Q.P. Code :36274

[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 from remaining five questions.
3. Assume suitable data if any required.

Q.1 Attempt any four 20

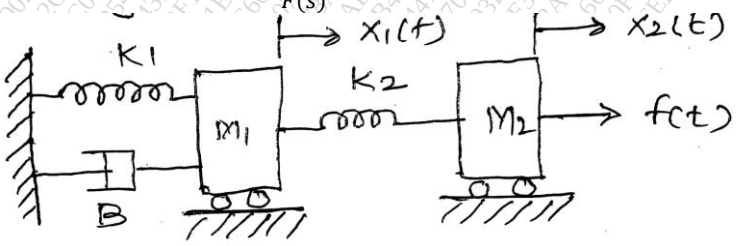
a) What are the frequency domain specifications?
b) What do you mean by angle of arrival how to determine it?
c) State and explain mason's Gain formula.
d) State and explain the Nyquist stability criterion.
e) Explain regenerative feedback.

Q.2 a) The open loop transfer function of a feedback control system is $G(s)H(s) = \frac{K}{S\,(s^2+2S+2)\,(s+4)}$ 10

i) Using routh array criterion, determine range of value of K for which system is stable.

ii) If the zero at $z = -4$ is added to forward path transfer function how is the path transfer function how is the stability affected?

b) Find the transfer function $\frac{x_2(s)}{F(s)}$ of the given system 10

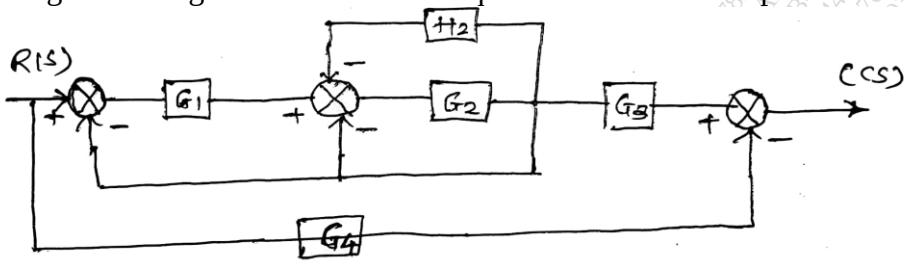


Q.3 a) A unity feedback system has a open loop transfer function $G(s) = \frac{10}{s(s+2)}$ find the rise time percentage overshoot step input of 12 units. 10

b) Sketch the root locus plot for the system with open loop transfer function 10

$G(s)H(s) = \frac{K(s+4)}{(s+1)(s^2+6S+13)}$ also find maximum value of K for stability.

Q.4 a) Using block diagram reduction technique find the closed loop transfer function. 10



b) Sketch the Bode plot of following open loop transfer function also find wgc, Wpc, gain margin and phase margin. 10

$$G(s) = \frac{10}{s(1+04S)(1+0.1S)}$$

Q.5 a) Sketch the polar plot for unity back system $(s) = \frac{1}{S(s+1)^2}$. 10

b) A closed loop transfer function of a second orders system is $\frac{C(S)}{R(S)} = \frac{wn^2}{S^2+2\,\xi\,wns+wn^2}$ obtain the equation for the output response c (t) for a unit step input for underdamped condition. 10

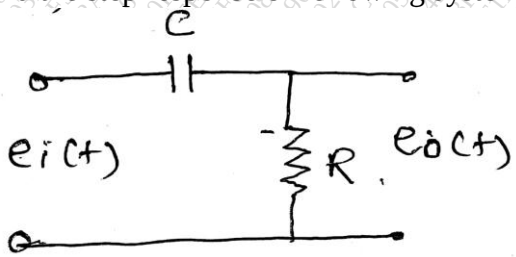
Q.6 a) A certain system is described by differential equation $\ddot{y} + b\dot{y} + 4y = r$ determine the value of b to satisfy the following specification 10

i) Mp to be small as possible but no greatest than 15%.

ii) Rise time 'tr' to be small as possible but not greater than 1.2 second.

b) Explain Nyquist stability criterion. 05

c) Find the step response of following system. 05



(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)**

Duration: 3 Hrs. **Total Marks: 80**

Note: 1) Question no **1** is compulsory

2) Solve any **Three** questions from remaining questions

3) Assume suitable data if required and mentioned it

Q.1 Solve the following **20**

a) Explain Torque-speed and speed – armature current characteristics of DC motor?

b) Explain working principle of single phase Induction Motor

c) State the advantages and disadvantages of moving iron instrument.

d) Explain the basic principle of ADC.

Q.2 a) Explain any one method for speed control of DC shunt motor **10**

b) Explain various losses in Induction Motor. **10**

Q.3 a) Explain construction and operating principle of DC motor. **10**

b) Explain the working of attraction type and repulsion type moving iron Instrument with neat diagram **10**

Q.4 a) Derive the bridge balance equation for whetstones bridge? Write its application **10**

b) For the circuit shown in Fig 1, if R_1=1150 Ω, R_2= 1kΩ, R_3= 750Ω and C_1= 0.1μf

Find Rx and Lx **10**

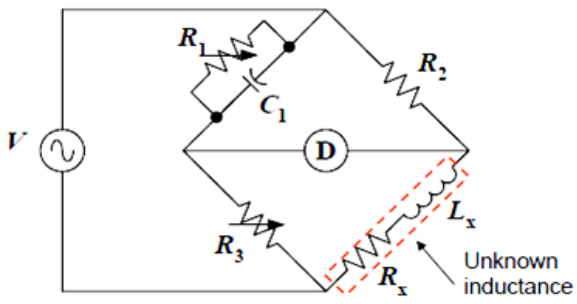


Fig: 1

Q.5 a).Explain working of Megger with suitable block diagram **10**

b) Draw and Explain working ofShaded pole induction motor. **10**

Q.6 a) Explain working of DMM with block diagram **10**

b) Applications of a.c. potentiometer. **10**

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

N. B. 1) Question No. **1** is **compulsory**.
2) Answer any **3** questions from the remaining **5** questions.
3) Assume suitable data wherever necessary.

Q1 Solve **any four** **20**
(a) Explain FM noise triangle
(b) Derive the power relationship in AM signal
(c) Explain pre-emphasis and de-emphasis in FM systems
(d) Write note on telemetry
(e) Compare TDM and FDM

Q2 (a) Explain any one method of SSB generation with neat block diagram **20**
(b) An FM wave is represented by the following

$$V_{FM} = 10Sin(5 * 10^7 t + 2Sin2500t)$$

Find- i) Carrier and Modulating frequencies
ii) Modulation Index and maximum deviation
iii) Power dissipated by this FM in 5Ω resistor
iv) Bandwidth of FM using Carlson rule

Q3 (a) Explain briefly:- **20**
i) Voltage Telemetry
ii) Current Telemetry
iii) Position Telemetry

(b) Explain PAM in detail and compare it with PWM.

Q4 (a) Explain in brief **20**
i) Quaternary Amplitude Modulation (QAM)
ii) Amplitude shift keying (ASK)

(b) Explain various communication modes as simplex, half duplex and duplex in details.

Q5 (a) Explain superheterodyne receiver in detail **20**
(b) Explain in detail errors associated with DM.

Q6 Write short note. **(Any Two)** **20**
a) OSI reference model
b) Pulse Position Modulation
c) Sampling techniques

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

N.B: 1. Question.No.1 is compulsory.
2. Attempt any three questions from remaining five questions.
3. Assume suitable data wherever necessary.

1 Attempt the following. **20**
a Explain electrodes used for PH measurement.
b Explain the working of any one type of dynamometer.
c Compare orifice and venturi meter.
d State piezo-resistive effect and piezo-electric effect.State their applications.

2 a What is ORP? Explain set up used for ORP measurement. **10**
b Draw and explain pressure measurement scheme using bourdon tube and LVDT. **10**

3 a Explain in details sutaible instrument used for calibration of pressure gauges. **10**
b State and derive Bernoullis equation **10**

4 a Classify flow measurement techniques .Explain the construction and working of mass flow meter. **10**
b Explain the need of temperature compensation for strain gauge and state applications of strain gauge. **10**

5 a A strain gauge bonded to a steel beam 0.1 m long and has a crossectional area 4 cm^2.Young's modulus for steel is 207 GN/m^2.The strain gauge has an unstrained resistance of 240Ω and gauge factor of 2.2.When a load is applied,the resistance of gauges changes by 0.013Ω.Calculate the change in length of the steel beam and an amount of force applied to the beam. **10**
b Explain with diagram working of Mcleod Gauge. **10**

6 Write a short note on the following:- **20**
a Torque measurement
b Hot Wire Annemometer
c Viscosity measurement