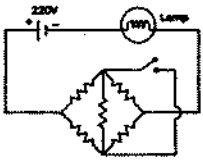
GATE : 1992

EE : Electrical Engineering

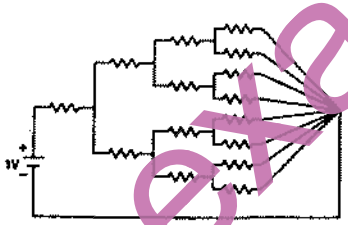
PART - A

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 ?



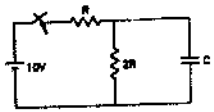
(*a*) increases
(*b*) decreases
(*c*) remains the same
(*d*) answer depends on the value of R

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



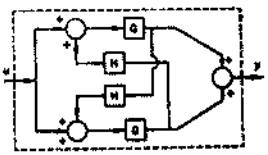
(*a*) 2 RC
(*b*) 3 RC
(*c*) $\frac{RC}{2}$
(*d*) $\frac{2RC}{3}$

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

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

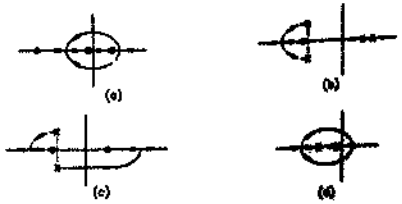
The Nyquist plot of G encircles the origin
(*a*) Never
(*b*) Once
(*c*) Twice
(*d*) Thrice

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.



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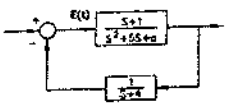
1.7. For what values of 'a' does the system shown in Figure have a zero steady state error [i.e., $\lim_{t \to \infty} \epsilon(t)$ for a step input ?



(*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 infinity

(*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

(*d*) the microprocessor reloads the program from the locations 0024 and 0025 H.

1.12. An unshielded moving iron voltmeter is used to measure the voltage in an a.c. circuit. If a stray d.c. magnetic field having a component along the axis of the meter coil appears, the meter reading would be

(*a*) unaffected

(*b*) decreased

(*c*) increased

(*d*) either decreased or increased depending on the direction of the *d.c.* field

1.13. A resistance is measured by the voltmeter-ammeter method employing d.c. excitation and 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 ± 1.4% 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*) $\vec{\nabla} \times \vec{H} = \vec{D}$

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

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

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 *kVA* of the two transformers closely equals

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

(*c*) 4 (*d*) 2

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1.18. The torque angle of a synchronous machine operating from a constant voltage bus, 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 kVA ratings working in parallel share the load in proportion to their ratings when their.
(*a*) per unit leakage impedances on the same kVA 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 the length
(*b*) increase in diameter of conductor
(*c*) increase in spacing between the phase conductors
(*d*) increase in load current carried by the conductors.

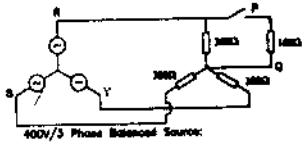
1.23. The selection of size of conductors for a distributor in a distribution system is governed by
(*a*) corona loss
(*b*) temperature rise
(*c*) radio interference
(*d*) voltage drop

1.24. A Buchholz relay is used for
(*a*) protection of a transformer against all internal faults
(*b*) protection of a transformer against external faults
(*c*) protection of a transformer against both internal and external faults
(*d*) protection of induction motors.

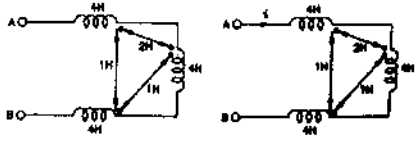
1.25. In the circuit of Figure.the switch 'S' is closed at $t = 0$ with $i_1(0) = 0$ and $v_c(0) = 0$. In the steady state v_c equals.

(*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, neglecting loading effects.

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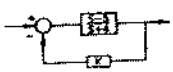
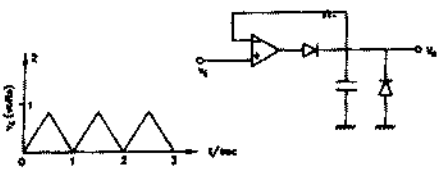
2.4. For what range of K is the following system (Figure) asymptotically stable ? Assume K ≥ 0



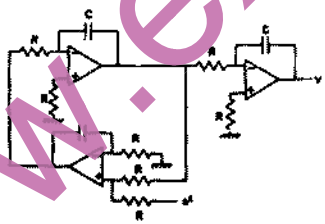
2.5. The circuit shown in Figure. is excited by the input [illegible] shown. Sketch the wavefor m of the output [illegible] indicating the salient values. Assuem all components to be ideal.



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 output 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 of the supply frequency of 50 Hz. If the reference voltage used is 2 V, the total conversion time for an input 1 V is _____ sec.

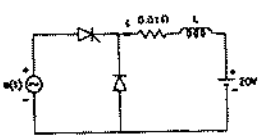
2.9. An electrostatic potential is given by $\phi = 2x\sqrt{y}$ volts in the rectangular co-ordinate system. The magnitude of the electric field at $x = 1m$, $y = 1m$ is _____ V/m.

2.10. A separately excited d.c. motor has an armature resistance of 0.5 ohm. It runs off a 250 V d.c. supply drawing an armature current of 20 A at 1,500 rpm. The torque developed for an armature 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 _____.

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

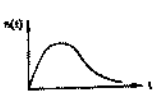


3.1. Match the following transfer functions and impulse responses

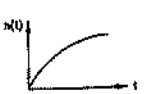
Transfer functions

Impulse Responses

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



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



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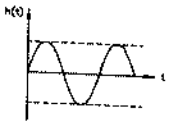
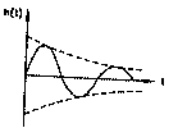
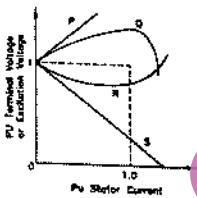
(c) $\frac{1}{s(s+1)+1}$ (R)



(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) Lightning 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)					

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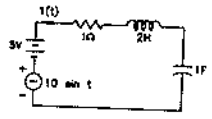
EE : Electrical Engineering

PART - II

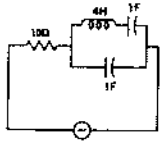
6.1. In the following circuit (Figure.) $i(t)$ under steady state is



(*a*) zero (*b*) 5

(*c*) 7.07 sin *t* (*d*) 7.07 sin $(t - 45°)$

6.2. The following circuit (Figure.) resonates at



(*a*) all frequencies (*b*) 0.5 rad/sec

(*c*) 5 rad/sec (*d*) 1 rad/sec

6.3. Consider a second order system whose state space representation is of the form

$$X = AX + Bu$$

If $x_1(t) = x_2(t)$, then system is

(*a*) controllable (*b*) uncontrollable

(*c*) observable (*d*) unstable

6.4. $s(t)$ is step response and $h(t)$ is impulse response of a system the response $y(t)$ for any input $u(t)$ is given by

(*a*) $\dfrac{d}{dt}\int_0^t s(t-\tau)\,u(\tau)\,d\tau$

(*b*) $\int_0^t s(t-\tau)\,u(\tau)\,d\tau$

(*c*) $\int_0^t \int_0^\tau s(t-\tau_1)\,u(\tau_1)\,d\tau_1\,d\tau$

(*d*) $\dfrac{d}{dt}\int_0^t h(t-\tau)\,u(\tau)\,d\tau$

6.5. The transfer function for the state variable representation

$X = AX + Bu, \quad y = CX + Du,$ is given by

(*a*) $D + C(sI - A)^{-1} B$

(*b*) $B(sI - A)^{-1} C + D$

(*c*) $D(sI - A)^{-1} B + C$

(*d*) $C(sI - A)^{-1} D + B$

6.6. Signal flow graph is used to obtain the

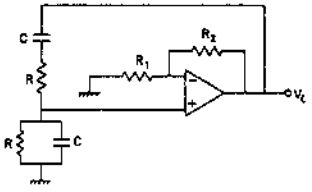
(*a*) stability of a system

(*b*) transfer function of a system

(*c*) controllability of a system

(*d*) observability of a system

6.7. A Wien bridge oscillator is shown in Figure. Which of the following statements are true, if f is the frequency of oscillation.



(*a*) For R = 1 K,

$$C = \frac{1}{2\pi}\,\mu F, \quad f = 1\ \text{kHz}$$

(*b*) For R = 3 K,

$$C = \frac{1}{18\pi}\,\mu F, \quad f = 3\ \text{kHz}$$

(*c*) The gain of the op.amp stage should be less than two for proper operation.

(*d*) The gain of the op.amp stage should be three for proper operation.

6.8. A 10 bit A/D converter is used to digitise an analog signal in the 0 to 5 V range. The maximum peak to peak ripple voltage that can be allowed in the D.C. supply voltage is

(*a*) nearly 100 mV (*b*) nearly 50 mV

(*c*) nearly 25 mV (*d*) nearly 5.0 mV

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6.9. Three devices A, B and C have to be connected to a 8085 microprocessor. Device A has highest priority and device C has the lowest priority. In this context which of the following is correct assignment of interrupt inputs ?

(*a*) *A* uses TRAP, *B* uses RST 5.5 and C uses RST 6.5

(*b*) *A* uses RST 7.5, *B* uses RST 6.5 and C uses RST 5.5

(*c*) *A* uses RST 5.5, *B* uses RST 6.5 and C uses RST 7.5

(*d*) *A* uses RST 5.5, *B* uses RST 6.5 and C uses TRAP

6.10. V_{RN}, V_{YN} and V_{BN} are the instantaneous line to neutral voltages and i_R, i_Y and i_B are instantaneous line currents in a balanced three-phase circuit, the computation, $V_{RN}(i_Y - i_B) - (V_{YN} - V_{BN}) i_R$ will yield a quantity proportional to

(*a*) the active power

(*b*) the power factor

(*c*) the reactive power

(*d*) the complex power

6.11. A CRO screen has ten divisions on the horizontal scale. If a voltage signal 5 sin (314 t + 45°) is examined with a line base setting of 5 msec/div, the number of cycles of signal displayed on the screen will be

(*a*) 0.5 cycles (*b*) 2.5 cycles

(*c*) 5 cycles (*d*) 10 cycles

6.12. A metal strain gauge has factor of two. Its nominal resistance is 120 ohms. If it undergoes a strain of 10^{-5}, the value of change of resistance in response to the strain is

(*a*) 240 ohms (*b*) 2×10^{-5} ohms

(*c*) 2.5×10^{-5} ohms (*d*) 1.2×10^{-3} ohms

6.13. The line integral of the vector potential A around the boundary of a surface S represents

(*a*) flux through in the surface *S*

(*b*) flux density in the surface *S*

(*c*) magnetic density

(*d*) current density

6.14. A 220/440 V, 50 Hz, 5 kVA single phase transformer operates on 220 V, 40 Hz supply with secondary winding. Then

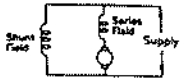
(*a*) the eddy current loss and hysteresis loss of the transformer decrease

(*b*) the eddy current loss and hysteresis loss of the transformer increase

(*c*) the hysteresis loss of the transformer increases while eddy curent loss remains the same

(*d*) the hysteresis loss remains the same whereas eddy current loss decreases

6.15. A cumulative compounded long shunt motor is driving a load at rated torque and rated speed. If the series field is shunted by a resistance equal to the resistance of the series field, keeping the torque constant,



(*a*) the armature current increases

(*b*) the motor speed increases

(*c*) the armature current decreases

(*d*) the motor speed decreases

6.16. A three phase alternator has negligible stator resistance. A short circuit test is conducted on this alternator. At a particular speed a field current of I_{f1} is required to drive the rated armature current. If the speed of the alternator is reduced to half, the field current required to maintain rated armature current

(*a*) would be equal to I_{f1}

(*b*) would be equal to $2 I_{f1}$

(*c*) would be equal to $I_{f1}/2$

(*d*) cannot be predicted due to insufficient data

6.17. A synchronous motor operates at 0.8 *p.f.* lagging. If the field current of the motor is continuously increased

(*a*) the power factor decreases upto a certain value of field current and thereafter it increases

(*b*) the armature curent increases upto a certain value of field current and thereafter it decreases

(*c*) the power factor increases upto a certain value of field current and thereafter it decreases

(*d*) the armature current decreases upto a certain value of field current and thereafter it increases.

6.18. A three phase slip ring induction motor is fed from the rotor side with stator winding short circuited. The frequency of the currents flowing in the short circuited stator is

(*a*) slip frequency

(*b*) supply frequency

(*c*) frequency corresponding to rotor speed

(*d*) zero

6.19. A three phase overhead transmission line has its conductors horizontally spaced with spacing between adjacent conductors equal to '*d*'. If now the conductors of the line are rearranged to form an equilateral triangle of sides equal to '*d*' then

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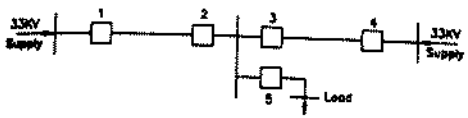
(a) average capacitance and inductance will increase
(b) average capacitance will increase and inductance will increase
(c) average capacitance will increase and inductance will decrease
(d) surge impedance loading of the line increases

6.20. The distribution system shown in Figure. is to be protected by over current system of protection.



For proper fault discrimination directional over current relays will be required at locations
(a) 1 and 4 (b) 2 and 3
(c) 1, 4 and 5 (d) 2, 3 and 5

6.21. The transient stability of the power system can be effectively improved by
(a) excitation control
(b) phase shifting transformer
(c) single pole switching of circuit breakers
(d) increasing the turbine valve opening

6.22. In load flow analysis, the load connected at a bus is represented as
(a) constant current drawn from the bus
(b) constant impedance connected at the bus
(c) voltage and frequency dependent source at the bus
(d) constant real and reactive drawn from the bus

6.23. The thermal resistance between the body of a power semiconductor device and the ambient is expressed as
(a) voltage across the device divided by current through the device
(b) average power dissipated in the device divided by the square of the RMS current in the device
(c) average power dissipated in the device divided by the temperature difference from body to ambient
(d) temperature difference from body to ambient divided by average power dissipated in the device

6.24. When a line commutated converter operates in the inverter mode
(a) it draws both real and reactive power from the A.C. supply
(b) it delivers both real and reactive power to the A.C. supply
(c) it delivers real power to the A.C. supply
(d) it draws reactive power from the A.C. supply

6.25. A chopper operating at a fixed frequency is feeding an R–L load. As the duty ratio of the chopper is increased from 25% to 75%, the ripple in the load current
(a) remains constant
(b) decreases, reaches a minimum at 50% duty ratio and then increases
(c) increases, reaches a maximum at 50% duty ratio and then decreases
(d) keeps on increasing as the duty ratio is increased

ANSWERS

6.1 (d)	6.2 (b)	6.3 (b)	6.4 (a)	6.5 (a)	6.6 (b)	6.7 (a,b,d)	6.8 (d)	6.9 (b)	6.10 (c)
6.11 (b)	6.12 (c)	6.13 (a)	6.14 (a)	6.15 (a,b)	6.16 (d)	6.17 (c,d)	6.18 (a)	6.19 (c)	6.20 (b)
6.21(a)	6.22 (d)	6.23 (d)	6.24 (c)	6.25 (a)					

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GATE : 1994

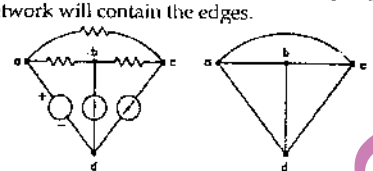
EE : Electrical Engineering

Duration : Three Hours *Maximum Marks : 150*

SECTION -A
(100 MARKS)

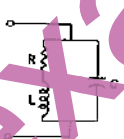
1. Each statement below is accompanied by several answers of which only one is correct. Indicate the correct answer. Each question carries ONE mark. (1 × 20 = 20)

1.1. Figure shows a d.c. resistive network and its graph is drawn aside. A 'proper tree' chosen for analysing the network will contain the edges.



(*a*) *ab, bc, ad* (*b*) *ab, bc, ca*
(*c*) *ab, bd, cd* (*d*) *ac, bd, ad*

1.2. At resonance, the given parallel circuit constituted by an iron-cored coil and a capacitor behaves like



(*a*) an open–circuit
(*b*) a short–circuit
(*c*) a pure resistor of value R
(*d*) a pure resistor of value much higher than R

1.3. If a two–port network is passive, then we have, with the usual notation, the following relationship
(*a*) $h_{12} = h_{21}$ (*b*) $h_{12} = -h_{21}$
(*c*) $h_{11} = h_{22}$ (*d*) $h_{11} \cdot h_{22} - h_{12} \cdot h_{21} = 1$

1.4. When a charge is given to a conductor
(*a*) it distributes uniformly all over the surface
(*b*) it distributes uniformly all over the volume
(*c*) it distributes on the surface, inversely proportional to the radius of curvature
(*d*) it stays where it was placed

1.5. When a transformer winding suffers a short–circuit, the adjoining coils of the same winding experience
(*a*) an attractive force (*b*) a repulsive force
(*c*) no force (*d*) none of the above

1.6. Skew is used in induction motors in order to reduce torque due to
(*a*) time harmonics
(*b*) space harmonics
(*c*) slot harmonics
(*d*) reverse rotating fields

1.7. Two transformers of identical voltages but of different capacities are operating in parallel. For satisfactory load sharing
(*a*) impedences must be equal
(*b*) per-unit impedences must be equal
(*c*) per-unit impedences and $\frac{X}{R}$ ratios must be equal
(*d*) impedences and $\frac{X}{R}$ ratios must be equal

1.8. In a 400 kV network, 350 kV is recorded at a 400 kV bus. The reactive power absorbed by a shunt rated for 50 MVAR, 400 kV connected at the bus is
(*a*) 61.73 MVAR (*b*) 55.56 MVAR
(*c*) 45 MVAR (*d*) 40.5 MVAR

1.9. HVDC Transmission is preferred to EHV – AC because
(*a*) HVDC terminal equipment are inexpensive
(*b*) VAR compensation is not required in HVDC systems
(*c*) system stability can be improved
(*d*) Harmonics – problem is avoided

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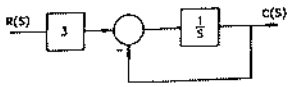
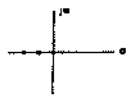
1.10. The matrix of any state-space equations for the transfer function $c(s)/R(s)$ of the system, shown below in Figure, is

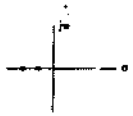


(a) $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 1 \\ 0 & -1 \end{bmatrix}$

(c) [−1] (d) [3]

1.11. The pole-zero configuration of a phase-lead compensator is given by

(a)  (b) 

(c)  (d) 

1.12. A 5 × 7 matrix has all its entries equal to −1. The rank of the matrix is

(a) 7 (b) 5

(c) 1 (d) zero

1.13. The eigen-values of the matrix $\begin{bmatrix} a & 1 \\ a & 1 \end{bmatrix}$ are

(a) $(a + 1), 0$ (b) $a, 0$

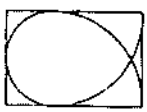
(c) $(a - 1), 0$ (d) $0, 0$

1.14. A 0–10 mA PMMC ammeter reads 4 mA in a circuit. Its bottom control spring snaps suddenly. The meter will now read nearly

(a) 10 mA (b) 8 mA

(c) 2 mA (d) zero

1.15. A Lissajous pattern, as shown in Figure, is observed on the screen of a CRO when voltages of frequencies f_x and f_y are applied to the x and y plates respectively. $f_x : f_y$ is then equal to



(a) 3 : 2 (b) 1 : 2

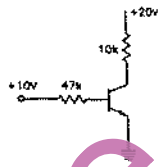
(c) 2 : 3 (d) 2 : 1

1.16. The number of comparisons carried out in a 4-bit flash-type A/D converter is

(a) 16 (b) 15

(c) 4 (d) 3

1.17. In the transistor circuit shown in Figure, collector-to-ground voltage is + 20 V. Which of the follwing is the probable cause of error ?



(a) Collector–emitter terminals shorted

(b) Emitter to ground connection open

(c) 10 kΩ resistor open

(d) collector–base terminals shorted

1.18. The contents of the accumulator in an 8085 microprocessor is altered after the execution of the instruction

(a) CMPC (b) CPI 3 A

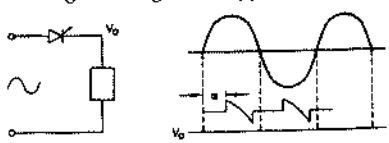
(c) ANI 5 C (d) ORA A

1.19. A switched mode power supply operating at 20 kHz to 100 kHz range uses as the main switching element

(a) Thyristor (b) MOSFET

(c) Triac (d) UJT

1.20. Referring to the Figure, the type of load is



(a) inductive load (b) resistive load

(c) dc motor (d) capacitive load

2. Indicate whether the following statements are TRUE or FALSE. Write the indicating work fully and legibly. A 'FALSE' answer must be accompanied by a very brief (preferably one or two sentences) justification. Each correct answer carries ONE mark.

(1 × 15 = 15)

2.1. Superposition principle is not applicable to a network containing time-varying resistors.

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2.2. In electrostatic field $\Delta \times \vec{E} \equiv 0$.

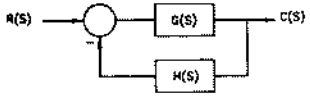
2.3. Static magnetic fields induce currents in closed conducting loops.

2.4. A 3–phase induction motor coupled to a pump is operating at normal speed. If one line gets disconnected, the motor stops.

2.5. In a power–system, the 3–phase fault MVA is always higher than the single–line–to–ground fault MVA at a bus.

2.6. The charging current of a 400 kV transmission line is more than that of a 220 kV line of the same length.

2.7. The closed loop system, of Figure, is stable if the transfer function $T(s) = \dfrac{C(s)}{R(s)}$ is stable.



2.8. If two vectors u and v in a plane are linearly independent, then, they can not be collinear.

2.9. The value of X, after the execution of the last line of the following Fortran routine is 2.0

```
X = 2.0        I = 3 / (4 – X) + 1.2        X = I
```

2.10. A precise measurement guarantees accuracy of the measured quantity.

2.11. A piezo–electric pick up is an example for an active transducer.

2.12. A practical R–C sinusoidal oscillator is built using a positive feedback amplifier with a closed loop gain slightly less than unity.

2.13. An analog comparator is a high–gain amplifier whose output is always either in positive or in negative saturation.

2.14. A line–commutated inverter changes dc voltage to ac voltage.

2.15. The output voltage of a six-pulse double star rectifier is the same as that of a three-phase half-wave rectifier.

3. In each of the following problems, there are Four items on the left hand side (marked A, B, C, D) and Six items on the right hand side (marked P, Q, R, S, T, U). Pick the items from the right hand side which match properly with the items on the left hand side and write as a matched pair (such as B → T). Each proper matching carries one mark. (Note that in each problem, there will be only four such pairs).

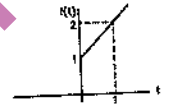
3.1. Match the waveforms on the left–hand side with the correct mathematical description listed on the right hand side.

Wave form $f(t)$

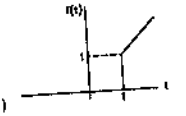
(*a*)

(*b*)

(*c*)



(*d*)



(P) $t \cdot u(t-1)$

(Q) $(t+1) \cdot u(t-1)$

(R) $t \cdot u(t)$

(S) $(t+1) \cdot u(t)$

(T) $(t-1) \cdot u(t)$

(U) $(t-1) \cdot u(t-1)$

(U) $(t-1) \cdot u(t-1)$

3.2. Match the appropriate item from the right hand side with those on the left hand side.

(*a*) Line charge	(P) Maxwell
(*b*) Magnetic Flux Density	(Q) Poynting's Vector
(*c*) Displacement current	(R) Transmission line conductors
(*d*) Power flow	(S) Biot–Savart's law
	(T) Gauss's law
	(U) Faraday's law

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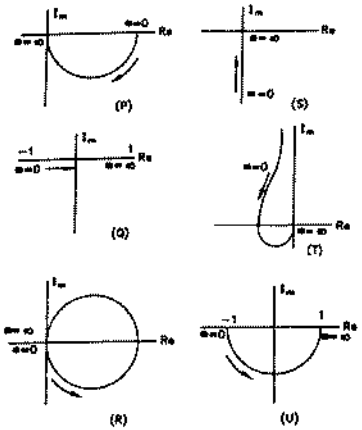
3.3. Match the polar plots for the following functions on the left hand side



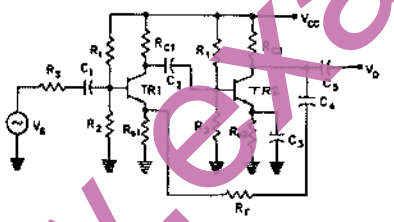
(a) $\frac{s}{(s+1)(s+2)}$

(b) $\frac{s^2+1}{s^3}$

(c) $\frac{s^2-1}{s^2+1}$

(d) $\frac{1}{s^2+10}$

3.4. Given Figure shows a two-stage small signal transistor feedback amplifier. Match the defective component (listed on the left hand side below) with its probable effect on the circuit (listed on the right hand side below)



(a) Capacitor C_1 is open

(b) Capacitor C_3 is open

(c) Capacitor C_4 is open

(d) Rc_2 is shorted

(P) All dc voltages normal normal, v_o increases marginally

(Q) Collector of TRZ is at V_{CC}, $v_o = 0$

(R) All dc voltages normal, gain of 2nd stage increase v_o decrease

(S) All dc voltages normal, $v_o = 0$

(T) All dc voltages normal, overall gain of the amplifier increases, v_o increases

(U) No change

3.5. Match the items on the right hand side with those on left hand side

(a) Commutation

(b) V-curves

(c) Free wheeling diode

(d) Overlap

(P) Resistive load

(Q) Inductive load

(R) Capacitive load

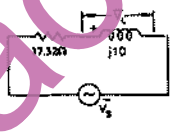
(S) Interpoles

(T) Source Inductance

(U) Synchronous motor

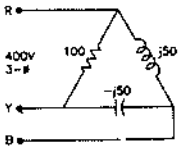
4. Fill in the blanks with the correct answer

4.1. In the given circuit, the voltage $\overline{V}_x$ has a phase



angle of _____ with respect to $\overline{V}_x$.

4.2. A set of 3 equal resistors, each of value R_Y, connected in star across RYB of given Figure. consumes the same power as the unbalanced delta-connected load shown. The value of R_Y is _____ Ω.



4.3. A hollow conductor is at a potential V. The potential at any point inside the hollow is _____

4.4. The inductance of a coil is proportional to the _____ of the number of turns, all other parameters remaining the same.

4.5. A six pole 50 Hz induction motor rotating at 1400 rpm is in _____ mode.

4.6. In a varibale frequency induction motor drive, the voltage must be varied _____ to the frequency.

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4.7. In a system, there are two generators operating in parallel. One generator, of rating 250 MVA, has an inertia-constant of 6 MJ/MVA while the other generator of 150 MVA has an inertia-constant of 4 MJ/MVA. The inertia-constant for the combined system on 100 MVA common base is _____ MJ/MVA.

4.8. The increase in resistance due to non-uniform distribution of current in a conductor is known as _____ effect.

4.9. The number of positive real roots of the equation $s^3 - 2s + 2 = 0$ is _____

4.10. If $f(t)$ is the step-response of a linear time-invariant system, then its impulse response is given by _____

4.11. The number of linearly independent solutions of the system of equations

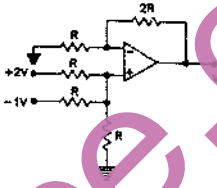
$$\begin{bmatrix} 1 & 0 & 2 \\ 1 & -1 & 0 \\ 2 & -2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = 0, \text{ is equal to } \_\_\_\_\_$$

4.12. The value of the integral $\int_{-5}^{+0} e^{-2t}\,\delta(t-1)\,dt$ is equal to _____

4.13. The light load adjustment is carried out on a single-phase house-service energy meter under _____ power factor conditions.

4.14. _____ torque is not provided in an electromagnetic flux meter.

4.15. Given figure, shows a non-inverting op-amp summer with $V_1 = 2$ V and $V_2 = -1$V. The output voltage V_0 = _____



4.16. The stack pointer of a microprocessor is at A $\phi\phi$ 1. At the end of execution of following instructions, the value of stack pointer is _____

PUSH	PSW
X	THL
PUSH	D
JMP FC	70 H

4.17. A triac can be triggered by a gate pulse of _____ polarity.

4.18. Thyristor circuits that directly convert polyphse ac voltages from one frequency to another frequency are called _____

ANSWERS

1.1 (*a*) **1.2** (*d*) **1.3** (*d*) **1.4** (*a*) **1.5** (*a*) **1.6** (*c*) **1.7** (*c*) **1.8** (*d*) **1.9** (*c*) **1.10** (*c*)

1.11 (*a*) **1.12** (*c*) **1.13** (*a*) **1.14** (*d*) **1.15** (*b*) **1.16** (*b*) **1.17** (*b*) **1.18** (*c*) **1.19** (*b*) **1.20** (*c*)

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