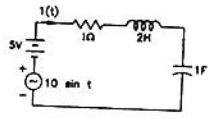
GATE : 1993

EE : Electrical Engineering

PART - II

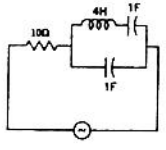
6.1. In the following circuit (Figure.) $i(t)$ under steady state is



(*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. Its 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

$X = AX + Bu$, $y = CX + Du$, 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

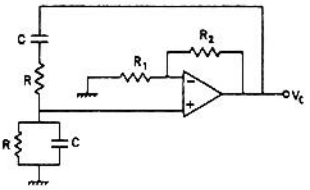
(*a*) stability of a system

(*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

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_n 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

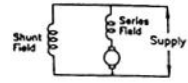
(*a*) the eddy current loss and hysteresis loss of the transformer decrease

(*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

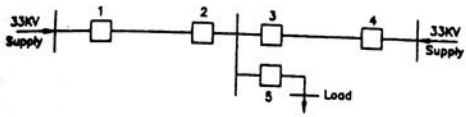
(*c*) frequency corresponding to rotor speed

(*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

(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)					