Instrumentation / Sem-IV - (CBSGS)
Applied Mathematics.
NOV. 2017

Q. P. Code: 24361

(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) If λ is eigen value of A and X is corresponding eigen vector of λ then show that λ^n is eigen value of A^n and corresponding eigen vector is X $(n>0)$. (5)

(b) Evaluate $\int_C \frac{z^2-2z+4}{z^2-1}dz$, where C is $|z-1|=1$. (5)

(c) Find the extremals of $\int_{x_1}^{x_2}(1+x^2y')y'dx$. (5)

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

Q.2

(a) Find eigen values and eigen vectors of A^2+2I where $A=\begin{bmatrix}8 & -8 & -2\\ 4 & -3 & -2\\ 3 & -4 & 1\end{bmatrix}$. (6)

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

(c) Obtain Laurent's series expansion of $f(z)=\frac{4z+3}{z^2-z-6}$ at $z=1$. (8)

Q.3 (a) Using Rayleigh-Ritz method find solution for the extremal of the functional $\int_0^1[(y')^2-2y-2xy]dx$ with $y(0)=2$ and $y(1)=1$. (6)

(b) Evaluate $\int_0^\infty \frac{1}{(x^2+1)(x^2+9)}dx$. (6)

(c) Show that matrix $A=\begin{bmatrix}-9 & 4 & 4\\ -8 & 3 & 4\\ -16 & 8 & 7\end{bmatrix}$ diagonalizable. Also find diagonal and transforming matrix. (8)

[Turnover]

Q.4

a) Verify Cayley Hamilton Theorem for $A=\begin{bmatrix}1 & 2 & -2\\ -1 & 3 & 0\\ 0 & -2 & 1\end{bmatrix}$. Also find A^{-1}. (6)

(b) Using Cauchy's Residue Theorem evaluate $\int_0^{2\pi}\frac{d\theta}{3+2\cos\theta}$. (6)

(c) Show that the extremal of isoperimetric problem $I=\int_{x_1}^{x_2}(y')^2\,dx$ subject to the condition $\int_{x_1}^{x_2} y\,dx=k$ is a parabola. (8)

Q.5 (a) Find 5^A where $A=\begin{bmatrix}3 & 1\\ 1 & 3\end{bmatrix}$. (6)

(b) Find an orthonormal basis for the subspace of R^3 by applying Gram-Schmidt process where $S=\{(1,1,1),(-1,1,0),(1,2,1)\}$ (6)

(c) Reduce the following quadratic form into canonical form and hence find its rank, index, signature and value class (8)
$Q=5x_1^2+26x_2^2+10x_3^2+6x_1x_2+4x_2x_3+14x_3x_1$.

Q.6 (a) State and prove Cauchy-Schwartz inequality. Hence show that for real values of a,b,θ $(a\cos\theta+b\sin\theta)^2\le a^2+b^2$. (6)

(b) Show that any plane through origin is a subspace of R^3. (6)

(c) Find the singular value decomposition of $A=\begin{bmatrix}4 & 4\\ -3 & 3\end{bmatrix}$. (8)

Instrumentation / Sem-IV - CBSGS / Electrical Technology & Instruments / Dec-2017

Q.P. Code: 25397

Duration: 3 Hours **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 **20**

a) Explain the types of DC motor

b) Explain the use of slip rings and brush assembly.

c) State the advantages of using the bridge circuits for the measurement.

d) What is sensitivity of voltmeters? Explain.

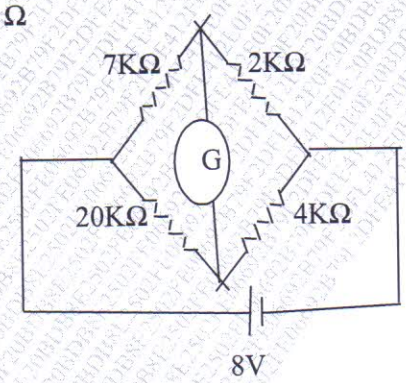
Q.2 a) A 230V, d.c. Shunt motor takes a no load current of 3A and runs at 1100 r.p.m. If the full load current is 41A, find the speed on Full load. Assume armature resistance as 0.25Ω and that of shunt field winding as 230 Ω. **10**

b) Explain the Torque slip characteristics of 3 phase induction motor. **10**

Q.3 a) Explain constructional details of PMMC instruments **10**

b) A bridge is shown in the figure. Calculate the current through Galvanometer. **10**

where Rg = 300 Ω



Q. 4) a) Explain how rotating magnetic field is produced in 3 phase induction motor **10**

b) Explain Kelvin's double bridge for low value resistance measurement? Derive the expression **10**

Q. 5) a) A 3phase, 4 pole, 50Hz induction motor has a star connected rotor. The voltage across each phase of the rotor at standstill is 121 V. The rotor resistance is 0.3Ω and standstill reactance is 0.8 Ω per phase. If in the running condition rotor current per phase is 15A, calculate the speed at which it is running. **10**

b) Explain losses in three phase induction motor **10**

Q.6) Write short notes on **(any two)** **20**

1) Star Delta Starter

2) Megger

3) Analog to Digital Converters

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INST / sem IV / CBSGS / NOV 2017 / Feedback Control System

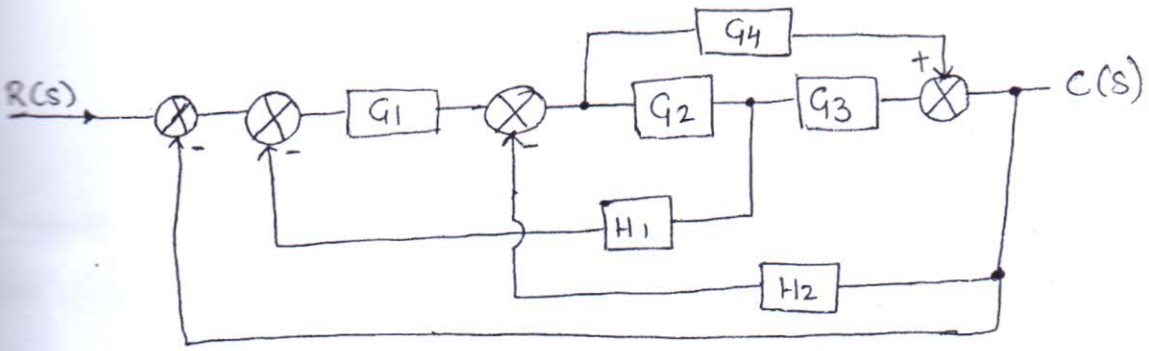
QP Code : 24265

[3 Hours] [Total Marks : 80]

N.B : 1. Question No. 1 is **compulsory.**
2. Solve any **three** questions from remaining questions.
3. Figures to the right indicate full marks.

1. Attempt any **five**. **20**
   (a) Explain the advantages and disadvantages of Routh's criteria.
   (b) Explain the effect of zeta on the second order system performance.
   (c) Compare open and closed loop system.
   (d) Explain the stability criteria on polar plot.
   (e) Compare time domain and frequency domain systems.
   (f) Explain how adding a pole to a function affects the root locus and its stability.

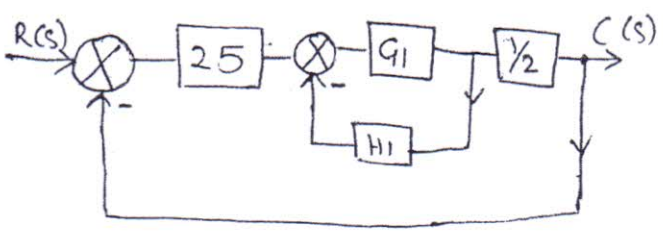
2. Answer the following **10**
   (a) Use block diagram reduction technique to obtain the transfer function of the following system.



   (b) For a system show determine type of the system, error coefficients and the error for the following inputs. **10**

   (i) $r(t) = 10$, (ii) $r(t) = 5t$, (iii) $r(t) = 10 + 5t + \frac{6}{2}t^2$ and

$$G1 = \frac{20}{(S+4)(S+10)}, \quad H1 = 10S$$



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3. Answer the following.

(a) Draw the root locus of the system whose characteristic equation is given by **10**

$S^3 + 9S^2 + Ks + K = 0$

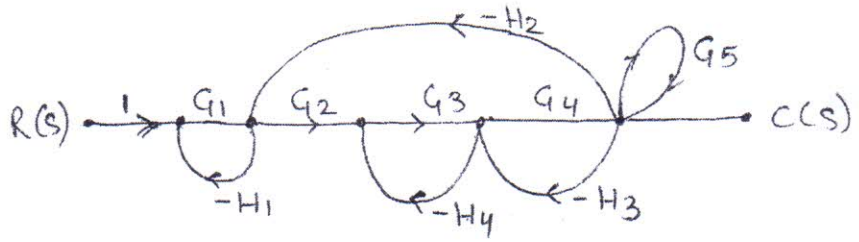
Comment on the stability.

(b) The open loop transfer function of a unity feed back system is $G(s) = \frac{K}{S(1+TS)}$. **10**

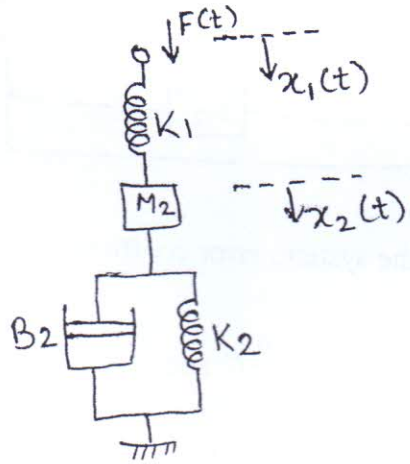
For the system overshoot reduces from 0·6 to 0·2 due to change in K only. Show that $\frac{Tk_1 - 1}{Tk_2 - 1} = 43{\cdot}33$ where k_1 and k_2 values of K for 0·6 to 0·2.

4. Answer the following :

(a) Use Mason's gain formula to obtain of the system shown below. **10**

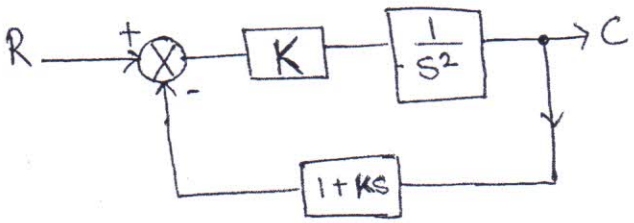


(b) Draw the equivalent mechanical system of the given system, write the equilibrium equations and obtain electrical analogous circuits using F-V and F-1 analogy. **10**



5. Answer the following :

(a) For the servomechanism shown below, determine the values of K and k, so that maximum overshoot for unit step input is 25% and peak time is 2 seconds. **10**



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(b) Draw Bode lot for a unity feedback system with $G(s) = \frac{K\,(S+0{\cdot}3)}{(S+4)\left(S^2+30s+20\right)}$ *where* $K = 2000$. Determine GM, PM, w_{pc}. Comment on stability. Determine the value of 'K' to obtain P.M. of 30. **10**

6. Answer the following :

(a) The closed loop transfer function of an antenna control system is given by- **10**

$$T(s) = \frac{K}{S^4 + 6S^3 + 30S^2 + 60S + K}$$

(i) determine the range in which K must lie for the system to be stable.

(ii) What should be the upper limit on K if all the poles of T(s) are required to be on the left of the line $\sigma = -1$.

(b) Draw the Nyquist plot and discuss the stability of the system with $G(s)\,H(s) = \frac{10}{2-S}$. **10**
