→ SE sem IV (CBSGS), Applied Mathematics IV, (ETRX EXT

QP Code : 348

(3 Hours) Total Marks: 8

N.B. (1) Question No.1 is compulsory.
(2) Attempt any three questions out of the remaining five questions.
(3) Figures to right indicate full marks.

Q1. (a) Evaluate $\int_c |z|\,dz$, where c is the left half of unit circle $|z|=1$ from $z=-i$ to $z=i$

(b) If λ is an Eigen value of the matrix A with corresponding Eigen vector X, prove th λ^n is an Eigen value of A^n with corresponding Eigen vector X.

(c) Find the extremal of $\int_{x_1}^{x_2} \frac{\sqrt{1+y'^2}}{x}\,dx$

(d) Find the unit vector orthogonal to both $[1,1,0]$ & $[0,1,1]$

Q2. (a) Find the curve on which the functional $\int_0^1 \left[y'^2 + 12xy\right]dx$ with $y(0)=0$ & $y(1)=1$ can be Extremised.

(b) Find the Eigen values and Eigen vectors for the matrix $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

(c) Obtain two distinct Laurent's series expansions of $f(z)=\frac{2z-3}{z^2-4z+3}$ in powers o $(z-4)$ indicating the region of convergence in each case

Q3. (a) If $A=\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$, find A^{50}

(b) Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)}\,dz$, where c is the circle $|z|=3$

(c) Using Rayleigh-Ritz method, find an approximate solution for the extremal of the functional $I(y)=\int_0^1 \left(y'^2 - 2y - 2xy\right)dx$ subject to $y(0)=2,\ y(1)=1$.

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Q4. (a) Find the vector orthogonal to both $[-6,4,2]$ & $[3,1,5]$

(b) Show that the matrix $A=\begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix}$ is derogatory and find its minimal polynomial.

(c) Reduce the matrix of the quadratic form $6x_1^2+3x_2^2+3x_3^2-4x_1x_2+4x_1x_3-2x_2$ to canonical form through congruent transformation and find its rank, signature, and val class.

Q5. (a) Find the extremal of $\int_{x_0}^{x_1}\left(2xy-y^{\cdot 2}\right)dx$

(b) Show that the set $W=\{[x,y,z]\mid y=x+z\}$ is a subspace of $\mathbf{R}^n$ under the usual addition and scalar multiplication.

(c) Show that the following matrix $A=\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is diagonalisable. Also find the diagonal form and a diagonalising matrix.

Q6. (a) If $f(a)=\int_c \frac{3z^2+7z+1}{z-a}\,dz$, where c is a circle $|z|=2$, find the values of

i) $f(-3)$, ii) $f(i)$, iii) $f'(1-i)$

(b) Evaluate $\int_0^{2\pi}\frac{d\theta}{13+5\sin\theta}$

(c) Verify Cayley-Hamilton theorem for the matrix A and hence find A^{-1} and A^4.

Where $A=\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

Sem IV (CBSGS), Feedback Control System, INST.

Q.P. Code : 3559

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

N.B. : (1) Question **No.1** is **Compulsory**
(2) Solve any **three** questions from remaining **five** questions.
(3) Assume suitable data if necessary.

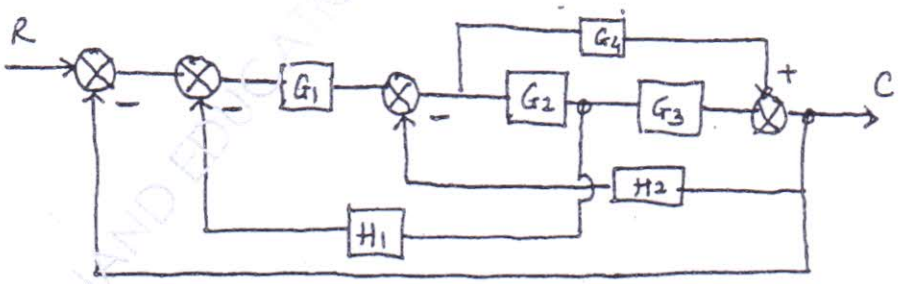
1. Attempt any four. **20**
   (a) Compare between open loop and closed loop system.
   (b) Derive the transfer function of simple closed loop system.
   (c) Explain relative stability analysis.
   (d) Sketch the nature of polar plot asymtotically for the open loop transfer function $G(S) = \frac{1}{S(S+2)}$
   (e) Derive the steady state error.

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

$$G(S)\ H(S) = \frac{k(s+5)}{s^2+4s+20}$$

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

3. (a) Sketch the signal flow graph of following block diagram. By using Mason's Gain formula find the transfer function of it. **10**



   (b) Draw a bode diagram of open loop transfer function G(S) Determine GM, PM, Wgc, Wpc. **10**

$$G(S) = \frac{800(S+2)}{S^2(S+10)(S+40)}$$

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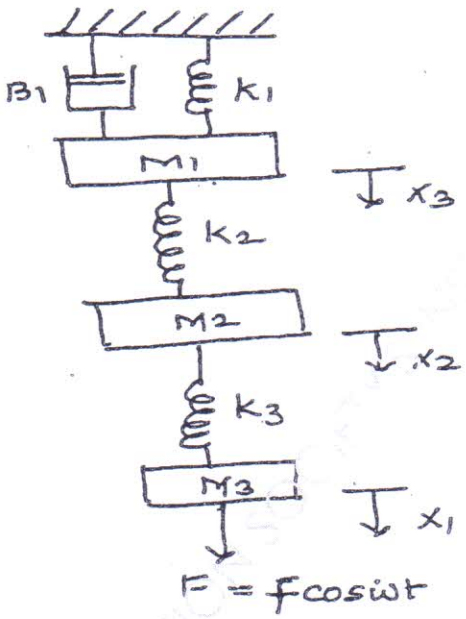
4. (a) Determine the stability of following open loop transfer function using Nyquist stability. 10

$$G(s)\,H(s) = \frac{K(S+3)}{S(S-1)}$$

(b) Draw the analogous electrical network based on (a) F-V (b) F-I 10



5. (a) The open loop transfer function of unity feed back system is 10

$G(S)\,\frac{K}{S(1+Ts)}$. For the system overshoot reduces from 0.6 to 0.2 due to change in K only. Show that $\frac{Tk_1 - 1}{Tk_2 - 1} = 43.33$ where K_1 and K_2 are values of K for 0.6 to 0.2

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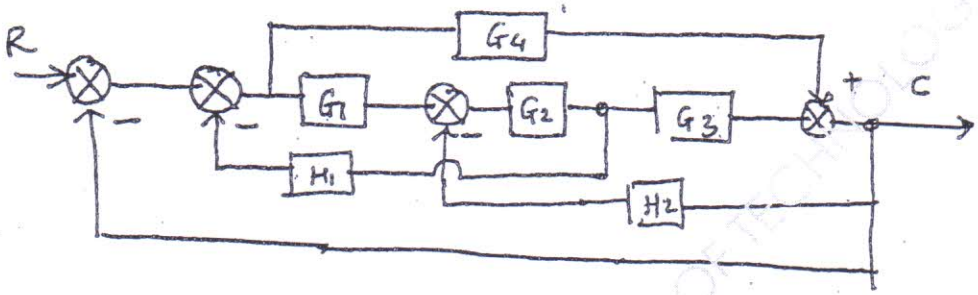
(b) Use a block diagram reduction rules to obtain the transfer function of the block diagram shown below. 10

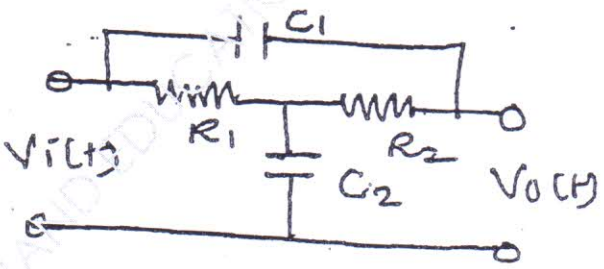


6. Solve the following.

(a) For a system with characteristic equation, 20
$F(s) = S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2 = 0$
examine stability.

(b) Write the short note on standard signals.

(c) Find the transfer function of following.



(d) What are the advantages and features of transfer function.

Sem IV (INSI) (BSCS) - (Communication ...

QP Code : **3567**

(3 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**.

1. Attempt any **five** :– 20
   (a) Discuss the need of modulation in communication systems
   (b) Write note on RF telemetry.
   (c) Derive Friis formula for total noise figure of cascaded amplifier.
   (d) Why SSB is not preferred for transmission of good quality of signal ?
   (e) Write note on OSI reference model.
   (f) Compare TDM and FDM

2. (a) Derive an expression for an AM signal. Also derive the power relationship. 10
   (b) A 20 MHz carrier is modulated by 600Hz audio sine wave. If the carrier voltage is 5V and maximum deviation is 15 KHz. Write the equation for this frequency modulated wave. If the modulating frequency is now changed to 1·5 KHz and carrier voltage is changed to 10V, all else remaining constant, write the equation for this wave, calculate the power dissipated across 100Ω resistor by both F.M. waves. 10

3. (a) Explain Indirect method of FM Generation. 10
   (b) Explain any one method of amplitude demodulation in detail. 10

4. (a) Explain briefly :–
      (i) Phase shift keying (PSK) 10
      (ii) Binary phase shift keying (BPSK)
   (b) Explain PCM transmitter and Receiver system. 10

5. (a) Explain in brief :– 10
      (i) Pulse width modulation
      (ii) Pulse position modulation
   (b) Explain in brief : 10
      (i) Frequency shift keying
      (ii) Amplitude shift keying.

6. (a) With the help of neat sketches explain voltage, current and position telemetry systems. 10
   (b) Explain the various communication modes as simplex, half duplex, duplex in detail. 10

Sem IV (CBSGS), Electrical Technology and Instrum... / INST

QP Code : 3564

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

4) Figure to the right indicates full marks

Q.1 Solve **any four** **20**

a) What is the difference between a generator and a motor?

b) Explain power flow diagram for an Induction Motor

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

d) Explain the applications of CRO

e) Explain the basic principle of ADC.

Q.2 a) Two series motors run at a speed of 700 r.p.m. and 750 r.p.m respectively, when taking 70A at 500 V. The terminal resistance of each motor is 0.5Ω. Calculate the speed of the combination when connected in series and coupled mechanically. The combination is taking 70A at 500V supply. **10**

b) Derive the following torque ratios in terms of slip and rotor parameters.

i) $\frac{T_{st}}{T_{ni}}$ ii) $\frac{T_{FL}}{T_{ni}}$ **10**

Q.3 a) Explain how rotating magnetic field is produced in 3Φ induction 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 the basic a.c. bridge **10**

b) What is Hay's bridge? Derive the balance equation. When it is preferred over Maxwell bridge? **10**

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Q. 5) (a) A 3Φ, 12 pole, induction motor has rotor resistance of 0.15Ω and standstill reactance of 0.25Ω per phase . On full Load it is running at a speed of 480 r.p.m. The rotor induced e.m.f. per phase at standstill is observed to be 32V. Calculate i) Starting Torque ii) Full load torque iii) maximum Torque iv)Speed at maximum torque. **10**

(b) Explain variable frequency drive. List its applications **10**

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

1) A. C. voltmeter

2) Shaded pole induction motor

3) Applications of a.c. potentiometer.

S.E. Sem. IV (CBSGS) INST - Transducers - II

QP Code : 3570

(3 Hours) Total Marks-80

N.B: 1. Question No. 1 is Compulsory.
2. Attempt **any Three** from the remaining questions.
3. Assume suitable data wherever necessary.
4. Figure to right indicate full marks.

1. Attempt **any Four** questions (20)
   a) Derive the equation for gauge factor in strain gauge.
   b) Compare Orifice and Venturimeter.
   c) State the materials and their properties of-
      i) elastic element ii) Piezoelectric transducer .
   d) Explain any one method for Torque measurement.
   e) Explain how PH meter is calibrated.

2. a) A rotameter is calibrated for metering a liquid density of 1000 kg/m^3 and a flow range scale ranging from 1 to 100 liters/meter. It is intended to use this meter for measuring the flow of gas of density 1.25 kg/cm^3 with a flow range of 20 to 2000 lit/min. Determine the density of new float, if the original one has a density of 2000 kg/m^3. The shape and volume of both float assume to be same. (10)
   b) Explain the construction and working of Electromagnetic flow meter. State its advantages and limitations. (10)

3. a) Explain with diagram conductivity measurement set up (10)
   b) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of manometer gives the reading of 50 cm of mercury. Find the rate of flow of oil of specific gravity 0.9 when the coefficient of dischage of meter is 0.64. (10)

4. a) Explain construction and working of Dead weight pressure gauge tester. (10)
   b) Draw and explain pressure measurement using Bourden tube and LVDT. (10)

5. a) Explain working of variable area type flowmeter. (10)
   b) A resistance strain gauge with a gauge factor of 2 is commented to a steel member, which is subjected to a strain of 1×10^{-10}. If the original resistance value of gauge is 130Ω. Calculate output voltage if half bridge and quarter bridge is used. Assume current through the gauge is 25 mA. (10)

6. Write a short note on- (20)
   a) Hot wire Anemometer.
   b) Force balance type pressure measurement.
   c) Mc lead gauge.
   d) Capillary tube viscometer.