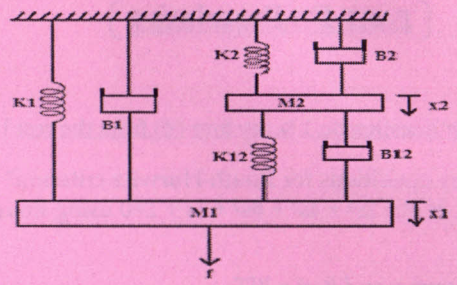
8. a. Find the system equations of the mechanical system as shown. 6+4=10



b. For a system having $G(s).H(s) = \frac{k(s+4)}{s(s^3+5s^2+6s)}$, find the range of K for a stable system.

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REV-00
MSE/05/10

2018/06

M.Sc. ELECTRONICS
FOURTH SEMESTER
POWER ELECTRONICS & CONTROL SYSTEM
MSE-401

(Use separate answer scripts for Objective & Descriptive)

Duration : 3 hrs. Full Marks : 70

[PART-A : Objective]

Time : 20 min. Marks : 20

Choose the correct answer from the following: *1x20=20*

1. In a thyristor, when anode is positive w.r.t. cathode, the blocked PN junction of the SCR is:
   a. J_1 b. J_2 c. J_3 d. J_4

2. The transfer function of a system is defined as the ratio of its output to input in:
   a. Fourier transform b. Laplace transform
   c. Z-transform d. None of the above

3. The motion of mechanical elements can be described as:
   a. Purely rotational. b. Purely translational.
   c. Rotational or translational or combination of both. d. None of these.

4. The minimum firing angle of a three phase full wave controlled rectifier is:
   a. 60° b. 30° c. 45° d. 90°

5. For a system having roots -5 and -2, the system is:
   a. Stable b. Unstable
   c. Marginally stable d. All of these

6. A chopper converts:
   a. Constant voltage dc into ac and then into variable voltage dc.
   b. Constant voltage dc into variable voltage dc directly.
   c. Converts ac to dc.
   d. None of these.

7. Three blocks with gains of 5, 6 and 4 are connected in cascade. The total gain of the arrangement is:
   a. 44 b. 150 c. 120 d. 70

8. The impulse response of a system $G(s)=\frac{2}{(s+1)(s+3)}$ is given by:
   a. $e^{-t} + e^{-2t}$ b. $e^{-t} + e^{-3t}$
   c. $e^{-3t} + e^{-t}$ d. $e^{-t} - e^{-3t}$

9. The minimum gate current which can turn on SCR is called:
   a. Trigger current b. Holding current
   c. Junction current d. Break-over current

10. A voltage V_{BB} is applied across the terminals of a UJT. The emitter voltage at peak point is:
   a. ηV_{BB} b. $(\eta+1)V_{BB}$
   c. $\eta V_{BB} + V_A$ d. V_A

11. The transfer function is defined for:
   a. Linear & time-variant system b. Linear & time-invariant system
   c. Non-linear & time-variant system d. All of these

12. Knowledge of the transfer function of a system is necessary for the calculation of:
   a. Time constant b. Output for a given input
   c. Order of the system d. None of these

13. The area under a unit impulse function is:
   a. Infinity b. Zero
   c. Unity d. None of these

14. Choose the correct statement:
   a. MOSFET is an uncontrolled device.
   b. MOSFET is a voltage controlled device.
   c. MOSFET is a current controlled device.
   d. MOSFET is a temperature controlled device.

15. Three blocks with gains 4, 6 and 8 are connected in parallel. The total gain of the arrangement is
   a. 18 b. 32 c. 196 d. 52

16. A power transistor is a:
   a. three layer, three junction device b. three layer, two junction device
   c. two layer, one junction device d. four layer, three junction device

17. Choose the false statement.
   a. SCR is a bidirectional device.
   b. SCR is a controlled device.
   c. In SCR the gate is the controlling terminal.
   d. SCR are used for high-power applications.

18. For a single phase thyristor circuit with resistive load & firing angle α, the conduction angle can be given by:
   a. $\pi+\alpha$ b. $2\pi+\alpha$ c. $\pi-\alpha$ d. α

19. The characteristic equation of a system is given as $3s^4+10s^3+5s^2+2=0$. This system is:
   a. Stable b. Marginally stable
   c. Unstable d. Linear

20. If the system has non-repeated poles on the $j\omega$ axis, the system is:
   a. Stable b. Unstable
   c. Marginally stable d. Conditionally stable

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PART-B : Descriptive

Time : 2 hrs. 40 min. **Marks : 50**

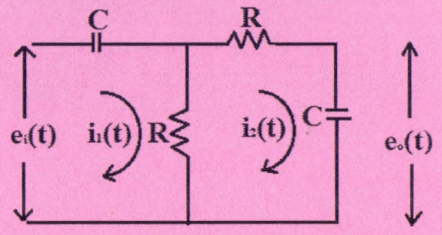
[Answer question no.1 & any four (4) from the rest]

1. a. What are the necessary conditions for Routh-Hurwitz criterion? 5+5=10
   b. Examine the stability of $s^5 + 2s^4 + 4s^3 + 8s^2 + 3s + 1=0$ using Routh's criteria.

2. a. Find the relation between α and β of a BJT. 3+7=10
   b. Elaborate the operation of MOS controlled thyristor with a schematic diagram.

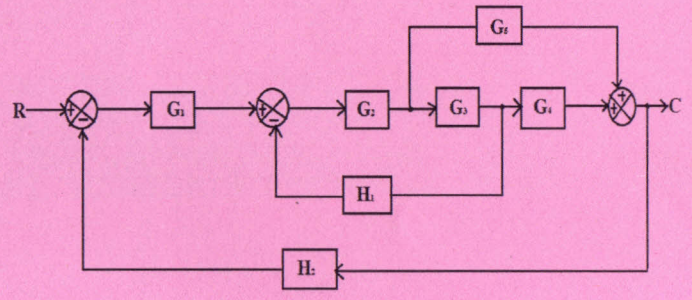
3. Find the ripple factor for a three phase half wave controlled rectifier with resistive load. Draw the voltage waveforms. 10

4. Find the transfer function of the given electrical network. 10



5. a. Explain the working of a single phase bridge inverter. 4+6=10
   b. Explain turn-on and turn-off process of GTO with necessary diagram.

6. Obtain the transfer function of the system by using block diagram reduction technique. 10



7. Write short notes on *any two* of the following: 5+5=10
   a. Linear Variable Differential Transformer (LVDT).
   b. Liquid cooling system.
   c. Hydroelectric power station.
   d. N-channel MOSFET.