C 58258 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2009

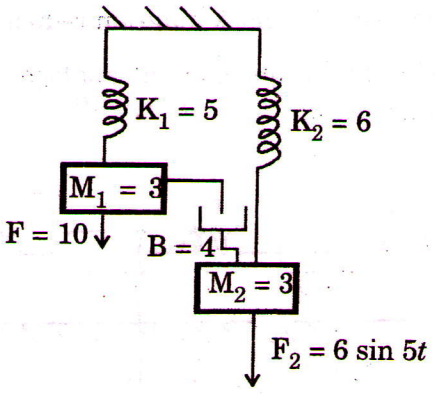
EE 2K 402/PTEE 2K 305—LINEAR SYSTEM ANALYSIS

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

I. (a) Write down the differential equations for mechanical translation system given below :



(b) List out various types of non-linearities with suitable sketches.

(c) Distinguish between active and passive elements.

(d) State d'Alemberts principle.

(e) Draw time response of a second order under damped and undamped systems when subjected to unit step input.

(f) Define steady state error.

(g) Write the state space model for a series RLC circuit in terms of charges and fluxes.

(h) State BIBO stability criterion.

(8 × 5 = 40 marks)

Turn over

Part B

II. (a) Obtain the transfer function of the network given below using signal flow graph technique.

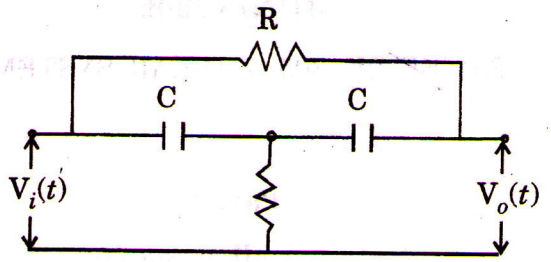
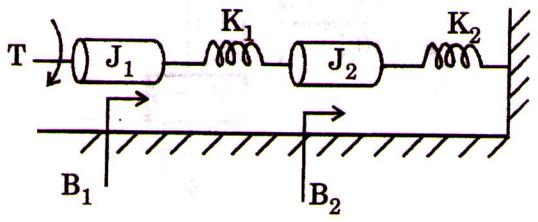


Fig. 2.

Or

(b) Explain various rules used for block diagram reduction.

III. (a) Draw Torque-voltage and Torque-current analogous circuits for the mechanical rotational system given below in Fig. (3).



Or

(b) Derive transfer function of a thermal system.

IV. (a) Derive the static error coefficients for a type 0, type 1 and type 2 system whose open loop transfer function is in standard time constant forms.

(b) A second order system has transfer function $\frac{Q(s)}{I(s)} = \frac{1}{Js^2 + Bs + K}$. A step input of 10 Nm is applied to the system and the test results are maximum overshoot = 6 %, time at peak overshoot = 1 sec and steady state value of output 0.5 radians. Determine the values of J, B and K.

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V. (a) (i) Discuss stability based on location of closed loop poles is S-plane. Also comment on time response.

(7 marks)

(ii) Find range of K for which the characteristic equation is stable $s^4 + 5s^3 + 8s^2 + 6s + K = 0$ use Routh Hurwitz criterion.

(8 marks)

Or

(b) Find solution for the state space model defined by :

$$\begin{bmatrix} x_1^0 \\ x_2^0 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t)$$

with $x(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $u(t)$ as step function.

(15 marks)

[4 × 15 = 60 marks]