EXTC & INST

SE | Sem-IV | EXTC & INST | CBGS | App. Maths-IV | May 14

QP Code : **NP-19713**

(3 Hours) [Total Marks : 80

N.B.: (1) Quesions No. **1** is **compulsory**.
(2) Solve any **three** from the **remaining**.

1. (a) Prove that Eigen values of a hermitian matrix are real. 5

(b) Evaluate $\oint_c \frac{e^{kz}}{z} dz$ over the circle $|z|=1$ and k is real. Hence prove that $\int_0^{\pi} e^{k\cos\theta} \cos(k\sin\theta)\, d\theta = 2\pi$. 5

(c) Find the extremal of $\int_{x_2}^{x_1} (16y^2 - (y'')^2 + x^2) dx$ 5

(d) Find a vector orthogonal to both u = (–6, 4, 2) and v = (3, 1, 5). 5

2. (a) Find the curve y = f(x) for which $\int_{x_1}^{x_2} y\sqrt{1+(y')^2}\, dx$ is minimum subject to the constraint $\int_{x_1}^{x_2} \sqrt{1+(y')^2}\, dx = \ell$. 6

(b) Find eigen values and eigen vectors of the matrix $A = \begin{bmatrix} -2 & 5 & 4 \\ 5 & 7 & 5 \\ 4 & 5 & -2 \end{bmatrix}$ 6

(c) Obtain Taylor's series and two distinct Laurent's series expansion of $f(z) = \frac{z^2-1}{z^2+5z+6}$ about z = 0, indicating region of covergence. 8

3. (a) State Cayley-Hamilton Theroern, hence deduce that $A^8 = 625I$, where $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ 6

(b) Using calculus of Residues, prove that $\int_0^{2\pi} e^{\cos\theta} \cos(\sin\theta - n\theta)\, d\theta = \frac{2\pi}{n!}$. 6

(c) Find the plane curve of fixed perimeter and maximum area. 8

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Con. 11555-14.

4. (a) State Cauchy-Schwartz inequality and hence show that $\left(x^2+y^2+z^2\right)^{1/2} \geq \frac{1}{13}\left(3x+4y+12z\right)$, x, y, z are positive. 6

(b) Reduce the quadratic form $Q = x^2+y^2-2z^2-4xy-2yz+10xz$ to Canonical form using congruent transformation. 6

(c) (i) If $A=\begin{bmatrix} \pi/2 & 3\pi/2 \\ \pi & \pi \end{bmatrix}$, find Sin A. 4

(ii) Show that the matrix $A=\begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$ is Derogatory. 4

5. (a) Using Rayleigh - Ritz method, find an appropriate solution for the extremal of the functional $I[y(x)]=\int_0^1 \left[xy+\frac{1}{2}\left(y^1\right)^2 \right] dx$ subject to $y(0) = y(1) = 0$. 6

(b) Find an orthonormal basis of the following subspace of R^3, $S = \{ [1,2,0]\ [0,3,1] \}$. 6

(c) Is the matrix $A=\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ diagonalizable. If so find diagonal form and transforming matrix. 8

6. (a) Find f(3), f'(1 + i), f"(1 – i), if $f(a)=\oint_c \frac{3z^2+11z+7}{z-a} dz$, c: $|z| = 2$. 6

(b) Evaluate $\int_0^\infty \frac{x^3 \sin x}{\left(x^2+a^2\right)^2}$ using contour integration. 6

(c) Find the singular value decomposition of the matrix $A=\begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 1 & -1 \end{bmatrix}$. 8

Sem IV / Communication System / Inst / 04-06-14

QP Code : NP-19800

(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. (a) Derive the power relationship in AM signal. 5
(b) Explain pre-emphasis and De-emphasis in FM systems. 5
(c) Compare PAM, PWM and PPM. 5
(d) Explain the linear delta modulation system. What are the errors associated with DM. 5

2. (a) Explain the phase shift method of SSB generation with neat block diagram. 10

(b) A transistor class c amplifier has maximum permissible collector dissipation of 20 watts and collector efficiency of 75%. If it is collector modulated to a depth of 90% then calculate, 5
(i) Maximum unmodulated carrier power
(ii) The power in sidebands.

(c) Compare wideband FM and narrowband FM. 5

3. (a) Explain any one method of F.M. generation with necessary equations and Waveforms. 10

(b) When the modulating frequency in an FM system is 400 HZ and the modulating voltage is 2.4v, the modulation index is 60. Calculate the maximum deviation. What is the modulation index when the modulating frequency is reduced to 250 HZ and the modulating voltage is simultaneously raised to 3.3 V? 10

4. (a) Explain in brief :— 10
(i) Quaternary Amplitude modulation (QAM)
(ii) Frequency shift keying (FSK)

(b) (i) Explain the various noises that affect communication. 6
(ii) An amplifier operating over a frequency range from 17 to 19 MHZ has a input resistance of 5 kΩ. What is the rms thermal noise voltage at the input of this amplifier? Assume the operating temperature as 17°c. 4

5. (a) What is Telemetry? Explain voltage telemetry and current telemetry with the help of a neat diagram. 10

(b) Explain the various communication modes as simplex, half duplex, duplex in detail. 10

6. Write short notes on any **four** of the following :— 20
   (a) Multiplexing techniques
   (b) QPSK transmitter and receiver
   (c) PCM transmission system
   (d) Independent sideband transmission
   (e) FM Noise triangle
   (f) OSI reference model.

INST

SE| IV |Inst| ETI | May 14

QP Code : **NP-19764**

(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 **required** and mentioned it.
(4) **Figures** to **right** indicate **full** marks.

1. Attempt any **four** questions from the following :—
   (a) Derive the emf equation of dc generator. 5
   (b) Explain speed control of dc shunt motor by means of variation of flux. 5
   (c) Define slip. Why an induction motor cannot run at synchronous speed. 5
   (d) Show that the driving torque in a moving iron instrument is given by — 5

   $T_d = \frac{1}{2} i^2 \frac{dL}{d\theta}$, where the symbols have their usual meaning.

   (e) What is swamping resistance ? 5

2. (a) Explain how a rotating magnetic field is produced in 3 φ induction motor. 10
   (b) A 440 volts, 4 pole, 3 φ, 50 Hz induction motor develops 25 H.P. inclusive of mechanical losses, when running at 440 rpm. The motor p.f. is 0·82 lagging, calculate : 10
      (i) slip
      (ii) rotor copper loss
      (iii) total input if stator losses are 1800 W,
      (iv) line current
      (v) overall efficiency if mechanical losses are 750 W.

3. (a) Explain double field revolving theory of 1 φ induction motor. 10
   (b) Explain starting methods of 3 φ inductions motor. 10

4. (a) Explain torque slip characteristics of 3 φ induction motor. 10
   (b) Derive torque equation of dc motor and draw Ta & N, Ta & Ia characteristics for dc shunt and series motor. 10

5. (a) A 250 V, dc shunt motor on no load runs at speed of 1000 rpm and takes a current of 5 A. The armature and shunt field resistances are 0·2 Ω and 250 Ω respectively. Calculate the speed when the motor is on load and is taking a current of 50 A. Assume that the armature reaction weakens the field by 3%. 10
   (b) Write short note on Megger. 10

6. (a) Explain the working of 1 φ induction type energy meter with neat diagram and derive the torque equation. 10
   (b) The four arms of balanced bridge network are made up as 10
      AB - Resistance 50 Ω in series with inductance 0·1 H.
      BC - Resistance 100 Ω
      CD - Unknown resistance in parallel with unknown capacitance
      DA - Resistance 1000 Ω
   The supply frequency 50 Hz maintained between A and C and a variation galvanometer is connected between B and D. Find unknown resistance and capacitance and draw phasor diagram.

Con. 12221-14.

SE(IV) / Inst. / 19-05-14

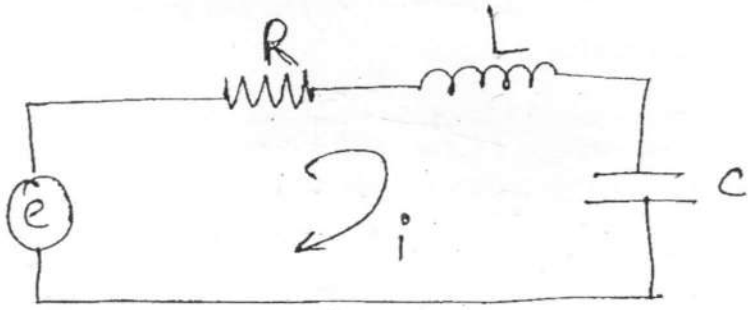
Feedback Control System.

QP Code : NP-19685

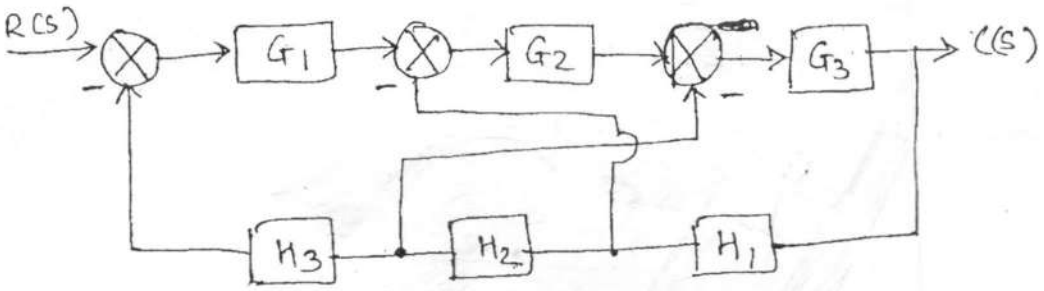
(3 Hours) **[Total Marks : 80**

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

1. Attempt any **four** :– 20
   (a) Compare : open loop and close loop system with examples.
   (b) Define gain and phase margin of system also comment on stability of system based on the gain and phase margin.
   (c) Explain Force voltage and force current analogy.
   (d) Explain stable, unstable, critically stable and relatively stable system.
   (e) Find out transfer function of given network.



2. (a) Using block diagram reduction technique find the close loop transfer of the system, 10



   (b) Test the stability for following :– 10
      (i) $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 15 = 0$.
      (ii) $S^8 + 5S^6 + 2S^4 + 3S^2 + 1 = 0$.

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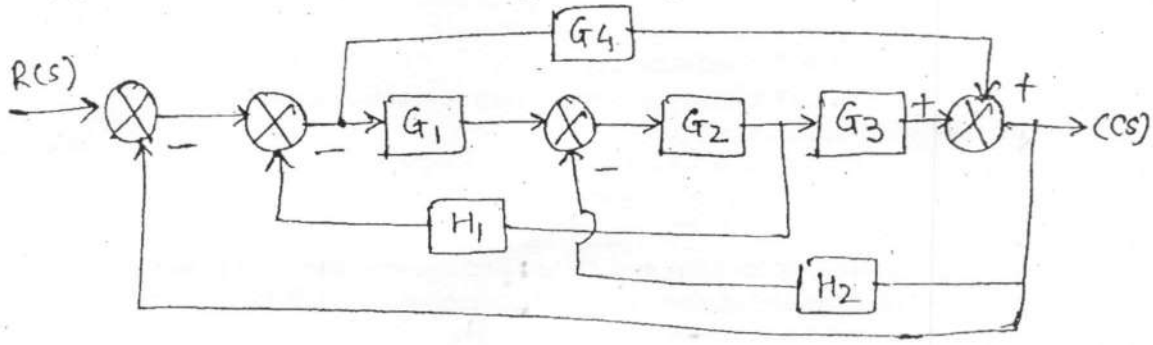
3. (a) Find the transfer function using mason's gain formula. 10



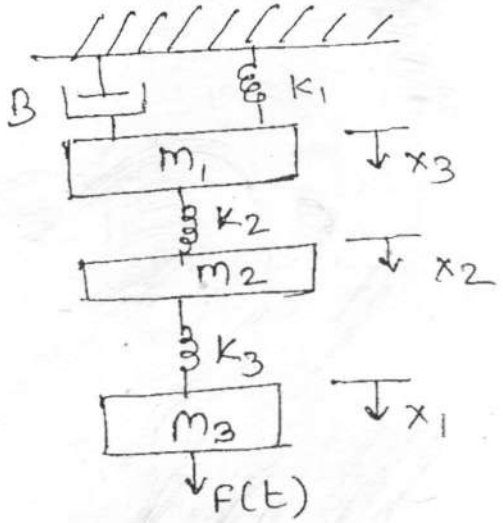
(b) For a system having $G(s) = \frac{15}{(s+1)(s+3)}$; $H(s) = 1$. 10

Determine :

(i) Characteristics equation
(ii) Wn and ξ
(iii) Time at which first undershoot will occur
(iv) Time period of oscillations
(v) No. of cycles output will per form, before settling down.

4. (a) Draw the root locus plot for a system with $G(s)\,H(s) = \frac{k}{s(s+2)(s+6)(s+10)}$. 10

(b) Draw the equivalent mechanical system of the given system. Write the set of equlibrium equation for it and obtain electrical analogy circuit using (i) F-V analogy (ii) F-I analogy. 10



5. (a) For a perticular unity feedback system $G(s) = \frac{242\,(s+5)}{s(s+1)\,(s^2+5s+121)}$ sketch the bode plot. Find W_{gc} and W_{pc}, GM, PM, commenton stability. 10

(b) For unity feedback system having openloop transfer function – 10

$$G(s) = \frac{14(s+3)}{s(s+5)\,(s^2+2s+2)}$$

Determine :–

(i) Type and order of the system

(ii) Error coefficient

(iii) Steady state-error for input $1+4t+\frac{t^2}{2}$.

6. (a) Sketch the polar plot and discuss the stability of the system reporesented 10

$$G(s)\cdot H(s) = \frac{k}{s(s+1)\,(s+5)}$$

(b) State and explain nyquist stblity theorem and its criteria. 10

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Sem-IV / Transducers-II / INST / 10-6-14

QP Code :NP-19839

(3 Hours) [Total Marks :80

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

1. Attempt the followings:— 20
   (a) Classify different types of density measurement methods along with their principles.
   (b) What is ORP? why it is require to measure.
   (c) Explain "Vena contract" & draw its pressure flow diagram.
   (d) Draw neat sketch of pressure sensing elastic elements.

2. (a) Derive Bernouli's Equation. 10
   (b) Give types of manometers. Derive final expressions for each type of manometer for differential pressure measurement (any **four**)

3. (a) Explain with diagram Electromagnetic flow meter. Also give its applications. 10
   (b) In the resistive strain Gauge; strain gauge resistance $R_1=R_2=R_3=R_4=120\Omega$, Eb=9V. If the output voltage of the bridge is 20 mV, find the value of force applied to the strip. Thicknes "t" of the strip = 1mm, width "b" of strip =10mm. Young's modulus E of strip material = $8x10^{10}$ N/m^2. Length L=50 mm.
   Strain at root of cantilever = 6 PL/Eb t^2. Assume output resistance as infinity. Gauge factor = 2.4.
   10

4. (a) Explain the following with respect to strain gauge:—
   (i) Working principle
   (ii) Materials
   (iii) Types
   (iv) Applications
   (b) Draw neat sketch of Pirani Gauge & explain the same with applications. 10

5. (a) State the working principles of following for pressure measurement along with their characteristics. 10
   (i) Piezo-electric transducer
   (ii) LVDT
   (iii) Capacitive transducer
   (iv) Strain gauge.
   (b) A nozzle in fitted in horizontal pipe diameter 15 cm, carrying gas of density 1.15 Kg/m^3, for the purpose of flow measurement. The differential pressure head indicated by a U-tube manometer containing oil of specific gravity 0.8 is 10 cm. If the coefficient of discharge & diameter of nozzle are 0.8 & 5 cm, respectively. Determine the flow of gas through the nozzle flowmeter. 10

6. Write a short note on:— 20
   (a) Viscosity measurement.
   (b) Positive Displacement flow meter.

Con. 13344-14.