Q.P. Code :36275

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

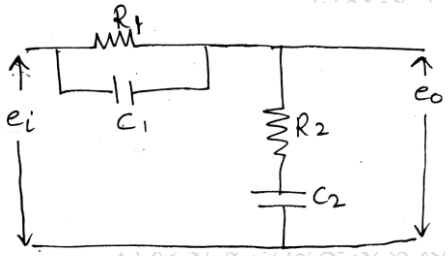
Please check whether you have got the right question paper.

N.B:
1. Question No. 1 is compulsory.
2. Attempt any three questions from remaining.
3. Assume suitable data if any required.
4. Figures to the right indicate full marks.

Q.1 Attempt any four from the following. 20

a) Explain the need of control in a system with an appropriate example. Also give the classification of control systems.

b) Find the transfer function of a given n/w.



c) Explain the effect of zeta on a second order system.

d) Distinguish between block diagram reduction technique and signal flow graph.

e) Explain the term analogous systems. What are the various analogous systems available?

f) Explain the nature of bode plots for poles at origin, simple pole and simple zero.

Q.2 a) The open loop transfer function of a certain control system is: 10

$$G(s)H(s) = \frac{10(1+T_1S)}{S^2(1+T_2S)}$$

Sketch the Nyquist Plot for

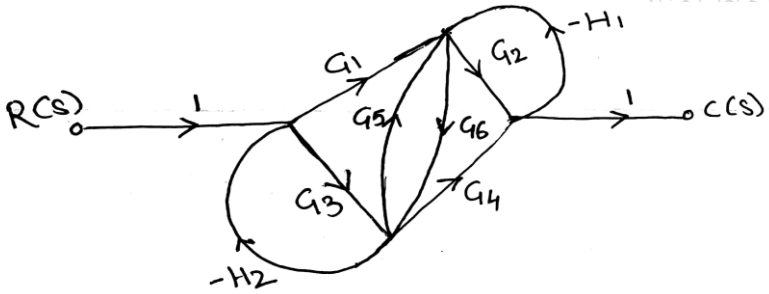
i) $T_1 > T_2$

ii) $T_1 < T_2$

iii) $T_2 = T_2$

Comment on stability

b) Determine the transfer function $\frac{C(S)}{R(S)}$ using Mason's gain formula for the signal flow graph shown below: 10



Q.3 a) Draw the root-locus of a system having 10

$$G(S)H(S) = \frac{K}{S(S^2 + 4S + 1)}$$

i) What is the range of damping factor for the dominant poles?

ii) What is the range of departure from complex open loop poles?

iii) For what values of K the system crosses imaginary axis?

b) Check the stability for the given characteristic equation: 10

$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$

Using Routh's criteria.

Q.4 a) A second order system is represented by the transfer function 10

$$\frac{Q(S)}{I(S)} = \frac{1}{Js^2 + fs + k}$$

A step input of 10Nm is applied to the system and the test results are,

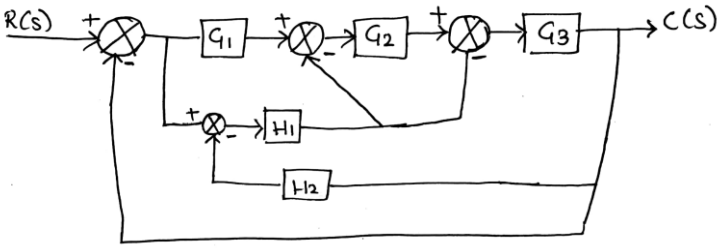
a) Maximum overshoot =6%

b) Time at peak overshoot = 1 sec

c) The steady state value of the output is 0.5 radians.

Determine the values of J, F and K

b) Find the transfer function 10



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Q.5 a) Sketch the Bode Plot for 10

$G(S)H(S) = \frac{K\,(1+0.2s)(1+0.025s)}{s^3(1+0.001s)(1+0.005s)}$

Show that system is conditionally stable. Find the range of K for which the system is stable.

b) Find K_p, K_v, K_a and steady state error for a system with open loop transfer function as: 10

$G(s)H(s) = \frac{10(s+2)(s+3)}{s(s+1)(s+5)(s+4)}$

input is $r(t) = 3 + t + t^2$

Q.6 a) Sketch the polar plot for the following transfer function. 10

$G(jw) = \frac{e^{-jwT}}{1+jwT}$

b) Define the following: 05

i) Gain crossover frequency
ii) Resonant frequency
iii) Phase margin
iv) Gain margin

c) How is the Gain margin and phase margin obtained from Bode Plot and what should be the right values of GM and PM for the system to be stable? 05

Q. P. Code: 24492

Duration: 3 Hours **Total Marks: 80**

N.B. : 1) Q.1. is compulsory.

2) Attempt any three from the remaining.

Q.1. a) Show that the set $\{e^x, xe^x, x^2e^x\}$ is linearly independent in $C^2(-\infty, \infty)$. (5)

b) Show that $\int_C \log z dz = 2\pi i$, where C is the unit circle in the z-plane. (5)

c) Find the projection of u=(3,1,3) along and perpendicular to v=(4,-2,2) (5)

d) Find the extremal of $\int_{x_1}^{x_2} \left(y^2 + y'^2 + 2ye^x\right) dx$ (5)

Q.2. a) If $A = \begin{bmatrix} 3/2 & 1/2 \\ 1/2 & 3/2 \end{bmatrix}$, find e^A (6)

b) Evaluate $\int_0^{\pi} \frac{d\theta}{3 + 2\cos\theta}$ (6)

c) Find the singular value decomposition of $\begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix}$ (8)

Q.3. a) Find the extremal of $\int_0^{\pi} \left(y'^2 - y^2\right) dx$ given $y(0) = 0, y(\pi) = 0$ (6)

b) Verify Cayley Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$ and hence find A^{-1} & A^4 (6)

c) Expand $f(x) = \frac{1}{(z-1)(z-2)}$ in the regions (i) $1 < |z-1| < 2$ (ii) $|z| < 1$ (8)

Q.4. a) Construct an orthonormal basis of R^3 using Gram Schmidt process to
S = {(3,1),(2,3)} (6)

b) Find the extremum of $\int_{x_0}^{x_1} (2xy + y''^2) dx$. (6)

c) Reduce the quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy + 4xz - 2zy$ to canonical form and hence, find its rank, index and signature and value class. (8)

Q.5. a) Using Residue theorem evaluate $\int_C \frac{z^2}{(z-1)^2(z+1)}dz$ where C is |z|=2. (6)

b) Find the linear transformation Y=AX which carries $X_1 = (1,0,1)', X_2 = (1,-1,1)', X_3 = (1,2,-1)'$ onto $Y_1 = (2,3,-1)', Y_2 = (3,0,-2)', Y_3 = (-2,7,1)'$ (6)

c) Check whether $V = \mathbb{R}^2$ is a vector space with respect to the operations

$(x_1,0)+(x_2,0) = (x_1+x_2,0); k(x_1,0) = (kx_1,0)$ (8)

Q.6.a) Obtain Taylor's series expansion for $f(x) = \frac{2z^3+1}{z(z+1)}$ about $z = i$ (6)

b) Let $W = span\left\{(0,1,0), \left(\frac{-4}{5},0,\frac{3}{5}\right)\right\}$, Express w =(1,2,3) in the form of $w = w_1 + w_2$ where

$w_1 \in W$ & $w_2 \in W^{\perp}$ (6)

c) Using Rayleigh- Ritz method, solve the boundary value problem $I = \int_0^1 \left(2xy - y^2 - y'^2\right)dx$;

given $y(0) = y(1) = 0$ (8)

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Q.P. Code: 25395

Three Hours **Total Marks: 80**

N.B. 1) Question No. 1 is compulsory.
2) Attempt any **THREE** questions from the remaining five questions.
3) Assume suitable data if necessary and mentioned it.

Q.1) Attempt any **Four** **20**

a) What are the various torques required in measuring instruments?
b) Define i) Back EMF, ii) Slip.
c) Why single phase induction motor is not self starting?
d) Derive the D.C. bridge balance equation.
e) Why DC series motor should not be started at NO LOAD condition?

Q.2) a) Explain the characteristics of DC shunt and DC series motor. **10**

b) With neat diagrams explain production of 'Rotating Magnetic Field' in 3 phase induction motor. **10**

Q.3) a) What is necessity of starter in DC motor? Explain 3 Point Starter. **10**

b) How the Kelvin Double Bridge is use as low value resistance measurement? **10**

Q.4) a) Write note on i) DVM and ii) DMM **10**

b) Explain construction and working of PMMC instruments **10**

Q.5) a) Star connected rotor of an 3 phase induction motor has a standstill impedance of (0.4 + j4) ohm/phase and rheostat impedance /phase is (6 + j2) ohm. The motor has an Induced emf of 80V between slip rings at standstill when connected to its normal supply voltage. Find rotor current i) at standstill with rheostat is in circuit.
ii) When slip rings are short circuited and motor is running with slip of 3%. **10**

b) Explain speed control methods of 3 phase induction motor**.** **10**

Q.6) a) Explain any one type of ADC **10**

b) Explain working of Q - meter. **10**

Q.P. Code: 25941

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from the remaining questions.
(3) Assume **suitable** data if **necessary**.

1. Attempt any **four** :- **20**

(a) Write note on PAM telemetry system.
(b) Compare the DSB and VSB techniques.
(c) Calculate the maximum bandwidth requirement for FM broadcast if the maximum deviation allowed is 75 kHz and the maximum modulation frequency allowed is 15 KHz.
(d) Explain the Elements of a communication system.
(e) Explain OSI reference model.

2. (a) Draw the block diagram of linear Delta Modulation system (transmitter and receiver) and explain the working with a suitable waveform. **10**
(b) List different methods of FM generation. Sketch the circuit and explain the principle of reactance modulator. Why is direct modulation not preferred for FM generation. **10**

3. (a) Define and describe pulse position modulation. Explain with waveforms how it is derived from PWM. **10**
(b) Explain the various communication modes as simplex, half duplex and duplex in detail. **10**

4. (a) Explain in brief :- **10**
(i) Amplitude Shift Keying (ASK)
(ii) Quaternary Phase Shift Keying (QPSK)
(b) Explain any one method of amplitude modulation in detail. **10**

5. (a) Explain with a neat block diagram Differential Pulse Code Modulation transmitter and receiver system. **10**
(b) With the help of neat sketches explain voltage, current and position telemetry Systems. **10**

6. Write Short notes on any **four**: - **20**
(a) SSB modulation
(b) Multiplexing techniques
(c) FM Noise Triangle
(d) Feedback Telemetry
(e) Adaptive Delta Modulation technique

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Q.P. Code :13546

[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 any four . 20
a What is ORP ? Explain set up used for ORP measurement.
b State the principle and materials of piezoelectric transducer.
c Explain solid flow meter.
d What is Vena contracta ? State and explain types of fluid flow.
e Explain different types of strain gauges.

2 a Draw and explain PH measurement setup along with its different electrodes. 10
b Derive the expression for volumetric flow rate (actual) flowing through a venturimeter. 10

3 a Draw and explain pressure measurement scheme using primary and secondary transducer. 10
b What is viscosity ? Mention different methods for measuring viscosity and explain any one of them. 10

4 a A simple U tube manometer containing mercury is connected to a pipe in which a fluid specific gravity 0.8 and having vacuum pressure is flowing.The other end of manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15 cm below. 10
b Explain with diagram working of Pirani Gauge. 10

5 a Classify flow measurement techniques .Explain with diagram ultrasonic flow meter. 10
b Derive the expression for gauge factor of strain gauge. Explain with suitable diagram the need of temperature compensation for strain gauge. 10

6 Write a short note on :- 20
a Variable area type flow meter
b Dynamometer
c Force measurement
