(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)**

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(Three Hours) (80 Marks)

N.B. 1) **Question-1** is compulsory and solve any **Three** questions from remaining questions
2) Assume suitable data if it is required

Que-1 Answer any **FIVE**

a	Explain any one Clamping circuit with proper waveforms.	4
b	Explain any one biasing method of JFET circuit with proper circuit diagram.	4
c	What are the advantages of Multistage amplifier?	4
d	Classify oscillator circuits with reference to frequency.	4
e	What are different techniques to improve CMRR in differential amplifier, explain any one.	4
f	How Power amplifier is different than Voltage Amplifier.	4

Que-2a For the Voltage divider biased circuit using BJT with the following data 10
$R_1 = 39\ K\Omega$, $R_2 = 3.9\ K\Omega$, $R_C = 10\ K\Omega$, $R_F = 1.5\ K\Omega$,
$C_1 = C_2 = C_E = 10\ \mu F$, $\beta = 140$, $V_{BE} = 0.7\ V$, $V_{CC} = 22\ V$
Determine V_{CEq}, I_{Cq} and state in which region the circuit is working.

b Derive equation of Av, Ri and Ro for Voltage Divider biased JFET amplifier circuit. 10

Que-3a Draw two stage CE-CE amplifier circuit, hence draw its ac equivalent model and derive ac parameters for each stage. 10

b Draw Block diagrams of different types of negative feedback amplifiers. 10

Que-4a For BJT differential amplifier derive equations of A_{DM}, A_{CM} and CMRR. 10

b Compare E-Mosfet and D-Mosfet Amplifier 10

Que-5a Explain Class B Power Amplifier in brief. 10

b Explain Low frequency response of JFET amplifier. 10

Que-6 Write short Notes on any **FOUR** of the following. 20
a Condition of Sustained Oscillations in Oscillator
b Wilson Current Source
c Types of Power Amplifiers
d DC load line of BJT circuit
e Clipping Circuit

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[Time: 3 Hours] [Marks:60]

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 **five** questions.
3. **Figures** to **right** indicate **full marks**.
4. Assume suitable **data**, if **any**.

Q1

(a) Explain the necessity of starter in D.C. Motor **05**

(b) State the important applications of brushless DC motor **05**

(c) A 4 pole, 50 Hz induction motor has full load speed of 1440 rpm. Calculate slip. **05**

Q2

(a) Explain construction and working principle of 3 phase squirrel cage induction motor. **08**

(b) What are the advantages, disadvantages and applications of switched reluctance motor? **07**

Q3

(a) Explain the principle of operation of capacitor start and capacitor run single phase induction motor. **08**

(b) Describe the construction and working principal of variable reluctance motor. **07**

Q4

(a) State the different types of brushless dc motor and explain any one. **07**

(b) Explain different speed control methods of DC shunt motor **08**

Q5

(a) Compare the different starting methods of three phase induction motor **07**

(b) Explain with neat sketches the armature reaction in DC machine **08**

Q6 **Write short notes on any three**

(a) The double field revolving theory in single phase induction motor **05**

(b) Permanent magnet synchronous motor. **05**

(c) Drive circuit of stepper motor **05**

(d) Control requirement for switched reluctance motor **05**

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