[Time: 3 Hours] **[Marks:80]**

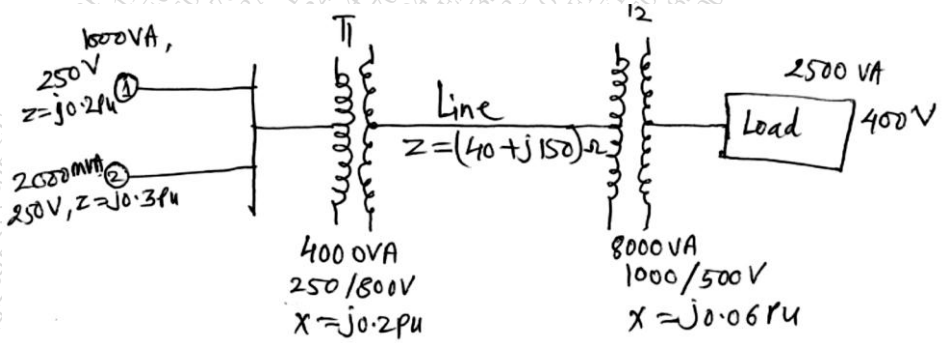
Please check whether you have got the right question paper.

N.B: 1. Questions No.1 is compulsory.
2. Solve three questions from remaining questions.
3. All questions carry equal marks.
4. Assume suitable data if required.

Q.1 a) What is the difference between overhead & underground system. **20**
b) Explain skin effect & proximity effect.
c) Explain transposition of power line
d) Explain step & touch potential.

Q.2 a) What is string efficiency & Derive expression for string efficiency? **20**
b) A 3- phase double circuit line has vertical configuration as radius of each conductor is 1.1 cm. the horizontal distance h is 5 m & Vertical distance D is 3m. Find the inductance per phase per km of line.

Q.3 a) Derive an expression from inductance of 1-phase, 2- wire line with solid conductor .write assumption. **20**
b) For a simple power system shown in below , draw the per unit impedance diagram on a common base of 5000 VA & 250 V.



Q.4 a) Derive an expression for capacitance per phase per km of a 1-phase line taking into account effect of ground. **20**
b) Find A, B, C, D parameters of a 3-phase, 80km, 50 hz transmission line with series impedance of 0.15 + j0.78 ohm/ km & a shunt capacitance of j 5 X 10^{-6} mho/km .use nominal T configuration.

Q.5 a) Prove that per unit impedance of transformer can be made some referred to both winding by selecting proper voltage base in either side. **20**
b) Explain tuned power line.

Q.6 a) Explain the measurement of earth resistance & soil resistivity. **20**

b) Explain the different method of neutral grounding.

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(3 Hours) **(Total Marks : 80)**

N.B.: 1) **Question No. 1** is **Compulsory**.
2) Attempt **any three** from the **remaining**.

1. a) Find the extremal of $\int_{x_0}^{x_1} \frac{1+y^2}{y'^2} dx$. **(05)**

b) Is the following set of vectors in P_2 linearly independent? $2-x+4x^2$, $3+6x+2x^2$, $2+10x-4x^2$? **(05)**

c) Show that Eigen values of Hermitian matrix are real. **(05)**

d) Evaluate $\int(z^2-2\bar{z}+1)\,dz$ over a closed circle $x^2+y^2=2$. **(05)**

2. a) Find the extremal $\int_0^{\pi}(y^2-y'^2-2ycosx)dx$, $y(0)=0$, $y(\pi/2)=0$. **(06)**

b) Find the Eigen Values and Eigen Vectors of the matrix A^3+3I, where **(06)**

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

c) Obtain all possible expansion of $f(z)=\frac{z}{(z-1)(z-2)}$ about $z=-2$ indicating region of convergence. **(08)**

3. a) Verify Cayley - Hamilton Theorem for $A=\begin{bmatrix}1 & -1 & 0\\ 2 & 3 & -2\\ -2 & 0 & 1\end{bmatrix}$ and find A^{-1}. **(06)**

b) Using Cauchy's Residue Theorem evaluate $\int_C \frac{e^z}{z^2+\pi^2} dz$ where C is |z|=4. **(06)**

c) Show that a closed curve 'C' of a given fixed length (perimeter) which encloses maximum area is a circle. **(08)**

4. a) Find an orthonormal basis for the subspace of R^3 by applying Gram-Schmidt process, where $u_1=(1,0,1,1), u_2=(-1,0,1,1), u_3=(0,-1,1,1)$. **(06)**

b) Find A^{20} for the matrix $A=\begin{bmatrix}2 & 3\\ -3 & -4\end{bmatrix}$. **(06)**

c) Reduce the Quadratic Form $2xy+2yz+2zx$ to diagonal form by orthogonal reduction method. **(08)**

5. a) Using Rayleigh-Ritz Method, find an approximate solution to the extremal problem $\int_0^1(y'^2-y^2-2yx)dx$, $y(0)=0$, $y(1)=0$. **(06)**

b) Let V be a vector space containing 2×2 matrices and $W\subseteq V$ such that $W=\begin{bmatrix}a & 0\\ 0 & b\end{bmatrix}$. Is W a subspace of V? Justify. **(06)**

c) Show that the matrix $A=\begin{bmatrix}8 & -8 & -2\\ 4 & -3 & -2\\ 3 & -4 & 1\end{bmatrix}$ is diogonable.Also find the transforming matrix and diagonal matrix. **(08)**

6. a) Using Cauchy's Residue Theorem, evaluate $\int_0^{2\pi}\frac{d\theta}{13+5\,sin\theta}$. **(06)**

b) Evaluate $\int_{1-i}^{2+i}(2x+1+iy)dz$ along the curve $x=t+1, y=2t^2-1$. **(06)**

c) Find the singular value decomposition of the matrix A= $\begin{bmatrix}2 & 3\\ 0 & 2\end{bmatrix}$ **(08)**

[Time: 3 Hours] **[Marks:80]**

Please check whether you have got the right question paper.

N.B: 1. Question No 1 is compulsory.
2. Attempt any THREE questions from remaining
3. Figures to right indicate full marks.

Q. 1 Attempt **any Four** questions.

a) How the back emf (Eb) makes the DC motor a self regulating machine. **(05)**
b) Explain the electro-mechanical energy conversion. **(05)**
c) Briefly explain the Swinburne's test for DC machine. **(05)**
d) Explain the conditions for parallel operation of single phase transformer. **(05)**
e) Why the terminal voltage of DC shunt generator falls when it is loaded. **(05)**

Q. 2 A) Explain the concept of singly excited machines and derive the expression for the electromagnetic torque. **(10)**

B) Derive the expression of copper saving in Auto-Transformer. **(10)**

Q. 3 A) Derive the expressions for Demagnetizing Amp-turns (ATd/pole) and cross magnetizing Amp-turns (ATc/poles) for armature reaction. **(10)**

B) Two identical dc shunt machine, when tested for Hopkinson's test, gave the following readings. **(10)**
Line voltage = 230V
Line current (excluding field currents) = 30A
Motor Armature current = 230A
Field currents 5A and 4A.
If the armature resistance of each machine = 0.025 Ω, calculate the efficiency of each machine.

Q. 4 A) Explain the Sumpner's test for single phase transformer. **(10)**

B) Two single phase transformers shared a load of 400 KVA at 0.8 p.f. lagging. Their equivalent impedances referred to secondary windings are (1 + j2.5) and (1.5 + j3) ohms respectively. **(10)**
Calculate the load shared by each transformer.

Q. 5 A) Explain the necessity of starter and hence explain the working of three point starter. **(10)**

B) A 7.46 kw, 220v, 900 rpm shunt motor has full load efficiency of 88% and armature resistance of 0.08 Ω, while shunt filed current of 2A. **(10)**
If the speed of this motor is reduced to 450 rpm by inserting a resistance in armature circuit. The load torque remains constant, find the motor output efficiency and the extra resistance inserted in armature circuit.

Q. 6 Write short note on each **(20)**

A) Electrical braking in separately excited DC motor.
B) Commutation process in DC Generator.

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(Time: 3 Hours) [Total Marks: 80]

Note:

1) **Question No.1 is Compulsory**
2) **Answer any three questions out of remaining.**
3) **Assume suitable data if required.**

Q.1 a. Define unit step and impulse signal **5*4**

b. Find the Fourier transform of $x(t) = e^{-2t}u(t-2)$

c. Obtain the Z transform of x(n)=(n-2)u(n)

d. Prove any two DFT properties.

Q.2 **a)** Check the linearity, stebility and time invariance of the system $y(t) = x^3(t)$ **(10)**

b)Sketch the signal -2u(t+2 and) and r(-t+3) **(05)**

c) Check whether the given signal $X(t)=2\sin^2 w_0 t$ is power signal or not. **(05)**

Q.3 **a)**

i) Find the initial value and final value of $X(Z) = \dfrac{10z(z-0.4)}{(z-0.5)(z-0.3)}$ **(05)**

ii) What you mean by ROC?Mention the significance.Find the ROC of finite duration right sided signal. **(05)**

b)

$$H(Z) = \frac{(1-0.5Z^{-1})(1-Z^{-1})}{(1+0.2Z^{-1})(1+0.8Z^{-1})(1-0.8Z^{-1})}$$ **(10)**

I. Give ROC condition
II. Sketch pole Zero diagram
III. Find the response of the system

Comment on the stability

Q.4 **a)** Find the phase and magnitude response of the system h(n)= [-1, -1/2] **(10)**

b) A causal LTI system is described by the difference equation. **(10)**

y(n)-3/4y(n-1)+1/8y(n-2) = u(n)+u(n-1)

Find the natural response of the system due to step input.

Q.5 a) State sampling theorem. How aliasing occurs? How it can be eliminated? **[5*4]**

b) Perform convolution of the following casual signals

$X_1(t) = t.\ u(t)$; $t \geq 0$ $X_2(t) = e^{-5t}.u(t)$; $t \geq 0$

c) Find the Fourier transform of the signum signal

d) Derive and sketch the ROC of any three infinite duration signals. Also comment on stability.

Q.6 a)An 8 point sequence is given by x(n)={2,4,6,8,2,4,6,8}.Compute 8 point DFT of x(n) by radix -2 DIT – FFT method. **(10)**

b) Perform the circular convolution using DFT. $X_1(n)=\{3,1,3,1\}$ $X_2(n)=\{1,2,3,4\}$ **(10)**

Q. P. Code: 38385

Duration – 3 Hours **Total Marks - 80**

N.B.: - (1) Question No.**1** is compulsory.
(2) **Attempt** any **Three**questions out of remaining **five** questions.
(3) Assume suitable data if necessary and justify the same.

Q 1.	A) List and draw the type of shift registers	**04**
	B) Draw the circuit of an Opamp as inverting amplifier. Also draw the input and output waveforms	**04**
	C) Draw and explain in brief the block diagram of an operational amplifier.	**04**
	D) State and prove De-Morgan's theorem.	**04**
	E) Comment on the frequency response of an operational amplifier	**04**
Q 2 a)	Explain the operation of IC 555 operating as an Monostable multivibrator and derive the equations for output voltage frequency.	**10**
Q 2 b)	Explain first order Butterworth low pass filter and also derive expression for voltage gain.	**10**
Q 3 a)	With neat diagrams and waveforms explain Opamp operating as a differentiator. Also Sketch the output waveform for the circuit when the input is a square waveform.	**10**
Q 3 b)	Minimize the Boolean expression using K-Map and implement using gates. $Y = \Sigma m(1,2,9,10,11,14,15)$	**10**
Q 4 a)	With neat diagram and waveforms describe Schmitt trigger using an Opamp.	**10**
Q 4 b)	Implement the following expression using 3 data select input multiplexer $F(A, B, C, D) = \sum m(0, 1, 2, 3, 4, 10, 11, 14, 15)$	**10**
Q 5 a)	Design a 3 bit binary to gray code converter and implement using logic gates	**10**
Q 5 b)	Design a mod-5 synchronous counter using JK flip flop.Also draw the timing diagram.	**10**
Q 6 a)	Explain successive approximation type ADC	**10**
Q 6 b)	List the types of logic family. Explain any logic family in detail.	**10**

(Time: 3 Hours) **Total Marks: 80**

Note:

- Question **1** is **compulsory**.
- Solve ant **three** questions from questions no. 2 to 6.
- Assume necessary data wherever necessary.

Q1 Answer the following questions **20**

A) Define error, accuracy and precision of numbers with suitable examples.

B) Derive the condition for convergence in case of Newton Raphson method.

C) What do you understand by unconstrained optimization? Write the algorithm for Golden section search method?

D) What are the basic requirements of Linear programming problem?

Q2 a) Solve the equation $\frac{dy}{dx} = x^2 + y^2$, using 2nd order RK method at x=0.2 and x =0.4, y(0) = 0. **10**

Q2 b) Solve the equation $dy/dx = 1 + xy^2$ with y (0) = 0.2 using Adam's Bashforth method. Determine y at x=0.5 with a step size of 0.1. **10**

Q3 a) Write the algorithm for Newton's forward difference interpolation and calculate f(3.5) for the following data **10**

x	2	3	4	5	6	7	8	9
f(x)	19	48	99	178	291	444	643	894

Q3 b) $Minimize\ Z = 2x_1^2 + x_2^2$ **5**

$subjected\ to\ x_1 + x_2 = 1$

$x_1, x_2 \geq 0$

Using Lagrange's multiplier method.

Q3 c) What are the basic requirements of Linear programming? Discuss the various terms used in LPP. **5**

Q4 a) Minimize cost $Z = 400x_1 + 800x_2$ **10**

subject to $6x_1 + 2x_2 \geq 12$

$2x_1 + 2x_2 \geq 8$

$4x_1 + 12x_2 \geq 24$

$x_1, x_2 \geq 0$ using graphical method.

10

Q4 b) Determine root of equation $f(x) = 0.51x - sinx$ using Newton Raphson method for three iterations.

Q5 a) Use LU Decomposition method to find solution of the following system of equations. **10**

$$2x + 2y + 3z = 4$$
$$4x - 2y + z = 9$$
$$x + 5y + 4z = 3$$

Q5 b) Use method of Regula Falsi to obtain root of equation $sins = x - 2$, near x = 2.5 for 5 iterations. x is in radians. Write the algorithm for this method. **10**

Q6 a) Using Simplex method solve **10**

$$Max\ Z = 500x_1 + 600x_2$$
$$subjected\ to\ \ x_1 + 2x_2 \leq 15$$
$$3x_1 + 2x_2 \leq 18$$
$$x_1, x_2 \geq 0$$

Q6 b) Solve the equation $\frac{dy}{dx} = x - y^2$ using Milne's Predictor-Corrector method. **10**
Find y at x = 0.8 and x = 1 with step size of 0.2.
Given that y(0) = 0, y(0.2) = 0.0199, y(0.4) = 0.079, y(0.6) = 0.1762.

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