ROLL NO. _____

DipIETE – ET (NEW SCHEME) – Code: DE65

Subject: CONTROL ENGINEERING

Time: 3 Hours **Max. Marks: 100**

DECEMBER 2011

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. The principle of homogeneity and superposition is applied to

(A) Linear time-variant system
(B) Non-linear time-variant system.
(C) Linear time-invariant system.
(D) Non-linear time invariant system

b. The Laplace transform of a unit step function is

(A) $\frac{1}{s}$ **(B)** S
(C) S^2 **(D)** s^3

c. The system with pole-zero plot in Fig.1 has

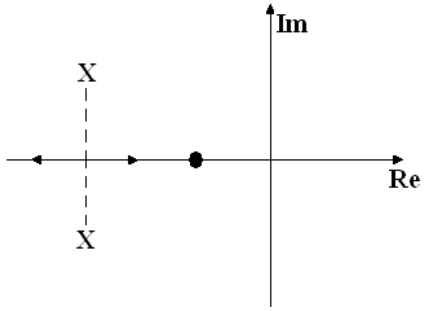

Fig. 1

(A) Two complex zeros and a pole **(B)** Two complex poles and a zero
(C) two real poles **(D)** Two complex poles

d. Synchros are generally used as transmitters of

(A) Data logger **(B)** Digital data
(C) Angular data **(D)** All of these

e. With a negative feedback, the system stability

(A) Improves **(B)** Deteriorates
(C) Remains unaltered **(D)** None of these

f. The number of individual loops in the signal flow graph as in Fig. 2

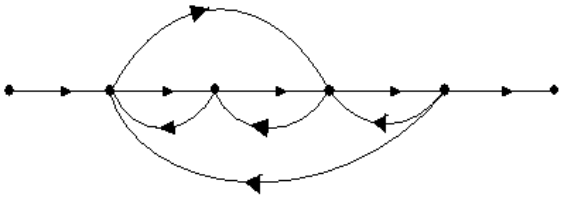

Fig. 2

(A) 5 **(B)** 6
(C) 3 **(D)** 7

g. A system with $G(S)H(S)= \frac{5}{s^2}$ of type

(A) 0 **(B)** 1
(C) 2 **(D)** 3

h. The transient response of a system with feedback compared to that of without feedback

(A) Decays more quickly **(B)** Decays slowly
(C) Rises at a lower rate **(D)** Rises at a faster rate

i. Differentiators are not used in a system due to

(A) large noise and saturation in the amplifier
(B) Large resistance and inductance
(C) Huge size and cost
(D) None of these

j. If some pole of a system lies on the imaginary axis, the system is

(A) Absolutely stable **(B)** Conditionally stable
(C) marginally stable **(D)** Unstable

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Distinguish between open loop and closed loop control systems. **(4)**

b. Define a control system with a neat sketch; explain the operation of a servomechanism. **(8)**

c. Find f(t) if $F(S)= \frac{(S+3)}{S(S+1)(S+2)}$ **(4)**

Q.3 a. Find the Laplace transform of y in the equation $\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 2y = 8$, assuming initial condition to be zero. **(4)**

b. Discuss the standard test signals with neat sketches. **(6)**

c. Determine the range of values of K so that the system having the following characteristic equation will be stable: $S(S^2+2S+3)(S+2)+K=0$ **(6)**

Q.4 a. Define transfer function. Also deduce the relation between impulse response and the transfer function. **(5)**

b. If the transfer function of a system and applied input to it are e^{-3t} and e^{-4t} respectively. Find the response of the system. **(5)**

c. Reduce the block diagram in Fig. 3 to its simplest possible form and hence obtain it's closed loop transfer function. **(6)**

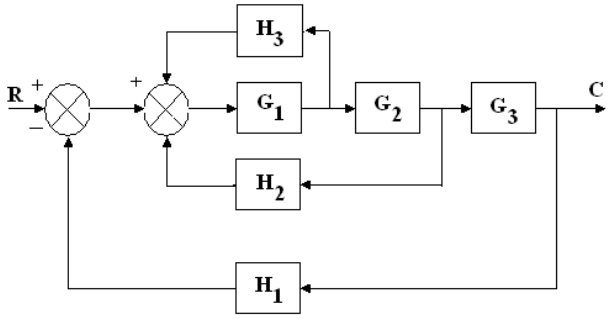

Fig. 3

Q.5 a. Discuss the different types of nodes, loops and paths in a signal flow graph. **(6)**

b. Find the transfer function of the network as shown in Fig. 4 using Mason's gain formula. **(10)**

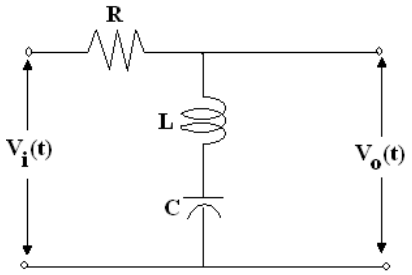

Fig. 4

Q.6 a. Define the sensitivity of a control system. Find the sensitivity of the overall transfer function. **(8)**

b. Deduce the expression for the steady state error for a closed loop system for step and ramp inputs. **(8)**

Q.7 Construct Bode plots for the frequency response function

$$GH(j\omega) = \frac{2}{j\omega(1 + j\omega/2)(1 + j\omega/5)}$$ **(16)**

Q.8 a. List five advantages of Nyquist plot. **(5)**

b. For $G(S)H(S) = \frac{1}{[S(S+2)]}$, draw the Nyquist plot and decide the stability. **(11)**

Q.9 a. Discuss the advantages and limitations of frequency domain analysis **(8)**

b. Find the root locus of the unity feedback system having $G(S) = \frac{K}{S+1}$ **(8)**