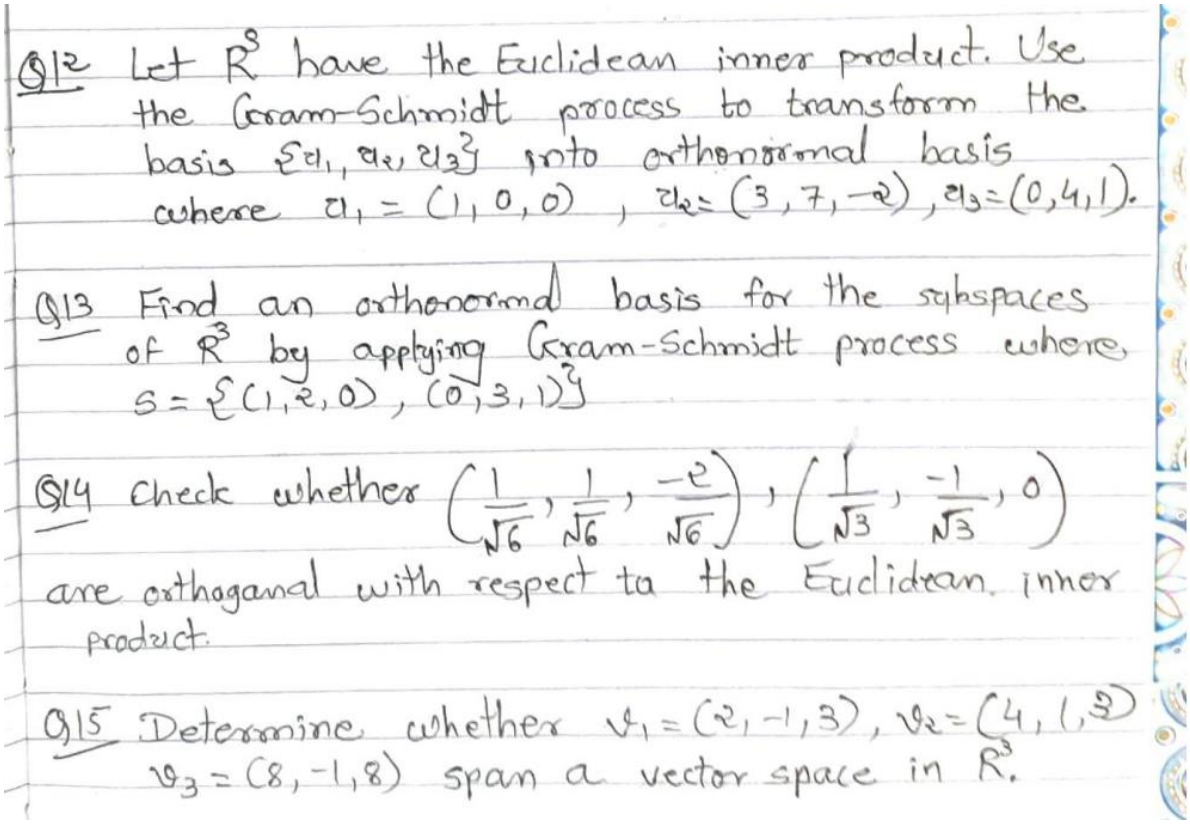
Q7 Is $W = \{(a,1,1) / a \in R\}$ a subspace of R^3?

Q8 Determine whether the following vectors span the vector space of all polynomials of second order. $P_1 = 1 - x + 2x^2$; $P_2 = 5 - x + 4x^2$
$P_3 = -2 - 2x + 2x^2$

Q9 Define: (i) Basis of vector space
(ii) Dimension of a vector space
(iii) Orthogonal set

Q10 Verify that the vectors $v_1 = \left(-\frac{3}{5}, \frac{4}{5}, 0\right)$, $v_2 = \left(\frac{4}{5}, \frac{3}{5}, 0\right)$, $v_3 = (0, 0, 1)$ form an orthonormal basis in R^3 w.r.t. the Euclidean inner product. Express the vector $(3, -7, 4)$ as a linear combination of v_1, v_2, v_3.

Q11 Let R^3 have the Euclidean inner product. Use Gram-Schmidt process to transform the basis $\{u_1, u_2, u_3\}$ into an orthonormal basis where $u_1 = (1, 1, 1)$, $u_2 = (-1, 1, 0)$, $u_3 = (1, 2, 1)$.



16. If a ,b ,c are three positive real numbers , then using Cauchy-Schwartz inequality prove that $(a+b+c)\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right) \geq 9$

17. If $\|u+v\| = 7$ *and* $\|u-v\| = 3$ $find\ u.v$.

Module-4: Probability Distribution and Sampling Theory

Short Questions for 2 marks

1. If *X* is normal variate with mean 10 & standard deviation 4, then what is $P(X \leq 12)$? (Given: Area from z = 0 to z = 0.5 is 0.1915)

2. The means of two independent samples of size 8 and 7 are 1134 and 1024 respectively. The standard deviation of these two samples is 35 and 40 respectively. What is the value of test statistic *t* in order to test the significance of difference between sample means?

3. If X is a normal variate with mean 10 and standard deviation 4. The value of standard normal variate Z is

4. X is a Poisson Variate with mean 1.8. Then P[X≥1] is

Questions for 4,6,8 marks

Q.1 In sampling a large number of parts manufactured by a machine the mean number of defectives in a sample of 20 is 2. Out of 100 such samples, how many would you expect to contain 3 defectives using Poisson distribution.

Q.2 The marks obtained by students in a college are normally distributed with mean 65 and variance 25. If 3 students are selected at random from this college what is the probability that at least one of them would have scored more than 75 marks?

Q.3 Monthly salary X in a big organization is normally distributed with mean Rs. 3000 and standard deviation of Rs. 250 What should be the minimum salary of a worker in this organization so that the probability that he belongs to top 5% workers?

Q.4 In an intelligence test administered to 1000 students, the average was 42 and standard deviation was 24. Find the number of students (i) exceeding the score 50 and (ii) between 30 and 54

Q 5 An insurance company found that only 0.01% of the population is involved in a certain type of accident each year. If its 1000 policy holders were randomly selected from the population, what is the probability that no more than two of its clients are involved in such accident next year?

Q 6 Define Poisson distribution. Also state its mean and moment generating function.

Q 7 i) Define Normal distribution.
ii) State recurrance relation for Poisson distribution.

Q 8 Can we have a Poisson distribution with mean 4 and variance 5? Justify your answer.

Q 9 If X is a Poisson variate and $P(X=0) = 6\,P(X=3)$, find $P(X=2)$.

Q 10 In a distribution exactly normal 7% of items are under 35 and 89% are under 63. What are the mean and standard deviation?

11. In an exam taken by 800 candidates, the average and standard deviation of marks obtained (normally distributed) are 40% and 10% respectively. What should be the minimum score if 350 candidates are to be declared as passed.

12. A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of day on which i) neither car is used ii) some demand is refused.

13. A certain drug administered to 12 patients resulted in the following change in their blood pressure.

5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4

Can we conclude that the drug increases the blood pressure?

14. When the first proof of 392 pages of a book of 1200 pages were read, the distribution of printing mistakes were found to be as follows.

No of mistakes in page (X)	0	1	2	3	4
No. of pages (f)	275	72	30	7	5

Fit a Poisson distribution to the above data and test the goodness of fit.

15. In an examination mark obtained by students in Mathematics, Physics and Chemistry are normally distributed with means 51, 53 and 46 with standard deviation 15, 12, 16 respectively. Find the probability of securing total marks i) 180 or above, ii) 80 or below

16. In a competitive examination the top 15% of the students appeared will get grade A, while the bottom 20% will be declared fail. If the grades are normally distributed with mean % of marks 65 and S.D. 10, determine the lowest % of marks to receive grade A.

17. Based on the following data determine if there is a relation between literacy and smoking

	Smokers	Non-smokers
Literates	83	57
Illiterates	45	68

(Given that Critical value of chi-square 1 d. f and 5% L.O.S is 3.841

18. A certain drug administered to 12 patients resulted in the following change in their Blood Pressure

5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4

Can we conclude that drug increase the Blood Pressure?

19. If a random variable X follows Poisson distribution such that

P(X=2) =9 P(X=4) +90 P(X=6)
Find the mean and variance of X.

20. Assume that the probability of an individual coal miner being killed in a mine accident during a year is 1/2400. Use appropriate statistical distribution to calculate the probability that in a mine employing 200 miners there will be at least one fatal accident every year.

21. If X is a normal variate with mean 30 and standard deviation 6, find the value of $X=x_1$ such that

$$P(X \leq x_1) = 0.05 \ .$$

22. The income distribution of workers in a certain factory was found to be normal with mean of Rs 500 and standard deviation Rs 50. There were 228 persons above Rs 600. How many persons were there in all?

Module-5: Linear Programming Problems

Short questions for 2 marks

1. The Standard form of following LPP is

Minimise Z= $-2x_1+x_2$

Subject to $4x_1+5x_2 \geq -4$

$-3x_1+5x_2 \leq 7$

$x_1, x_2 \geq 0$

2. Find the dual of the following LPP

Maximize $5x_1 + 2x_2 + x_3$

Subject to ;

$3x_1 + x_2 + 7x_3 \leq 3$,

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1, x_2, x_3 \geq 0$

Questions for 4,6,8 marks

1. Solve by the Simplex method

Maximize $z = 10x_1 + x_2 + x_3$

Subject to $x_1 + x_2 - 3x_3 \leq 10$ $4x_1 + x_2 + x_3 \leq 20$

$$x_1, x_2, x_3 \geq 0$$

2. Find the dual of the following LPP

Maximize $z = 2x_1 - x_2 + 3x_3$

Subject to $x_1 - 2x_2 + x_3 \geq 4$; $2x_1 + x_3 \leq 10$; $x_1 + x_2 + 3x_3 = 20$

$x_1, x_3 \geq 0$ x_2 unrestricted.

3. Solve using dual simplex method

Minimize $z = 2x_1 + 2x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$,

$3x_1 + x_2 + 7x_3 \leq 3$,

$x_1 + 4x_2 + 6x_3 \leq 5$

$$x_1, x_2, x_3 \geq 0$$

4. Using Simplex method solve the following LPP

Maximize $z = 5x_1 + 3x_2$

Subject to $x_1 + x_2 \leq 2$

$5x_1 + 2x_2 \leq 10$

$3x_1 + 8x_2 \leq 12$; $x_1, x_2 \geq 0$

5. Write the dual of the following LPP

$$Maximise \quad Z = 3x_1 + x_2 - x_3$$

$$Subject\ to\ \ x_1 + x_2 + x_3 \geq 8$$

$$2x_1 - x_2 + 3x_3 = 4$$

$$-x_1 + x_3 \leq 6$$

$x_1, x_3 \geq 0, x_2$is unrestricted.

6. Using Simplex method
Maximize $z = 10x_1 + 6x_2 + 5x_3$
Subject to $2x_1 + 2x_2 + 6x_3 \leq 300$
$10x_1 + 4x_2 + 5x_3 \leq 600$
$x_1 + x_2 + x_3 \leq 100$
$x_1,\ x_2, x_3 \geq 0$

7. Using the Big M method solve the following LPP
Maximize $z = 5x_1 - 2x_2 + 3x_3$
Subject to $2x_1 + 2x_2 - x_3 \geq 2$
$3x_1 - 4x_2 \leq 3$
$x_2 + 3x_3 \leq 5$
$x_1,\ x_2, x_3 \geq 0$

8. Determine all basic feasible solutions of the equations
$2x_1 + 6x_2 + 2x_3 + x_4 = 3$,
$6x_1 + 4x_2 + 4x_3 + 6x_4 = 2$

9. Construct the dual of the following problem,
Minimize $z = 2x_1 - x_2 + 3x_3$
Subject to $x_1 - 2x_2 + 3x_3 \geq 4$
$2x_1 + x_3 \leq 10$
$x_1 + x_2 + 3x_3 = 20$
$x_1,\ \ x_3 \geq 0$, $x_2\ unrestricted.$

10. Using Simplex method
Maximize $z = 5x_1 + 3x_2 + 7x_3$
Subject to $x_1 + x_2 + 2x_3 \leq 26$
$3x_1 + 2x_2 + x_3 \leq 26$
$x_1 + x_2 + x_3 \leq 18$
$x_1, x_2, x_3 \geq 0.$

11. Using the Big M method solve the following LPP
Maximize $z = 4x_1 + 5x_2 + 2x_3$
Subject to $2x_1 + x_2 + x_3 \leq 10$
$x_1 + 3x_2 + x_3 \leq 12$
$x_1 + x_2 + x_3 = 6$
$x_1, x_2, x_3 \geq 0$

12. Construct the dual of the following problem,
Minimize $z = 2x_1 + 9\,x_2 + 11x_3$
Subject to $x_1 - x_2 + x_3 \geq 3$

$$-3x_1 + 2x_3 \leq 1$$
$$2x_1 + x_2 - 5x_3 = 1$$
$$x_1,\ \ x_2\ , x_3 \geq 0\ ,$$

13. Determine all basic feasible solutions of the equations

$$2x_1 + 3x_2 + x_3 + 4x_4 = 8\ ,$$
$$x_1 - 2x_2 + 6x_3 - 7x_4 = -3$$

Module-6: Nonlinear Programming Problems

Short questions for 2 marks

1. The value of Lagrange's multiplier for the following NLPP is

Optimise Z=$7{x_1}^2 + 5{x_2}^2$

Subject to $2x_1$+$5x_2$=7

$$x_1, x_2 \geq 0$$

2. The value of Lagrange's multiplier λ for the following NLPP is

Optimize $z = 6x_1^2 + 5x_2^2$

Subject to $x_1 + 5x_2 = 7$

$$x_1, x_2 \geq 0$$

Questions for 4,6,8 marks

1. Obtain the relative maximum or minimum of the function
   $z = 2x_1 + x_3 + 3x_2x_3 - {x_1}^2 - 3{x_2}^2 - 3{x_3}^2 + 17$
2. Maximize
   $z = 6{x_1}^2 + 5{x_2}^2$

   Subject to

   $$x_1 + 5x_2 = 3$$
   $$x_1, x_2 \geq 0$$

3. Optimize

$z = 2{x_1}^2 + 3{x_2}^2 + {x_3}^2$

Subject to $x_1 + x_2 + 2x_3 = 13$, $2x_1 + x_2 + x_3 = 10$

$x_1, x_2 \geq 0$

4. Using Kuhn-Tucker conditions
Maximize
$z = 7{x_1}^2 + 5{x_2}^2 + 6x_1$

Subject to $x_1 + 2x_2 \leq 10$

$x_1 - 3\,x_2 \leq 9$

$x_1, x_2 \geq 0$

5. Find the relative maximum or minimum of the function

$$z = {x_1}^2 + {x_2}^2 + {x_3}^2 - 8\,x_1 - 10x_2 - 12x_3 + 100$$

6. Using Lagrange's multiplier
optimize $z = 4\,x_1 + 6x_2 - 2\,{x_1}^2 - 2\,x_1\,x_2 - 2{x_2}^2$
subject to $x_1 + 2x_2 = 2$

$$x_1,\ x_2 \geq 0$$

7. Using Lagrange's multipliers solve

$$Optimise \quad Z = 3{x_1}^2 + 2{x_2}^2 + 4x_1 + 2x_2$$

$$Subject\ to\ \ 3x_1 + 5x_2 = 11$$

$$x_1, x_2 \geq 0$$

8. Solve the following NLPP by using Kuhn-Tucker conditions:

Maximize $z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2$

Subject to $2x_1 + x_2 \leq 5$

$x_1, x_2 \geq 0$

9. Solve following NLPP using Kuhn-Tucker method

Maximize $z = 2x_1^2 - 7x_2^2 - 16x_1 + 2x_2 + 12x_1x_2 + 7$

Subject to $2x_1 + 5x_2 \leq 105$

$$x_1, x_2 \geq 0$$

10. Solve the following NLPP using Kuhn-Tucker conditions

$$Maximise \quad Z = 16x_1 + 6x_2 - 2{x_1}^2 - {x_2}^2 - 17$$

$$Subject\ to \quad 2x_1 + x_2 \leq 8$$

$$x_1, x_2 \geq 0$$

11. Using the method of Lagrange's multiplier solve the following NLPP

Optimize $z = 2x_1 + 6x_2 - x_1^2 - x_2^2 + 14$

Subject to $x_1 + x_2 = 4$; $x_1, x_2 \geq 0$

12. Using Lagrange's multipliers solve the following NLPP

Optimise $z = 4x_1 + 8x_2 - x_1^2 - x_2^2$

Subject to $x_1 + x_2 = 2$

$x_1, x_2 \geq 0$

13. Find the relative maximum or minimum of the function

$$z = -4{x_1}^2 - 9{x_2}^2 - 9{x_3}^2 + 2\,x_1 + 9x_2x_3 + 6x_3$$

SOMAIYA
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DEPARTMENT OF INFORMATION TECHNOLOGY

Academic Year (2021-22) **EVEN SEM**

Subject: Computer Network & Network Design

Class: SYIT **SEM: IV**

Question Bank for End Semester Exam

Module 1: Introduction to Computer Networks

1. Describe network application.
2. Discuss and compare various types of Networks.
3. Explain the relationship between transmission media and topology.
4. Explain the functions and protocols of each layer.
5. Evaluate the services of each layer in OSI model.
6. Write short notes on: Network topologies.
7. List and describe Error Reporting Messages of ICMP.
8. List and describe Query Reporting Messages of ICMP.
9. Evaluate working of ARP.
10. Draw and explain header of IP Protocol.
11. Apply handshaking signal in TCP Protocol.
12. Describe working of Domain Name System with examples.
13. Evaluate configuration of SMTP at email server?
14. Illustrate working of Network Devices.
15. Design and explain protocols of TCP/ IP model.
16. Illustrate Redirection message with diagram.
17. Evaluate execution of tracert command with diagram and examples.
18. Design and explain TCP header.
19. Describe five categories of connecting devices as per the layers.
20. Differentiate between TCP and UDP.
21. State the number of cable links and I/O ports to create a network of 32 nodes using Mesh topology.
22. Compare connectionless and connection-oriented services.

Module 2: Physical Layer & Data Link Layer

23. Evaluate the functions of Physical Layer.
24. Design a hop-to-hop delivery network with explanation.
25. Explain the functions of Data Link Layer.
26. Describe types of Transmission Media.

27. Design types of guided media with applications.
28. Design types of unguided media with applications.
29. Explain propagation methods.
30. Discuss Piggybacking concept.
31. State the factors that need to be considered for designing the transmission media.
32. A group of N stations share 100 Kbps slotted ALOHA channel. Each station output a 500 bits frame on an average of 5000ms even if previous one has not been sent. What is the required value of N?
33. Explain Distance Vector Routing with suitable example.
34. Construct Huffman code for the given symbols $\{x_1, x_2, \ldots\ldots, x_8\}$ with probabilities P(x) = {0.07, 0.08, 0.04, 0.26, 0.14, 0.09, 0.07, 0.25}. Find the coding efficiency.
35. A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$.
    a) What is the actual bit string transmitted?
    b) Suppose the third bit from the left is inverted during transmission. How will receiver detect this error?

Module 3: Network Layer

36. Explain the functions of Network Layer.
37. Design a host-to-host delivery network with explanation.
38. Describe Addressing with types.
39. Compare Digikstra Algorithm with Bellmon Ford Algorithm.
40. Explain with examples the classification of IPv4 addresses.
41. What are different types of routing algorithms?
42. Describe Link State Routing.
43. Explain CSMA Protocols. Explain how collision are handle in CSMA/ CD.
44. Describe Distance Vector Routing.
45. What is routing in network? Explain the shortest path routing protocol.
46. Compare Circuit Switching and Packet Switching.
47. Find the error, if any, in the following IPv4 addresses:
    (a) 121.56.042.87 (b) 57.45.290.41
48. Explain techniques of transition from IPv4 to IPv6.

Module 4

49. Evaluate the different protocol scenario for establishing a connection using 3 way handshakes.
50. Differentiate between TCP and UDP.
51. Explain the Connection Establishment and Termination in TCP.
52. Explain the function of Session Layer.
53. Explain the function of Transport Layer.
54. Explain TCP Sliding Window protocol with neat diagram in detail. What are the elements of Transport Layer?
55. Draw and explain TCP segment header.
56. Evaluate different causes of congestion and describe how token bucket algorithm provides the solution.
57. Explain stream delivery with Sending and receiving buffers.
58. Explain working of State transition diagram.
59. What is Traffic Shaping? Describe Leaky Bucket Algorithm in details.
60. Describe Token Bucket Algorithm in details.

61. Compare between Lossy Compression and Lossless Compression
62. List and describe methods of Lossy Compression.
63. List and describe methods of Lossless Compression.
64. Draw and elaborate scheduling algorithms of Quality of Service.
65. Draw and elaborate traffic shaping algorithms of Quality of Service.
66. Compare TCP with UDP.
67. Define Persistence and KeepAlive Timer in TCP.
68. Compare Lossy and Lossless Compression Technique.
69. Describe the working of Remote Procedure Call (RPC) in detail.

Module 5

70. Define the functions of Application Layer.
71. Analyse the functions of Presentation Layer.
72. Why do HTTP, FTP, SMTP, and POP3 run on top of TCP rather than on UDP?
73. Compare Lossy Compression and Lossless Compression with examples.

Module 6

74. Apply the steps of VLAN.
75. Describe the need of VPN.
76. Explain ISL working in VLAN.
77. Discuss different types of VLAN.
78. Discuss VPN in detail.
78. Design the network of your college campus w.r.t to following guidelines:
    (a) Networking Devices
    (b) IP Addressing
    (c) Protocols to be used
    (d) Services to be used

Subject Incharge
Dr. Vaishali Gaikwad

DEPARTMENT OF INFORMATION TECHNOLOGY

Academic Year 21-22

Subject: Computer Organization & Architecture **SEM** : IV

Module 1: Overview of Computer Architecture & Organization

1. Discuss Evolution of Computers.

2. Draw and explain Von Neumann Model

3. List & Discuss Performance Measure of Computer Architecture.

4. Comaire Computer Organization & Architecture

5. Define Computer Organization

6.Defined Stored Program concept

7. Discuss Basic organization of computer and block level description of the functional unit.

8.Write note on von Neumann architecture.

9.Explain with suitable diagram architecture of 8086 microprocessor

10. explain addressing mode of 8086 microprocessors with suitable example

11. Explain different addressing mode with example.

12. Explain any five instructions of 8086 microprocessors with suitable example.

13.List and explain Branch instruction of 8086

Module 2: Processor Organization and Architecture

1. Write a short note on Register organization of processor
2. What are the functions of following registered ?
    a. Z
    b. SP
    c. MAR
    MDR
3. Draw and explain basic instruction execution cycle.
4. Explain instruction cycle with interrupt execution with example
5. What is meant by fetch cycle, instruction cycle, machine cycle and interrupt cycle in brief.
6. Explain design of control unit w.r.t. soft wired and hardwired approach
7. Explain hardwired approach to the design of control unit.
8. Explain with diagram functioning of hardwired control unit
9. Write detailed notes on microinstruction format.
10. Explained the type of microinstruction formats.
11. Differentiate between hardwired and micro programmed control unit
12. What are application of microprogram
13. Describe nano programming
14. Explain concept of nano programming
15. Describe flynn's classification in details
16. What is instruction pipelining ?
17. Draw and explain five stage instructions pipelining
18. Write note on pipeline hazards
19. What are the types of pipeline hazards

Module 3: Data Representation and Arithmetic Algorithms

1. Using Booths Multiplication algorithm multiply the following multiplicand 7 multiplier = 3
2. Multiply the following numbers using Booths algorithm
3. Using Booths algorithm multiples the following Multiplicand = +22 multiplier = -5
4. Multiply the following signed number using booths algorithm
5. Multiplicand (14) base 10 multiplier (-10) base 10
6. Draw the flowchart of booths algorithm and multiply (-3)* (4) using Booths Algorithm.
7. Perform division of following number using restoring division algorithm
    a. Dividend = 1011 Divisor = 0011
    b. Dividend = 1001 Divisor = 0011
8. Divide 13 by 4 using restoring division algorithm.
9. Divide 11 by 2 using restoring division.
10. Represent the number (-1.125) base 30 in signle and double precision IEEE 754 binary format
11. Express (-10,100) base 10 in IEEE 754 single and double precision standard of floating point number representation
12. Represent(12.25)base 10 in double precision
13. Express(28.75) based 10 in IEEE 754 single and double precision standard of floating point

Module 4: Memory Organization

1. Compare SRAM and DRAM
2. Explain the hierarchical organization of computer memory
3. Explain in details memory hierarchy with example
4. Discuss various characteristics of memory
5. List and explain key characteristics of computer memory
6. Discuss memory allocation policy
7. Write a short note on L1,L2,L3 chache memory
8. Describe features of cache design
9. What are the elements of cache design explain in details?
10. Write note on cache memory mapping techniques
11. Explain direct mapping, associative mapping, set associative mapping
12. Explain in details of cache coherency

Module 5: I/O Organization

1. What is DMA? Explain working of DMA
2. Explain working od DMA and its different configurations
3. Explain concept of DMA in details
4. Comparison between programmed I/O and Interrupt Driven I/O
5. Write a note on interrupt execution
6. Write a note on interrupt driven I/O
7. Explain programmed I/O technique of data transfer
8. Write a not on Programmed I/O
9. What are the major function of an I/o Module
10. Discuss I/O module structure with diagram

Module 6: Overview of 8051 Microcontroller

1. Explain Architecture of 8051 Microcontroller with pin diaram
2. Difference between Microcontroller and Microprocessor
3. List advantage of Microcontroller
4. List and discuss various Instruction Set of 8051

Subject Incharge

Mr. Prashant Sawant

SOMAIYA VIDYAVIHAR
K J Somaiya Institute of Engineering and Information Technology
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DEPARTMENT OF INFORMATION TECHNOLOGY

Academic Year (2021-2022) Even SEM

Question Bank

Course: Operating System (OS)
Course Code: 1UITC403
Class: SYIT
SEM: IV

Course Outcomes:
Upon completion of the course, the learners will be able to:

1. Explain the basic concepts related to Operating System.
2. Describe the process management policies and illustrate the scheduling of processes by CPU.
3. Apply synchronization primitives and evaluate deadlock conditions as handled by Operating System.
4. Explain the memory allocation and management functions of Operating Systems.
5. Explain the services provided by Operating System for storage management.
6. Compare the functions of various special-purpose Operating Systems.

Module 1 : Fundamentals of Operating System (CO1,CO6)

1. Describe characteristics of Modern Operating System.
2. Discuss different functions of OS?
3. Explain objectives and functions of Operating System.
4. What are the major functions carried out by an Operating System?
5. What is System Call? Explain any four System Calls.
6. Explain various services of operating system?
7. Differentiate between Multiprogramming and Multiprocessing system?
8. Discuss the Difference between Monolithic and Micro kernel.
9. What are System Programs? Explain in brief various categories in which it is divided.
10. The services and functions provided by an operating system can be divided into two main categories. Briefly describe the two categories and discuss how they differ?
11. What are major activities of an Operating System with regard to File Management and Memory Management?
12. Briefly explain the different kernel architectures.

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13. What is Context-Switch? Describe the actions taken by a kernel to context switch between processes?
14. What is kernel? Discuss briefly the approaches of designing kernel?
15.

Module 2 : Process Management (CO2)

16. Explain various states of process with the help of State Transition diagram. (4M)
17. Discuss the process. Draw process state diagram?
18. Discuss distributed operating system.
19. Explain thread. Compare process and thread with example.
20. Use following Scheduling algorithm to calculate ATAT &AWT for the following process:
    a) FCFS
    b) Pre-emptive and Non-Pre-emptive SJF
    c) Round Robin
    d) Pre-emptive Priority

Process	Arrival Time	Burst Time	Priority
P1	0	8	3
P2	2	1	1
P3	2	3	2
P4	3	2	3
P5	4	6	4

21. What is thread? Explain User level threads and Kernel level threads?
22. Explain the Multithreading Models in detail.
23. How process control block helps in context switching?
24. Write a short note on Inter Process Communication (IPC).
25. Compare Pre-emptive and Non-Pre-emptive Scheduling?
26. What is Scheduling? Give different scheduling Policies and their comparison?
27. Explain with an example, which of the following algorithms could result in starvation.

a) FCFS
b) SJF
c) Round Robin
d) Priority

28. Consider the following set of processes, with the length of CPU burst given in milliseconds. The processes are assumed to arrive in order P1, P2, P3, P4, and P5 all at time 0.

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-pre-emptive priority (a smaller priority number implies a higher priority), and RR (quantum=1) scheduling. Calculate the average turnaround time and average waiting time for each process?

29. Describe the actions taken by a kernel to context-switch between processes.
30. Which characteristics are used for comparison between different scheduling algorithms?
31. Explain the differences in how much the following scheduling algorithms discriminate in favor of short processes:
    a) FCFS
    b) RR
    c) Multilevel Feedback Queues
32. What resources are used when a thread is created? How do they differ from those when a process is created?
33. Consider the following snapshot of the process to be executed. Draw the Gantt chart and determine the average waiting time and average turnaround time for FCFS, SJF (pre-emptive), SJF (non-Pre-emptive) and Round-Robin (quantum=2) scheduling algorithm?

Process	Arrival Time	Burst time

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P1	0	7
P2	1	4
P3	3	3
P4	5	1
P5	7	5

34. Define Process scheduling along with type of schedulers in detail.
35. What is meant by Inter Process Communication (IPC)? Explain various models of it.
36. Describe the Process Control Block (PCB) in process management.
37. Summarize the steps in Context Switch Mechanism in operating system.
38. Distinguish between:
    a) Program and Process.
    b) Process and Thread.
    c) User Level Thread and Kernel Level Thread.
    d) Long Term, Short Term and Medium-Term Scheduler.

Module 3 : Process Coordination(CO3)

39. What is producer-consumer problem? How to solve with an example?
40. Describe how does Critical Section problem avoid race condition. What are the properties that data item should possess to avoid critical section?
41. Show that Peterson's algorithm satisfies the requirement of mechanisms to control access to a critical section?
42. How Peterson's algorithm will help to achieve mutual exclusion?
43. What do you mean by Critical Section? Using Semaphores, write a solution to reader-writer problem that gives priority to readers?
44. Define the Critical Section. What are the requirements to solve the critical Section Problem?
45. Explain in brief the Race Condition in process synchronization.
46. Write a short note on "Semaphores".
47. Describe in brief the Classical Problems of Synchronization. Explain any one type with the help of one example.
48. Discuss the idea of message passing in process coordination.

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Module 4: Memory Management (CO4)

49. Compare and contrast paging and segmentation.
50. What is address translation? Consider a logical address space of 32 pages with 1024 words per pages, mapped onto a physical memory of 16 frames.
51. How many bits are required for in logical address?
52. Explain internal fragmentation with example.
53. How many bits are required in physical address?
54. What is thrashing? Elaborate its effect on processing performance?
55. Compare logical and physical address.
56. Short note on: Page Replacement Algorithms.
57. Explain in brief about Translation Look Aside Buffer.
58. With a help of a neat diagram, explain the h/w support with TLB for paging.
59. Consider the following page reference string 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6
    a. How many page faults would occur for the following replacement algorithms assuming 1, 2, 3, 4, 5, 6, and 7 frames?
    b. Remember all the frames are initially empty, so your first unique page will cost one fault each. LRU, FIFO, Optimal
60. Calculate page faults and Hits using FIFO,LRU and Optimal page replacement algorithm for the following page sequence (2,3,5,4,2,5,7,3,8,7).Assume page frame size is 3.
61. Given memory partitions of 100KB,500KB, 200KB,300KB, and 600KB (in order),how would each effect the First –fit, Best-fit and Worst-Fit algorithm place processes of 212KB,417KB,112KB and 426 KB(in order)?which algorithm makes more efficient use of memory?
62. How logical address is converted into physical address in paging?
63. Explain Internal and External Fragmentation?
64. On a simple paging system with 2^24 bytes of physical memory, 256 pages of logical address space, and a page size of 2^10 bytes
    (b) How many bytes are in page frame?
    (c) How many bits in the physical address specify the page frame?
    (d) How many entries in the page table.

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(e) How many bits are in the logical address?

65. Compare the following main memory organization schemes: Contiguous memory allocation, pure segmentation, pure paging with respect to following issues:
    (f) External Fragmentation.
    (g) Internal Fragmentation.

66. Apply **Banker's algorithm** answer the following question.
    a) How many resources of type A, B, C, D are there?
    b) What are the contents of need Matrix?
    c) Find system is in safe state? If it is, Find safe sequence.

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	2	1	2	0	3	2	2	2	5	3	2
P1	1	1	0	2	2	7	5	2				
P2	2	2	5	4	2	3	7	6				
P3	0	3	1	2	1	6	4	2				
P4	2	4	1	4	3	6	5	8				

Module 5 : Storage Management (CO5)

67. Explain various RAID Levels?
68. Write short note on File access methods?
69. Discuss various file allocation methods.
70. Compare and contrast Contiguous Allocation, Linked Allocation and Indexed Allocation.
71. What are the methods for selecting disk scheduling algorithm?
72. Describe and design i-node structure of Unix Operating system?
73. Explain any three allocation Schemes that exist for allocating secondary storage to files?
74. Explain the disk scheduling algorithms?
75. Discuss free space management.
76. Discuss RAID storage structure.
77. Discuss File System Implementation.
78. Differentiate between RAID 1 and RAID 2 level.
79.

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Module 6 : Special- Purpose Operating Systems (CO6)

80. Compare Open-source and Proprietary Operating System.
81. Compare Network Operating System and Embedded Operating Systems
82. Compare Cloud and IoT Operating Systems
83. Compare Real-Time and Batch Operating System
84. Compare Mobile Operating System
85. Compare Cloud and IoT Operating Systems. Discuss the 4 main components of the IoT system with a neat diagram.
86. Discuss distributed operating system.
87. Compare Multimedia and Batch Operating System.
88. Compare Function of various Special-purpose Operating Systems.
89. Discuss the features of Mobile OS. Sketch and explain memory management in Mobile OS.

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DEPARTMENT OF INFORMATION TECHNOLOGY

Academic Year: 2021-22 (Even Semester)

Course: Automata Theory (1UITC404)

B.Tech. (Information Technology) – Semester IV

Question Bank

1. Define regular expression and list properties of regular expression.
2. Write a regular expression for the set of strings in which every 1 is immediately followed by at least two 0's.
3. Write a regular expression for the set of strings of 0's and 1's not containing 010 as a substring.
4. Write a regular expression for the set of strings which has no pair of consecutive ones.
5. Write a regular expression for the set of all strings containing exactly 2 a's.
6. Write a regular expression for the set of all strings containing at least 2 a's.
7. Write a regular expression for the set of all strings containing at most 2 a's.
8. Write a regular expression for the set of all strings containing the substring aa.
9. Explain operations of regular expressions.
10. Write an algorithm to convert right-linear grammar to left-linear grammar.
11. Write an algorithm to convert left-linear grammar to right-linear grammar.
12. Convert given RL to LL (refer sums in ppt).
13. Convert given LL to RL (refer sums in ppt).
14. Explain DFA.
15. Explain NFA.

16. Differentiate between DFA and NFA.

17. Explain Moore machine.

18. Explain Mealy machine.

19. Differentiate between Mealy machine and Moore machine.

20. Define DFA and design a DFA to accept a string not containing 101 as its substring over ∑={a,b} and show the computation for the string 001110.

21. Design DFA for accepting strings having some number of a's followed by some number of b's with the total length of the string being odd.

22. Design DFA for accepting strings over ∑={a,b} that end with either ab or ba. Show the computation for the input string w=ababaab.

23. Differentiate between NFA and DFA.

24. Design DFA to accept set of strings where the number of 1's in every string is multiple of 3. ∑ = {0,1}

25. Design NFA for the language L= {0,1} that have at least two consecutive 0's and convert it to a DFA.

26. Design a NFA for accepting input strings that contain either the keyword 000 or 010 and show the derivation of string 000101.

27. Design NFA for accepting binary strings in which the sum of the last four digits is odd. (e.g. 00101011)

28. Design NFA for binary strings of any length with alternating 0s and 1s. The NFA must have just three states.

29. Design NFA for the regular expression: a*b*c*.

30. Design NFA for the language of strings containing 101 as a substring.

31. Design DFA for string which accept set of all strings over ∑ = {0,1} with no more than three 0s.
32. Design a DFA that accepts set of strings where the 0s in every string is multiple of 3 over ∑ = {0,1}.
33. Design a DFA that accepts set of strings containing exactly four 1s in every string over ∑ = {0,1}.
34. Design DFA for strings containing even number of 0s and even number of 1s.
35. Define CFG.
36. Define CNF.
37. Define GNF.
38. Construct context free grammar for following languages: $a^{2n} b^{n}$
39. Construct context free grammar for following languages:All strings over {a,b} with either equal numbers of a and b or twice as many b s as a s.
40. Construct context free grammar for following languages:L = { wcw^{R} | w ε (0,1) *}
41. Construct context free grammar for following languages:L = { $a^{n}b^{m}$ | n < m}
42. Construct context free grammar for following languages:r = 1* 10 1*(0 +1)*
43. Explain steps involved in simplification of CFG.
44. Show that S -> SaS | b is ambiguous. Construct an unambiguous equivalent of the grammar.
45. Is the following grammar ambiguous? S -> AB|aaB, A -> a|Aa, B -> b
46. Convert the following grammar to Chomsky Normal Form (CNF):S -> abS | baS | ε
47. S -> AS | AAAS, A -> SA|aa|b
48. Convert given CFG to CNF.
49. Convert given CFG to GNF.
50. Construct PDA for following languages: L= { w ε { a, b }* | w has the equal number of a's and b's }
51. Construct PDA for following languages:L = { $a^{n} b^{2n}$ | n >= 1 }
52. Construct PDA for following languages:L = {wcw^{R} | w ε { a, b }* }
53. Construct PDA for following languages:L = {ww^{R} | w ε { a, b }* }

54. Convert PDA to CFG.
55. Convert CFG to PDA.
56. Construct PDA for following languages:L = $\{a^n b^n \mid n>=1\}$
57. Construct a PDA equivalent to the following grammar: S -> aSa | bSb |a.
58. Give CFG generating the language accepted by the following PDA:

    M = ({q0,q1} , { 0, 1} , { Zo, X }, ď, qo, Zo, Ø), where ď is given below:

    ď(qo , 1 , Zo) = { (qo, XZo)}

    ď(qo, 1, X) = { (qo, XX) }

    ď(qo, 0, X) = { (q1, X) }

    ď(qo, ε, Zo) = { (qo, ε) }

    ď(q1, 1, X)= { (q1, ε) }

    ď(q1, 0, Zo) = { (q0, Zo) }.

59. Construct a Turing machine that accept L = $\{ 0^n 1^n \mid n >= 0 \}$
60. Construct a Turing machine that accept L = $\{ 0^n 1^n \mid n >= 1\}$
61. Explain Deterministic Turing Machine.
62. Describe variants of Turing Machine.
63. Design Turing Machine for accepting even palindromes with the help of suitable State-Transition diagram. Show the computation of sample string.
64. Explain Turing Machine.
65. Describe deterministic and non-deterministic Turing Machine.
66. Design Turing Machine for L = $\{ 0^n 1^n \mid n >= 1\}$ with the help of suitable State-Transition diagram. Show the computation of sample string.
67. Discuss applications of Pushdown Automata in detail.
68. Explain any two applications of Pushdown Automata.
69. Discuss applications of Finite Automata and Context Free Grammar in detail.

70. Discuss application of Automata Theory.
71. Explain any two applications of Finite Automata.
72. Discuss phases of Complier in detail.
73. Discuss applications of Pushdown Automata and Turing Machine in detail.
74. Discuss applications of Turing machine in detail.

Ms. Reena Lokare

Subject Teacher