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B. TECH
(SEM IV) THEORY EXAMINATION 2017-18
ELECTRICAL MACHINES & AUTOMATIC CONTROL

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

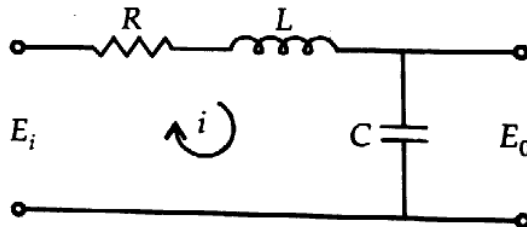
- a) What is the difference between an ideal and practical transformer.
- b) Why a stator is necessary for a DC motor?
- c) What is meant by an induction motor?
- d) What are the essential elements for generating EMF in alternators?
- e) Explain the linear and non-linear systems.
- f) Define the dynamic and static system.
- g) Define: (i) Delay Time, (ii) Rise Time, (iii) Peak Time, (iv) Settling Time.
- h) Explain the concept of stability.
- i) Explain the phase margin.
- j) Define static velocity error constant.

SECTION B

2. Attempt any three of the following:

10 x 3 = 30

- a) Explain how EMF induced in a winding of transformer is related to the number of turns and the flux density in the core.
- b) Bring out clearly, with the help of neat sketches the differences between the 3-phase slip ring induction motor and the three-phase squirrel cage induction motor.
- c) Determine the transfer function of the electrical network shown in figure



- d) When a second order control system is subjected to a unit step input, the values of $\xi=0.5$ and $\omega_n=6$ rad/sec. Determine the rise time, peak time, settling time and peak overshoot.
- e) The forward path transfer function of a unity feedback system is given by $G(s) = \frac{K}{s(s+4)(s+8)}$. Sketch the root locus as K varies from zero to infinity.

SECTION C

3. Attempt any one part of the following: 10 x 1 = 10

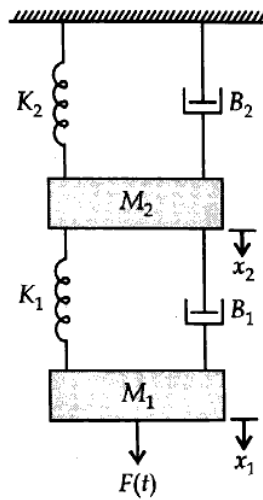
- a) Explain the principle of operation of DC motors. What is back EMF in DC motors? What is its effect?
- b) What are the losses taking place in a DC machine and how do they vary with load current and derive the condition for maximum efficiency?

4. Attempt any one part of the following: 10 x 1 = 10

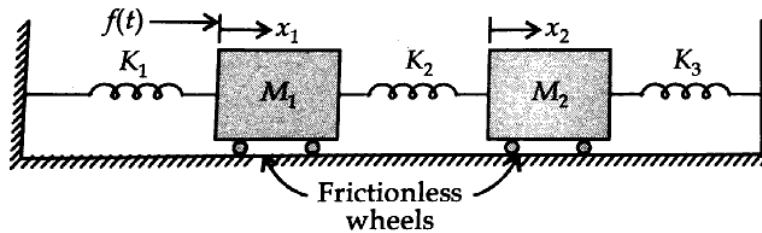
- a) Why rotating field system is preferred over the stationary field system in a synchronous generator?
- b) Define form factor, chording factor and breadth factor. Also derive emf equation of an alternator.

5. Attempt any one part of the following: 10 x 1 = 10

- a) Draw the free body diagram and write the differential equation of the given system shown in figure.

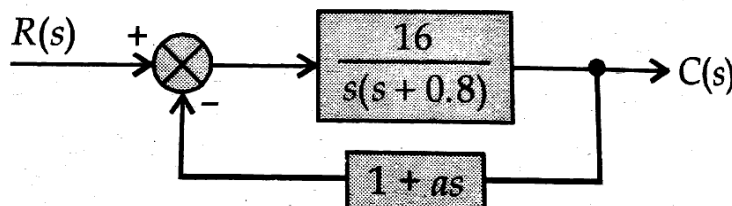


- b) Draw the mechanical equivalent network, write the system equations and find $F(s)/X_2(s)$ of the system shown in figure.



6. Attempt any one part of the following: 10 x 1 = 10

- a) Consider the system as shown in figure. Determine the value of 'a' such that the damping ratio is 0.5. Also obtain the values of rise time and maximum overshoot M_p in its step response.



- b) Find the dynamic error coefficients of the unity feedback system whose forward transfer function is $G(s) = \frac{200}{s(s+5)}$. Find the steady state error of the system for the input $4t^2$.

7. Attempt any one part of the following:

10 x 1 = 10

- a) Explain the effects of addition of poles and zeros on root locus in detail.
b) Discuss the Bode plot in detail with an example.