SE (ETRX) App. maths (old)
Sem - III

(OLD COURSE) **QP Code :12207**

(3 Hours) **[Total Marks : 100**

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

1. (a) Determine the constants a, b, c, d if $f(z)=x^2+2axy+by^2+i\left(cx^2+2dxy+y^2\right)$ is analytic 5
(b) Find the Fourier series expansion for $f(x)=x \quad in \quad (0,2\pi)$ 5
(c) Find the Laplace transform of $\cos 2t \cdot \cosh 2t$ 5
(d) If $\{f(k)\}=\{2^0,2^1,2^3,\ldots\ldots\}$ find $Z\{f(k)\}$. 5

2. (a) Evaluate $\int_0^\infty e^{-3t}\cos^3 t\,dt$ 6

(b) Find the Fourier series expansion for $f(x)=\left(\frac{\pi-x}{2}\right)^2$ in the interval 6

$0\le x\le 2\pi$ & $f(x+2\pi)=f(x)$ Also deduce that $\frac{\pi^2}{6}=\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}\ldots\ldots$

(c) For what value of λ the equations 8
$x+y+z=1, \quad x+2y+4z=\lambda, \; x+4y+10z=\lambda^2$ have a solution and solve them completely in each case

3. (a) Find Laplace Transform of following 6

i) $\int_0^t \frac{1-e^{-au}}{u}\,du$ ii) $\frac{1}{t}\cdot e^{-t}\sin t.$

(b) Reduce the following matrices to normal form and find its rank. 6

$$\begin{bmatrix} 1 & -1 & 3 & 6 \\ 1 & 3 & -3 & -4 \\ 5 & 3 & 3 & 11 \end{bmatrix}$$

(b) Evaluate by Green's theorem $\int_C \left[\left(3x^2-8y^2\right)dx+\left(4y-6xy\right)dy\right]$ where C is 8
the boundary of the region bounded by $y=\sqrt{x}, \quad y=x^2$.

4. (a) Obtain complex form of Fourier series for the functions $f(x)=e^{ax} \; in \quad (0,a)$ 6

(b) Express the following matrix as the sum of symmetric and skew-symmetric 6
matrices. $\begin{bmatrix} 0 & 5 & -3 \\ 1 & 1 & 1 \\ 4 & 5 & 9 \end{bmatrix}$

(c) Find inverse Laplace Transform of following 8

i) $\log\left(1+\frac{a^2}{s^2}\right)$ ii) $\frac{3s+7}{s^2-2s-3}$

5. (a) Prove that $u = e^x \cos y + x^3 - 3xy^2$ is harmonic. 6

(b) For the matrix A verify that A (adj A) $= |A| I$ where $A = \begin{bmatrix} 2 & 1 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$. 6

(c) Show that the set of functions $\cos x, \cos 2x, \cos 3x, \cdots\cdots$ is a set of orthogonal functions over $[-\pi, \pi]$. Hence construct a set of orthonormal functions 8

6. (a) Obtain half-range sine series for $f(x) = x(2-x)$ *in* $0 < x < 2$ 6

(b) Find the bilinear transformation under which 1, i, -1 from the z-plane are mapped onto 0, 1, ∞ of w-plane. 6

(d) Use Stoke's theorem to evaluate $\int_C \overline{F}.d\overline{r}$ where $\overline{F} = x^2\, i + xy\, j$ and C is the boundary of the rectangle $x = 0, y = 0, x = a, y = b$.

7. (a) Find inverse Z-transform of $F(z) = \frac{z}{(z-1)(z-2)}, \ |z| > 2$ 6

(b) Find the analytic function $f(z) = u + iv$ in terms of z if $u - v = e^x(\cos y - \sin y)$ 6

(c) Using laplace transform solve the following differential equation with given condition. $(D^2 - 2D + 1)x = e^t$, *with* $x = 2, Dx = -1$, *at* $t = 0$ 8

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S.E Sem III (OLD)

(OLD COURSE) **QP Code :12237**

(3 Hours) [Total Marks : 100

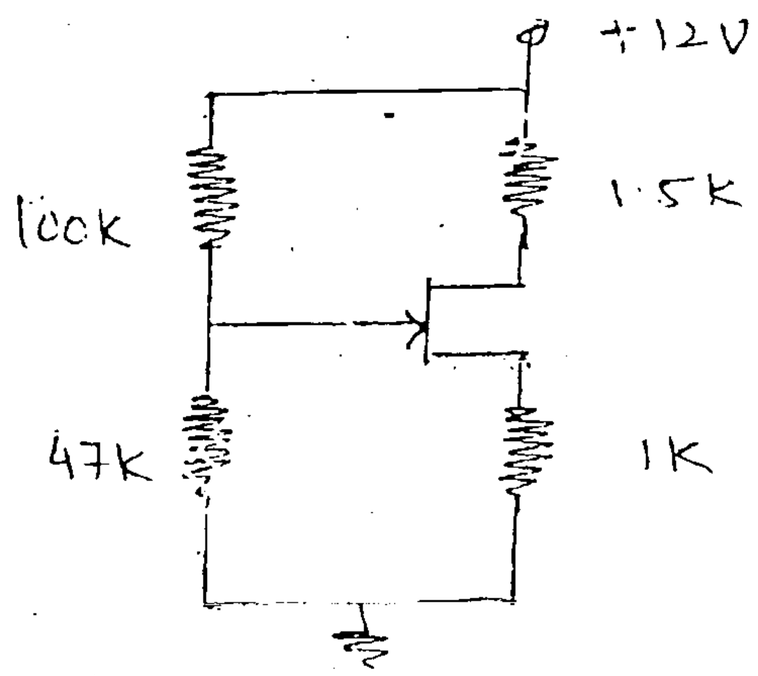
N.B : (1) Question **No. 1** is **compulsory**.
(2) Answer any **four** out of remaining **six** questions.
(3) **Assume** any suitable **data** wherever required.

1. (a) What is maximum reverse voltage (PIV) across a diode. 5
   (i) HWR
   (ii) FWR
   (iii) Bridge rectifier
   (b) Derive condition for zero temperature drift blasing of FET. 5
   (c) Derive the relationship between α and β. 5
   (d) Draw positive clamper circuit with I/P and output waveform. 5

2. (a) Explain the concept of thermal runaway in BJT. 10
   (b) Draw bridge rectifier explain its operation with input an i output waveform. 10

3. (a) Explain the different biasing techniques for EMOSFET. 10
   (b) Draw voltage doubler circuit and explain it's working with equivalent diagram.. 10

4. (a) Explain with neat diagram zener as regulator. 10
   (b) Obtain the values of V_{GSQ}, I_{DQ}, and V_{DSQ} for voltage divider bias circuit shown in fig. 10

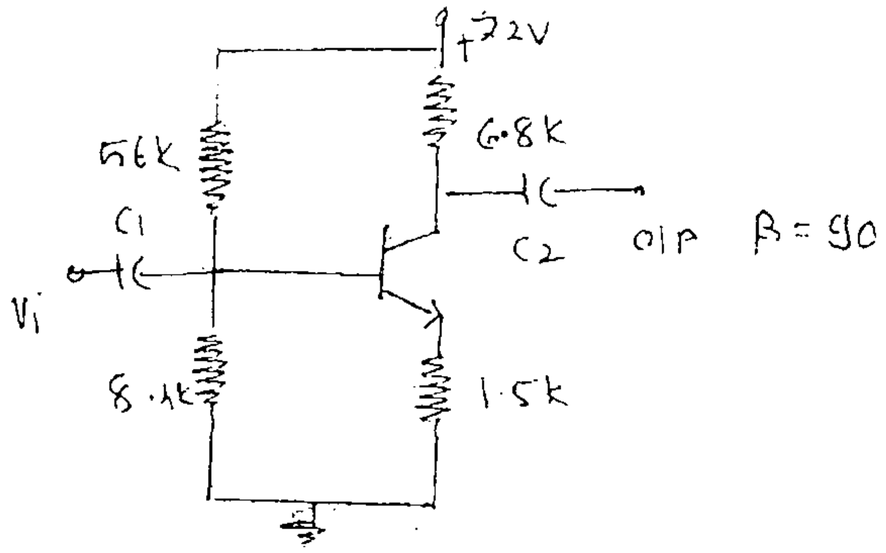


$I_{DSS} = 6mA$

$V_P = -4V$

5. (a) Explain construction and characteristics of E-MOSFET.

(b) For circuit shown in fig. Use re-model to determine input and output impedances, voltage gain and current gain. **10**



6. Design a single stage CE amplifier suitable for low frequencies upto 10 KHz to give voltage gain |AV| =70 and output voltage 4.5 volts employing transistor type BC 147A. Calculate the expected |AV| and maximum output voltage with negligible distortion that can be obtained from designed circuit. **10**

7. Write a short note on (any **three**) :— **20**
   (a) Photodiode and its application
   (b) BJT as a switch
   (c) Input protection circuit of MOSFET
   (d) LC filter.

S E Sem 3 (Old) ... 12/12/14.
Control System.

QP Code : **12346**

(OLD COURSE)

(3 Hours) **[Total Marks : 100**

N.B : (1) Question **1** is **compulsory**.
(2) Answer any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data if **necessary.**
(4) **Figure** to the **right** indicate **full** marks.

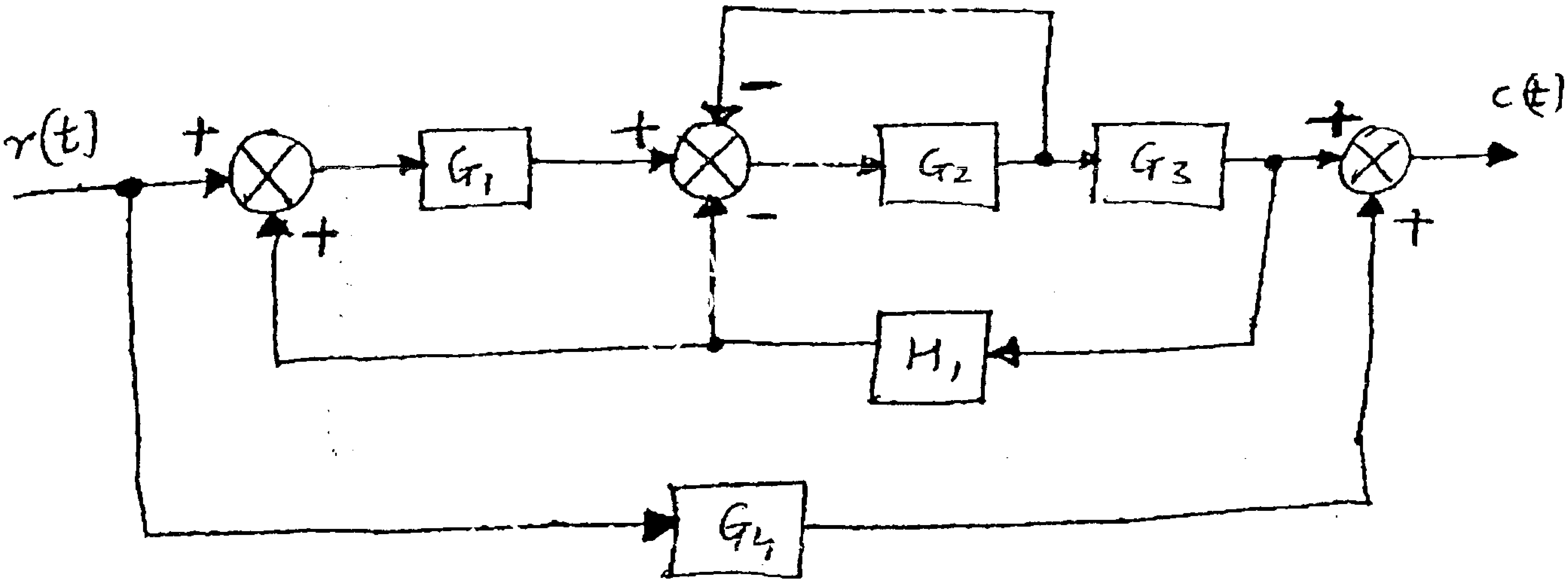
1. (a) Explain how to find G-M. and P.M. from polar plots. **20**
(b) Explain any five rules of root locus plot.
(c) Explain principle of argument.
(d) Derive an expression for peak time of a standard second order control system

2. (a) Obtain Bode plot– **10**

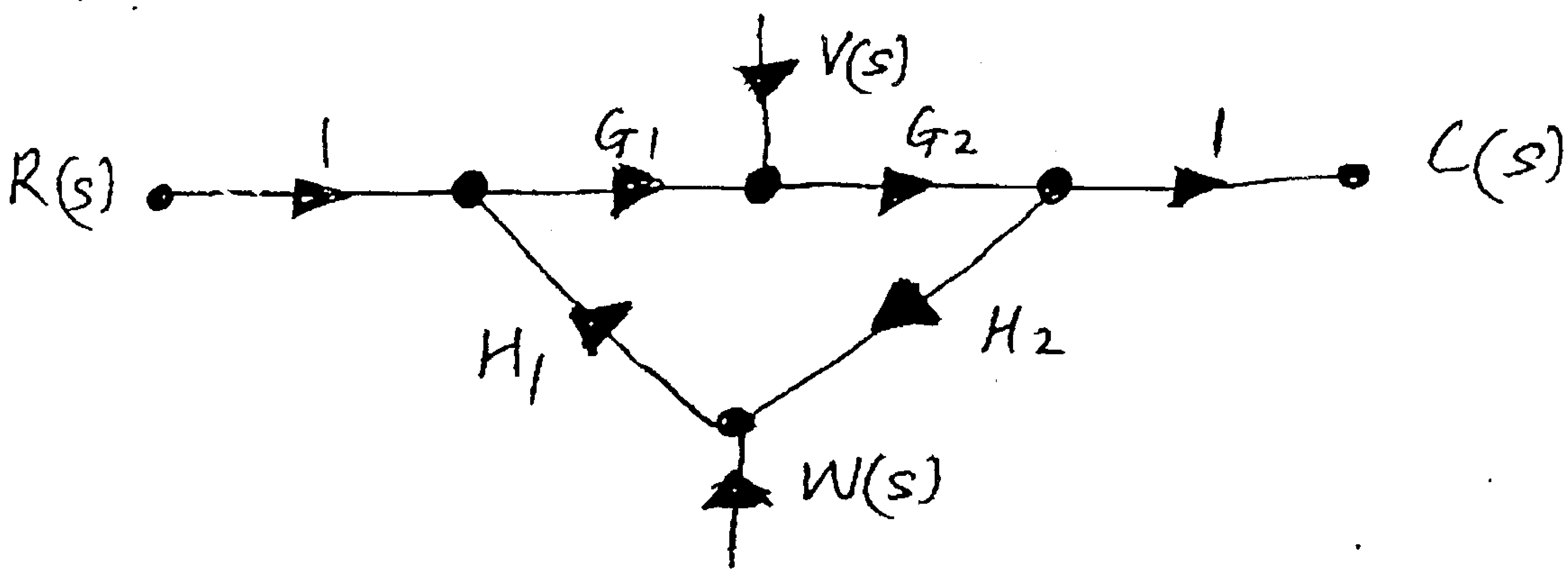
$$G(s)\ H(s) = \frac{10[1-s]}{s(s+2)(s^2+2s+25)}$$

Hence obtain G.M. and P.M.

(b) Obtain overall Transfer function. **10**



3. (a) Find the value of C(s) using Mason's gain formula. **10**



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(b) The error response 10

$e(t) = 2{\cdot}5\ e^{-10t} \sin\left[50t + 50°\right]$ for a unit step input.

Find natural frequency, damped frequency, damping ratio and comment on the type of damping.

4. (a) Plot root locus plot – 12

$$G(s)\ H(s) = \frac{K}{s(s+4)\left(s^2+4s+20\right)}.$$

(b) Find K marginal and frequency of oscillation given. 8

$$1 + \frac{K}{s(s^2+2s+2)\left(s^2+6s+10\right)} = 0$$

5. (a) Derive an expression for Bandwidth of a standard second order control system. 8

(b) Obtain $G(s)\ H(s) = \frac{6}{s(s+1)(s+2)}$. 12

Find W_{pc} and G. M.

If '6' is replaced by K then using polar plot find range of K for stability and K marginal.

6. (a) $G(s)\ H(s) = \frac{K}{s(s+3)\left(s^2+s+1\right)}$. 8

Determine the value of K that will cause sustained oscillations in the closed Loop system.

Also find the frequency of oscillation.

(b) Obtain Nyquist plot– 12

(i) $G(s)\,H(s) = \frac{10}{s(s-6)}$

(ii) $G(s)\,H(s) = \frac{4(s\ 1)}{s(s-2)}$

Hence comment on stability and number of Pole's on R.H.S. of jw axis.

7. Write short notes on the following : 20

(a) Synchro transmitter's.

(b) Static error constants

(c) Compensation techniques.

(d) Stepper Motor's,
