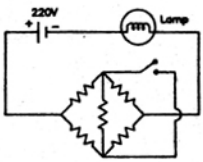
GATE : 1992

EE : Electrical Engineering

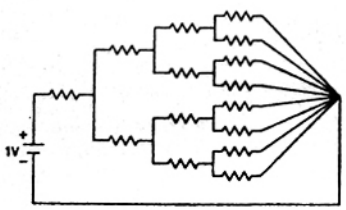
PART - A

1.1. All resistances in the circuit in Figure are of R ohms each. The switch is initially open. What happens to the lamp's intensity when the switch is closed ?



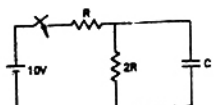
(*a*) increases
(*b*) decreases
(*c*) remains the same
(*d*) answer depends on the value of R

1.2. All the resistances in Figure are 1Ω each. The value of current 'I' is



(*a*) $\frac{1}{15}$ A (*b*) $\frac{2}{15}$ A
(*c*) $\frac{4}{15}$ A (*d*) $\frac{8}{15}$ A

1.3. The time constant of the network shown in Figure, is



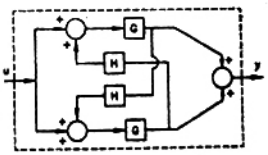
(*a*) 2 RC (*b*) 3 RC
(*c*) $\frac{RC}{2}$ (*d*) $\frac{2RC}{3}$

1.4. A unity feedback system has the open loop transfer function

$$G(s) = \frac{1}{(s-1)(s+2)(s+3)}$$

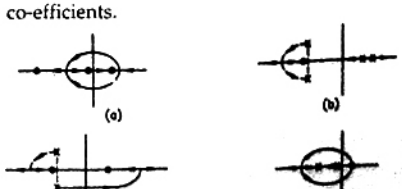
The Nyquist plot of G encircles the origin
(*a*) Never (*b*) Once
(*c*) Twice (*d*) Thrice

1.5. The Nyquist plot encloses the origin only once from the above figure. Hence choice B is correct. The overall transfer function of the system in Figure, is

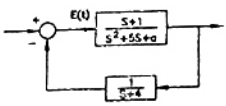


(*a*) $\frac{G}{1-GH}$ (*b*) $\frac{2G}{1-GH}$
(*c*) $\frac{GH}{1-GH}$ (*d*) $\frac{2G}{1-H}$

1.6. Which of the following figure(s) represent valid root loci in the s-plane for positive K? Assume that the system has a transfer function with real co-efficients.



1.7. For what values of 'a' does the system shown in Figure have a zero steady state error [i.e., $\lim_{t \to \infty} \epsilon([t])$ for a step input ?



(*a*) $a \neq 0$ (*b*) $a = 0$

(*c*) $a \geq 4$ (*d*) for no value of 'a'

1.8. In a Common Emitter amplifier, the unbypassed emitter resistance provides

(*a*) Voltage-shunt feedback

(*b*) Current-series feedback

(*c*) Negative-voltage feedback

(*d*) Positive-current feedback

1.9. An ideal OPAMP is used to make an inverting amplifier. The two input terminals of the OPAMP are at the same potential because

(*a*) the two input terminals are directly shorted internally

(*b*) the input impedance of the *OPAMP* is infiinity

(*c*) the open loop gain of the *OPAMP* is infinity

(*d*) *CMRR* is infinity

1.10. In an RC–coupled Common Emitter amplifier, which of the following is true ?

(*a*) Coupling capacitance affects the h_f response and bypass capacitance affects the I_f response

(*b*) Both coupling and bypass capacitances affect the I_f response only

(*c*) Both coupling and bypass capacitances affect the h_f response only

(*d*) Coupling capacitance affects the I_f response and the bypass capacitance affects the h_f response.

1.11. If the HLT instruction of a 8085 microprocessor is executed,

(*a*) the microprocessor is disconnected from the system bus till the Reset is pressed

(*b*) the microprocessor enters into a Halt state and the buses are tri-stated

(*c*) the microprocessor halts execution of the program and returns to monitor

1.12. An unshielded [illegible]ter is used to measure the volta[illegible]. If a stray d.c. magnetic field ha[illegible]long the axis of the meter coil ap[illegible]ading would be

(*a*) unaffected

(*b*) decreased

(*c*) increased

(*d*) either decreased or increased de[illegible] the direction of the *d.c.* field

1.13. A resistance is measured by the voltm[illegible] ammeter method employing d.c. excitation an[illegible] a voltmeter of very high resistance connected directly across the unknown resistance. If the voltmeter and ammeter readings are subject to maximum possible errors of ± 2.4% and ± 1.0% respectively, then the magnitude of the maximum possible percentage error in the value of resistance deduced from the measurement is nearly

(*a*) 1.4% (*b*) 1.7%

(*c*) 2.4% (*d*) 3.4%

1.14. The number of comparators needed in a parallel conversion type 8-bit A to D converter is

(*a*) 8 (*b*) 16

(*c*) 255 (*d*) 256

1.15. In d.c. potentiometer measurements, a second reading is often taken after reversing the polarities of the d.c. supply and the unknown voltage, and the average of the two reading is taken. This is with a view to eliminate the effects of

(*a*) ripples in the *d.c.* supply

(*b*) stray magnetic fields

(*c*) stray thermal emf's

(*d*) erroneous standardisation

1.16. Which of the following equations represents the Gauss' law in a homogeneous isotropic medium ?

(*a*) $\phi\phi \vec{D} \cdot \vec{ds} = \iiint \rho dV$

(*b*) $\overline{V} \times \vec{H} = \vec{D}$

(*c*) $\overline{V} \cdot \vec{J} + \rho = 0$

(*d*) $\overline{V} \cdot \vec{E} = \frac{\rho}{\varepsilon}$

1.17. Two transformers of the same type, using the same grade of iron and conductor materials, are designed to work at the same flux and current densities ; but the linear dimensions of one are two times those of the other in all respects. The ratio of *k*VA of the two transformers closely

1.18. The torque angle of a synchronous machine operating from a constant voltage hus, is usually defined as the space angle between
(*a*) Rotor *mmf* wave and stator *mmf* wave
(*b*) Rotor *mmf* wave and resultant flux density wave
(*c*) Stator *mmf* wave and resultant flux density wave
(*d*) Stator *mmf* wave and resultant *mmf* wave

1.19. Neglecting all losses, the developed torque (T) of a d.c. separately excited motor, operating under constant terminal voltage, is related to its output power (P) as under
(*a*) $T \propto \sqrt{P}$ (*b*) $T \alpha P$
(*c*) $T^2 \propto P^3$ (*d*) T independent of P

1.20. The developed electromagnetic force and/or torque in electro-mechanical energy conversion systems act in a direction that tends
(*a*) to increase the stored energy at constant *mmf*
(*b*) to decrease the stored energy at constant flux
(*c*) to decrease the co-energy at constant *mmf*
(*d*) to decrease the stored energy at constant *mmf*

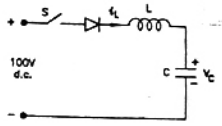
1.21. Two transformers of different *k*VA ratings working in parallel share the load in proportion to their ratings when their.
(*a*) per unit leakage impedances on the same *k*VA base are the same
(*b*) per unit leakage impedances on their respective ratings are equal
(*c*) ohmic values of the leakage impedances are inversely proportional to their ratings
(*d*) ohmic values of the magnetising reactances are the same

1.22. The inductance of a power transmission line increases with
(*a*) decrease in line length
(*b*) increase in diameter of conductor
(*c*) increase in spacing between the phase conductors
(*d*) increase in load current carried by the conductors.

1.23. The selection of size of conductors for a distributor in a distribution system is governed by
(*a*) corona loss

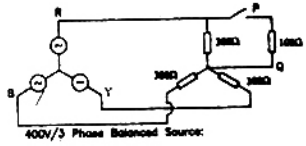
1.24. A Buchholz relay is
(*a*) protection of a transf ternal faults
(*b*) protection of a transforme faults
(*c*) protection of a transformer ag internal and external faults
(*d*) protection of induction motors.

1.25. In the circuit of Figure.the switch 'S' is closed at $t = 0$ with $i_L(0) = 0$ and $v_c(0) = 0$. In the steady state v_c equals.

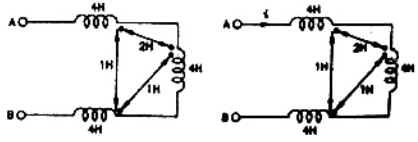


(*a*) 200 V (*b*) 100 V
(*c*) zero (*d*) – 100 V

2.1. Using Thevenin equivalent circuit, determine the rms value of the voltage across the 100 ohm resistor after the switch is closed in the 3-phase shown in Figure.

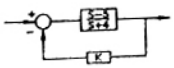


2.2. The equivalent inductance seen at terminals A - B in Figure. is ..... H.

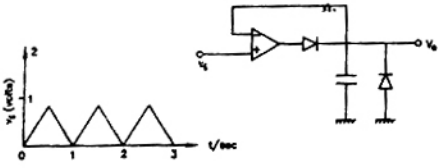


2.3. The impulse response of a network is $h(t) = 1$ for $0 \le t < 1$ and zero otherwise. Sketch the impulse response of two such networks in cascade.

2.4. For what range of K is the following system (Figure) asymptotically stable ? Assume $K \geq 0$



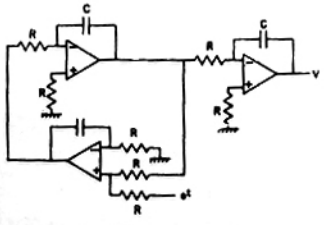
2.5. The circuit shown in Figure. is excited by the input wave shown. Sketch the wavefor m of the output voltage, indicating the salient values. Assuem all components to be ideal.



2.6. In the following circuit (Figure.) the 5 V zener diode requires a minimum current of 10 mA. For obtaining a regulated output of 5V, the maximum permissible load current, I_L, is ___ mA and the minimum power rating of zener diode is __ W.

2.7. In the following circuit (Figure.), the ouptut V follows an equation of the form

$$\frac{d^2v}{dt^2} + a\frac{dv}{dt} + bv = f_{(t)}.$$ Find a, b and $f_{(t)}$.



2.8. In a dual slope integrating type digital voltmeter the first integration is carried out for 10 periods

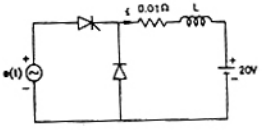
2.9. An electrostatic pote... $= 2x\sqrt{y}$ volts in the rectangul... m. The magnitude of the elec... $y = 1$m is _____ V/m.

2.10. A separately excited d.c. motor has ... resistance of 0.5 ohm. It runs off a ... supply drawing an armature current of ... 1,500 rpm. The torque developed for an armat... current of 10 A will be _____ for the same field current.

2.11. In load flow studies of a power system, the quantities specified at a voltage-controlled bus are _____ and _____.

2.12. In the circuit shown in Figure, L is large and the averge value of 'i' is 100 A. The thyristor is gated in the _____ half cycle of 'e' at a delay angle α equal to _____.

$$e_{(t)} = \sqrt{2} \cdot 200 \sin 314\, t$$

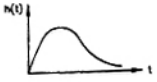


3.1. Match the following transfer functions and impulse responses

Transfer functions

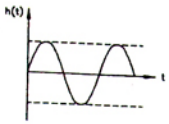
Impulse Responses

(a) $\frac{s}{s+1}$ (P)

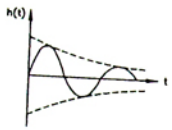


(b) $\frac{1}{(s+1)^2}$ (Q)

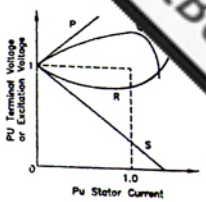
(c) $\frac{1}{s(s+1)+1}$ (R)



(d) $\frac{1}{s^2+1}$ (S)



3.2. Figure. depicts the load characteristics of an isolated three-phase alternator, running at constant speed. Match the following sets of operating conditions with the given characteristics. Disregard the effects of saliency, saturation and stator resistance.



(a) Constant excitation and non-zero leading power-factor
(b) Constant excitation and zero power-factor, leading
(c) Constant terminal voltage and zero power-factor, leading
(d) Constant terminal voltage and non-zero leading power-factor

3.3. Match the following

Equipment	Function
(a) Circuit breaker	(P) Voltage control
(b) Lighting arrester	(Q) Power control
(c) Governor	(R) Over voltage protection
(d) Exciter	(S) Over current protection

ANSWERS

1.

1.1 (c)	**1.2** (d)	**1.3** (b)	**1.4** (b)	**1.5** (b)	**1.6** (a)	**1.7** (a)	**1.8** (b)	**1.9** (c,d)	**1.10** (d)
1.11 (b)	**1.12** (d)	**1.13** (d)	**1.14** (c)	**1.15** (c)	**1.16** (a,d)	**1.17** (c)	**1.18** (a)	**1.19** (b)	**1.20** (b)
1.21(a)	**1.22** (c)	**1.23** (d)	**1.24** (a)	**1.25** (b)					