

May 2018

S.E. SEM IV (CBSSGS) INST.

Q. P. Code: 38142

A. M. W.
(3 Hours)

[Total Marks: 80]

N.B. : 1) Question No. 1 is Compulsory.

2) Answer any **THREE** questions from Q.2 to Q.6.

3) Figures to the right indicate full marks.

Q.1 (a) Verify Cauchy-Schwartz inequality for $u = (2, 1, -3)$ $v = (3, 4, -2)$. (5)

Also find angle between u & v .

(b) If $A = \begin{bmatrix} 2 & 0 & 0 \\ 5 & -1 & 0 \\ 2 & 3 & 3 \end{bmatrix}$ find Eigen values of $A^2 + 6A^{-1} - 3I$. (5)

(c) Evaluate $\int_C \frac{z^3 + 2z}{(z-1)^2} dz$ when C is $|z| = 2$. (5)

(d) Find the extremals of $\int_{x_1}^{x_2} (x + y')y' dx$. (5)

Q.2 (a) Verify Cayley-Hamilton theorem & hence find A^{-1} , where $A =$ (6)

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

(b) Find the extremal of $\int_{x_1}^{x_2} (2xy - y''^2) dx$. (6)

(c) Obtain Laurent's series expansion of $f(z) = \frac{z+2}{(z-3)(z-4)}$ about $z = 0$. (8)

Q.3 (a) Evaluate $\int_0^{1+i} z^2 dz$ along the parabola $x = y^2$. (6)

(b) Show that $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is derogatory & find its minimal polynomial. (6)

(c) Reduce the following quadratic form into canonical form & hence find it's rank, index, signature & value class (8)

$$x^2 + 2y^2 + 3z^2 + 2yz + 2xy - 2zx.$$

Q.4 (a) Find unit vector orthogonal to both $u = (-6, 4, 2)$ $v = (3, 1, 5)$. (6)

(b) Evaluate $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+1)(x^2+4)} dx$. (6)

(c) Show that matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ is diagonalizable. Also find its diagonal and transforming matrix. (8)

Q.5 (a) Using Rayleigh-Ritz method find solution for the extremal of the functional $\int_0^1 (2xy + y^2 - (y')^2) dx$ given $y(0) = y(1) = 0$. (6)

(b) Find an orthonormal basis for the subspace of \mathbb{R}^3 using Gram-Schmidt process where $s = \{(1, 0, 0), (3, 7, -2), (0, 4, 1)\}$ (6)

(c) Find the curve C of given length 'l' which encloses a maximum area. (8)

Q.6 (a) If $A = \begin{bmatrix} \pi & \frac{\pi}{4} \\ 0 & \frac{\pi}{2} \end{bmatrix}$ find $\cos A$. (6)

(b) Check whether the set of all pairs of real numbers of the form $(1, x)$ with operations (6)

$(1, a) + (1, b) = (1, a + b)$ and $k(1, a) = (1, ka)$ is a vector space, where k is real number.

(c) Find the singular value decomposition of $A = \begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$. (8)

S.E. SEM IV (CBSSGS) (INST) Rev. 2012. May 2018
 feedback Control System,
 [3 Hours]

QP Code : 24267

[Total Marks : 80]

- NB:** 1. Question No. 1 is **compulsory**.
 2. Solve any **three** questions from remaining questions.
 3. Assume suitable data if it is **required**.

1. Attempt any four.

20

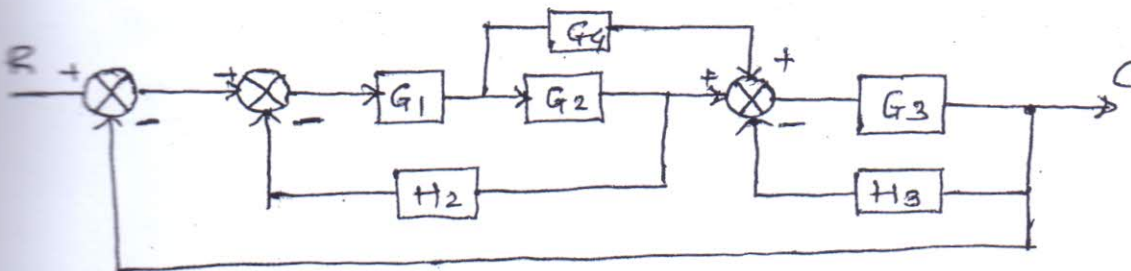
- Compare between open loop and closed loop system.
- Explain standard test signals.
- State the construction rules of root locus.
- Explain the term relative stability and conditional stability with suitable examples.
- Derive the transfer function of a simple closed loop system.

2. (a) Sketch the complete root locus for the following system having 10

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

(b) Derive the unit step response of second order underdamped system. 10

3. (a) Use block diagram reduction method to obtain the equivalent transfer function 10
 from R to C.



(b) Draw a bode diagram of a open loop transfer function $G(s)$. Determine GM, PM, 10

$$W_{gc}, W_{pc} \quad G(s) H(s) = \frac{100 (S + 4)}{S(S + 0.5)(S + 10)}$$

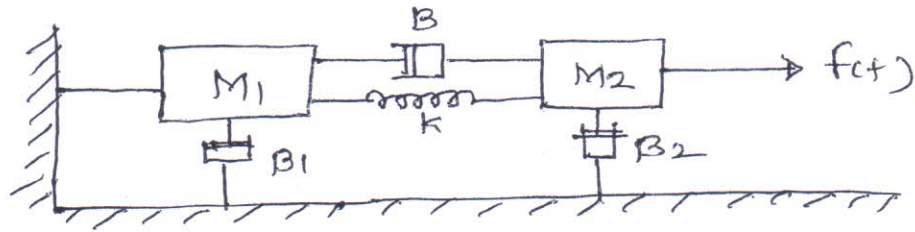
4. (a) Determine the stability of following open loop transfer function using Nyquist 10

$$\text{stability } G(s) H(s) = \frac{4 (S - 1)}{(S + 2)}$$

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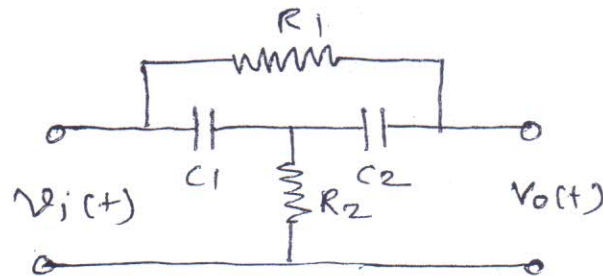
- (b) Draw the analogous electrical network based on (a) F-V (b) F-I

10



5. (a) Find the transfer function of following

5

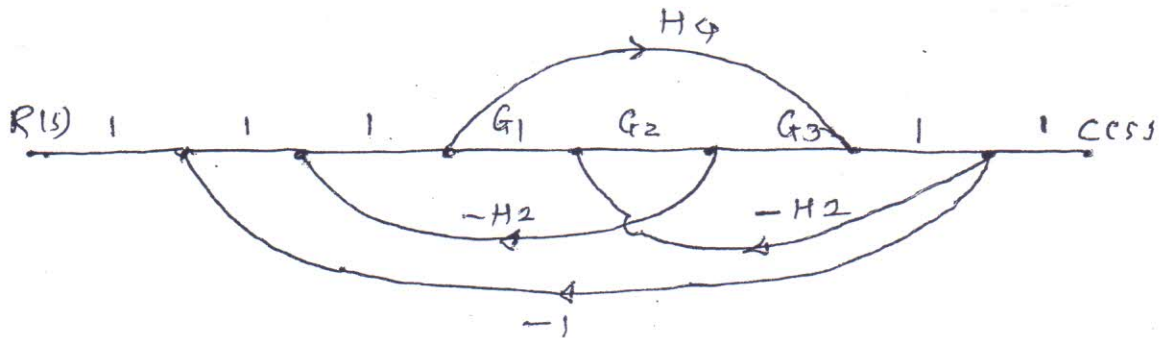


- (b) For the system with characteristic equation $S^6 + 4S^5 + 3S^4 - 16S^2 - 64S - 48 = 0$ Examine stability.

5

- (c) Find the transfer function by using Mason's Gain formula.

10



6. (a) The open loop transfer function of a unity feed back system is $G(s) = \frac{K}{S(1+TS)}$

10

For the system overshoot reduces from 0.6 to 0.2 due to change in K only. Show

that $\frac{T_{k1-1}}{T_{k2-1}} = 43.33$ where k_1 and k_2 values of K for 0.6 to 0.2.

- (b) What is the effect of adding zeros to the system.

5

- (c) Explain any one thermal system and also write different equation.

5

Duration: 3 Hrs

Marks: 80

- INSTRUCTIONS**
1. Question No-1 is **compulsory**.
 2. Attempt any **three** questions from the remaining questions.
 3. Assume **suitable** data wherever **necessary**.

Q-1. Solve Following. (Any four)**(4X5=20)**

- A. What are the different performance parameters of radio receivers?
Explain sensitivity and selectivity curve.
- B. What is frequency modulation? Draw and explain with suitable waveforms.
- C. Draw and explain slope overload error and granular noise.
- D. Describe block diagram of telemetry.
- E. Explain the applications of GPIB Bus.

Q-2. A. Explain adaptive delta modulation.**(10)****B. Describe the working of Super-heterodyne receiver with suitable waveforms.****(10)****Q-3. A. Draw and explain OSI reference model.****(10)****B. Compare amplitude and frequency modulation.****(10)****Q-4. A. Compare PAM, PWM and PPM.****(10)**

B. An AM transmitter supplies 10.5 kW of carrier power to a 750 Ohm load. It operates at a carrier frequency of 1.5MHz and is 90% modulated by a 5 kHz sine wave.

a. Sketch neatly labelled frequency spectrum.

b. Calculate sideband amplitude, total sideband power, total average power in amplitude modulated signal in watts.

(10)**Q-5. A. Draw and explain data transmission modes used in communication.****(10)**

B. What is SSB? How is it obtained? Explain the phase shift method of SSB generation.

(10)**Q-6. A. With a neat diagram explain the working of Armstrong method of FM generation.****(10)****B. Explain how TDM differs from FDM.****(10)**

[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. What is Vena contracta ? State and explain types of fluid flow.
 - c. What are the different methods of humidity measurement ? Explain any one of them.
 - d. Explain any one method for force measurement.
2. a. A strain gauge bonded to a steel beam 0.1 m long and has a crosssectional 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. What is ORP ? Explain set up used for ORP measurement. 10
3. a. Draw and explain pressure measurement scheme using LVDT. 10
- b. State and derive Bernoullis equation 10
4. a. A strain gauge bonded to a steel beam 0.1 m long and has a crosssectional 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
5. a. Classify flow measurement techniques .Explain the construction and working of electromagnetic flow meter. 10
- b. Explain the need of temperature compensation for strain gauge and state applications of strain gauge. 10
6. A. Compare orifice and venturi meter. 20
- B. What are the different methods of Viscosity measurement ? Explain any one of them.
