Q.1 Two independent random variables X and Y are uniformly distributed in the interval $[-1, 1]$. The probability that $\max[X, Y]$ is less than $1/2$ is

a) $3/4$ b) $9/16$ c) $1/4$ d) $2/3$

(GATE EE 2012)

Q.2 If $x = \sqrt{-1}$, then the value of x^x is

a) $e^{-\pi/2}$ b) $e^{\pi/2}$ c) x d) 1

(GATE EE 2012)

Q.3 Given $f(z) = \frac{1}{z+1} - \frac{2}{z+3}$. If C is a counterclockwise path in the z-plane such that $|z + 1| = 1$, the value of $\frac{1}{2\pi j} \oint_c f(z)dz$ is

a) -2 b) -1 c) 1 d) 2

(GATE EE 2012)

Q.4 In the circuit shown below, the current through the inductor is

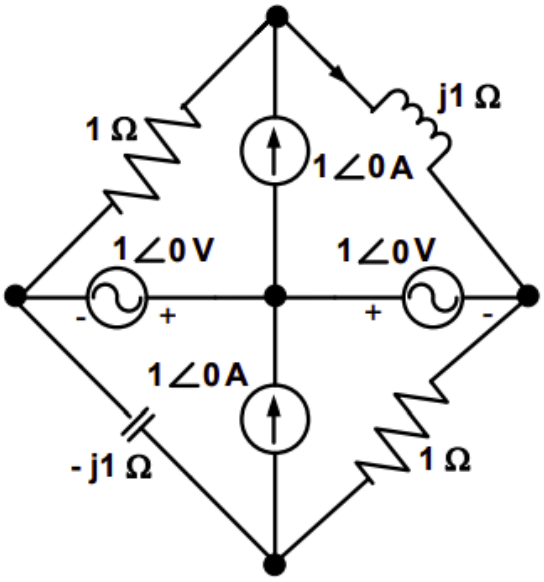

Fig. 1.

(GATE EE 2012)

a) $\frac{2}{1+j}A$ b) $\frac{-1}{1+j}A$ c) $\frac{1}{1+j}A$ d) $0A$

Q.5 The impedance looking into nodes 1 and 2 in the given circuit is

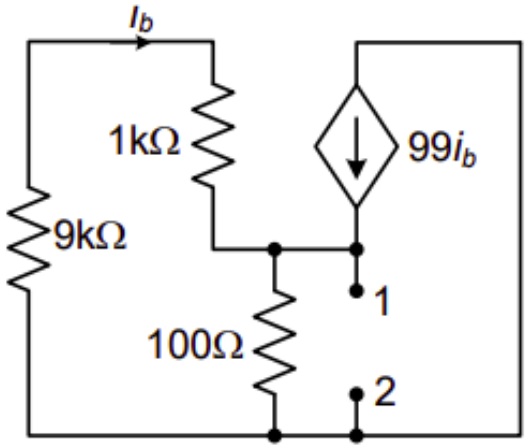

Fig. 2.

a) 50 Ω
b) 100 Ω
c) 5 $k\Omega$
d) 10.1 $k\Omega$

(GATE EE 2012)

Q.6 A system with transfer function $G(s) = \frac{(s^2+9)(s+2)}{(s+1)(s+3)(s+4)}$ is excited by $\sin(\omega t)$. The steady-state output of the system is zero at

a) $\omega = 1$ rad/s
b) $\omega = 2$ rad/s
c) $\omega = 3$ rad/s
d) $\omega = 4$ rad/s

(GATE EE 2012)

Q.7 In the sum of products function $f(X, Y, Z) = \sum(2, 3, 4, 5)$, the prime implicants are

a) $\overline{X}Y$, $X\overline{Y}$
b) $\overline{X}Y$, $X\overline{Y}\overline{Z}$, $X\overline{Y}Z$
c) $\overline{X}Y\overline{Z}$, $\overline{X}YZ$, $X\overline{Y}$
d) $\overline{X}Y\overline{Z}$, $\overline{X}YZ$, $X\overline{Y}\overline{Z}$, $X\overline{Y}Z$

(GATE EE 2012)

Q.8 If $x[n] = (1/3)^{|n|} - (1/2)^n u[n]$, then the region of convergence (ROC) of its Z-transform in the Z-plane will be

a) $\frac{1}{3} < |z| < 3$
b) $\frac{1}{3} < |z| < \frac{1}{2}$
c) $\frac{1}{2} < |z| < 3$
d) $\frac{1}{3} < |z|$

(GATE EE 2012)

Q.9 The bus admittance matrix of a three-bus three-line system is $Y = j\begin{pmatrix} -13 & 10 & 5 \\ 10 & -18 & 10 \\ 5 & 10 & -13 \end{pmatrix}$. If each transmission line between the two buses is represented by an equivalent π-network, the magnitude of the shunt susceptance of the line connecting bus 1 and 2 is

a) 4 b) 2 c) 1 d) 0

(GATE EE 2012)

Q.10 The slip of an induction motor normally does not depend on

a) rotor speed
b) synchronous speed
c) shaft torque
d) core-loss component

(GATE EE 2012)

Q.11 A two-phase load draws the following phase currents: $i_1(t) = I_m \sin(\omega t - \phi_1)$, $i_2(t) = I_m \cos(\omega t - \phi_2)$. These currents are balanced if ϕ_1 is equal to

a) $-\phi_2$
b) ϕ_2
c) $(\pi/2 - \phi_2)$
d) $(\pi/2 + \phi_2)$

(GATE EE 2012)

Q.12 A periodic voltage waveform observed on an oscilloscope across a load is shown. A permanent magnet moving coil ($PMMC$) meter connected across the same load reads

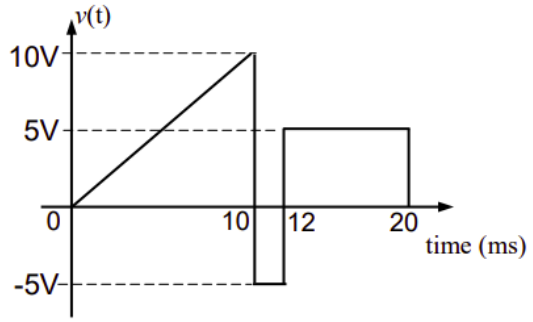

Fig. 3.

a) 4 V
b) 5 V
c) 8 V
d) 10 V

(GATE EE 2012)

Q.13 The bridge method commonly used for finding mutual inductance is

a) Heaviside Campbell bridge
b) Schering bridge
c) De Sauty bridge
d) Wien bridge

(GATE EE 2012)

Q.14 With initial condition $x(1) = 0.5$, the solution of the differential equation $t\frac{dx}{dt} + x = t$ is

a) $x = t - \frac{1}{2}$
b) $x = t^2 - \frac{1}{2}$
c) $x = \frac{t^2}{2}$
d) $x = \frac{t}{2}$

(GATE EE 2012)

Q.15 The unilateral Laplace transform of $f(t)$ is $\frac{1}{s^2+s+1}$. The unilateral Laplace transform of $tf(t)$ is

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

(GATE EE 2012)

Q.16 The average power delivered to an impedance $(4 - j3)\ \Omega$ by a current $5\cos(100\pi t + 100)$ A is

a) 44.2 W
b) 50 W
c) 62.5 W
d) 125 W

(GATE EE 2012)

Q.17 In the following figure, C_1 and C_2 are ideal capacitors. C_1 has been charged to 12 V before the ideal switch S is closed at $t = 0$. The current i(t) for all t is

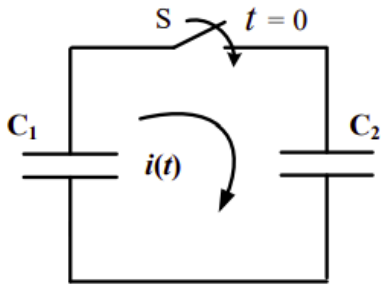

Fig. 4.

a) zero
b) a step function
c) an exponentially decaying function
d) an impulse function

(GATE EE 2012)

Q.18 The i-v characteristics of the diode in the circuit given below are $i = \begin{cases} \frac{v-0.7}{500} A, & v \geq 0.7\ V \\ 0\ A, & v < 0.7\ V \end{cases}$ The current in the circuit is

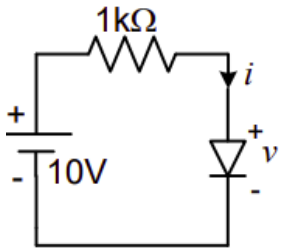

Fig. 5.

a) 10 mA
b) 9.3 mA
c) 6.67 mA
d) 6.2 mA

(GATE EE 2012)

Q.19 The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than the 2-bit input B. The number of combinations for which the output is logic 1, is

a) 4
b) 6
c) 8
d) 10

(GATE EE 2012)

Q.20 Consider the given circuit.

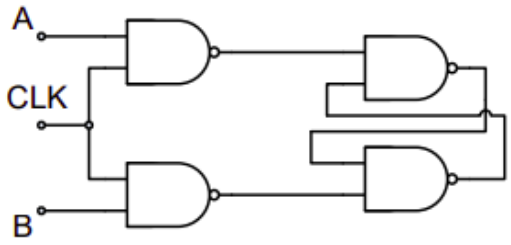

Fig. 6.

In this circuit, the race around

a) does not occur
b) occurs when $CLK = 0$
c) occurs when $CLK = 1$ and $A = B = 1$
d) occurs when $CLK = 1$ and $A = B = 0$

(GATE EE 2012)

Q.21 The figure shows a two-generator system supplying a load of $P_D = 40$ MW, connected at bus 2.

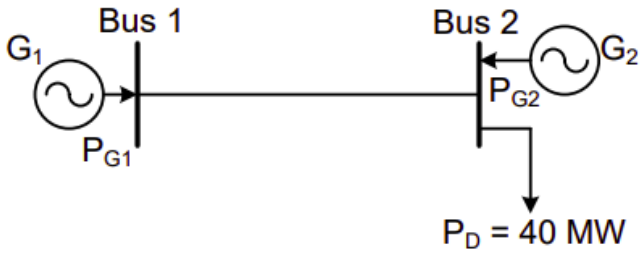

Fig. 7.

The fuel cost of generators G_1 and G_2 are: $C_1(P_{G1}) = 10,000$ Rs/MWh and $C_2(P_{G2}) = 12,500$ Rs/MWh and the loss in the line is $P_{loss(pu)} = 0.5P^2_{G1(pu)}$, where the loss coefficient is specified in pu on a 100 MVA base. The most economic power generation schedule in MW is

a) $P_{G1} = 20,\ P_{G2} = 22$
b) $P_{G1} = 22,\ P_{G2} = 20$
c) $P_{G1} = 20,\ P_{G2} = 20$
d) $P_{G1} = 0,\ P_{G2} = 40$

(GATE EE 2012)

Q.22 The sequence components of the fault current are as follows: $I_{positive} = j1.5$ pu, $I_{negative} = -j0.5$ pu, $I_{zero} = -j1$ pu. The type of fault in the system is

a) LG
b) LL
c) LLG
d) LLLG

(GATE EE 2012)

Q.23 A half-controlled single-phase bridge rectifier is supplying an R-L load. It is operated at a firing angle α and the load current is continuous. The fraction of cycle that the freewheeling diode conducts is

a) $1/2$
b) $(1 - \alpha/\pi)$
c) $\alpha/2\pi$
d) α/π

(GATE EE 2012)

Q.24 The typical ratio of latching current to holding current in a 20 A thyristor is

a) 5.0 b) 2.0 c) 1.0 d) 0.5

(GATE EE 2012)

Q.25 For the circuit shown in the figure, the voltage and current expressions are $v(t) = E_1 \sin(\omega t) + E_3 \sin(3\omega t)$ and $i(t) = I_1 \sin(\omega t - \phi_1) + I_3 \sin(3\omega t - \phi_3) + I_5 \sin(5\omega t)$. The average power measured by the Wattmeter is

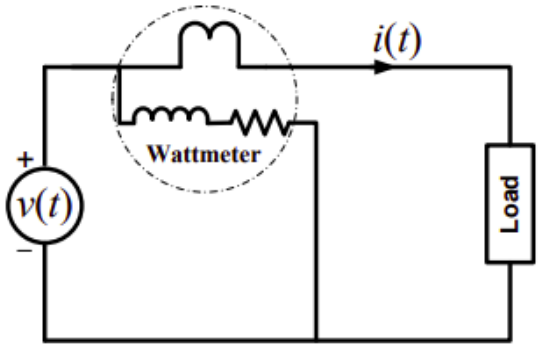

Fig. 8.

a) $\frac{1}{2}E_1 I_1 \cos\phi_1$
b) $\frac{1}{2}[E_1 I_1 \cos\phi_1 + E_1 I_3 \cos\phi_3 + E_1 I_5]$
c) $\frac{1}{2}[E_1 I_1 \cos\phi_1 + E_3 I_3 \cos\phi_3]$
d) $\frac{1}{2}[E_1 I_1 \cos\phi_1 + E_3 I_1 \cos\phi_1]$

(GATE EE 2012)

Q.26 Given that $A = \begin{pmatrix} -5 & -3 \\ 2 & 0 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, the value of A^3 is

a) $15A + 12I$ c) $17A + 15I$
b) $19A + 30I$ d) $17A + 21I$

(GATE EE 2012)

Q.27 The maximum value of $f(x) = x^3 - 9x^2 + 24x + 5$ in the interval $[1, 6]$ is

a) 21 b) 25 c) 41 d) 46

(GATE EE 2012)

Q.28 If $V_A - V_B = 6$ V, then $V_C - V_D$ is

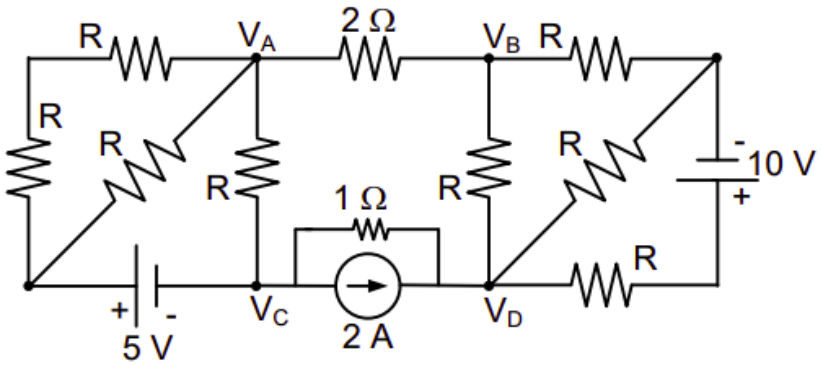

Fig. 9.

a) -5 V b) 2 V c) 3 V d) 6 V

(GATE EE 2012)

Q.29 The voltage gain A_v of the circuit shown below is

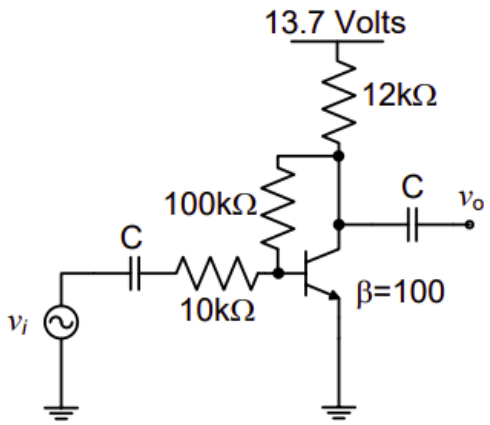

Fig. 10.

a) $|A_v| \approx 200$ b) $|A_v| \approx 100$ c) $|A_v| \approx 20$ d) $|A_v| \approx 10$

(GATE EE 2012)

Q.30 The state transition diagram for the logic circuit shown is

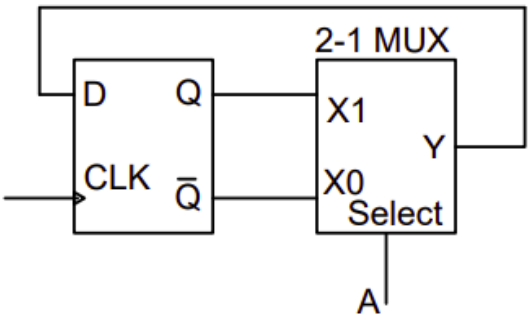

Fig. 11.

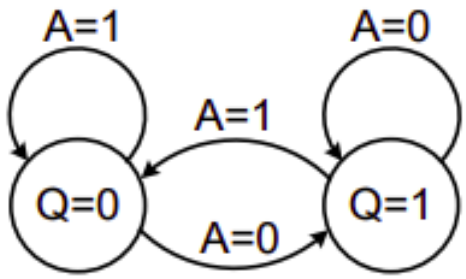

Fig. 12.

a)

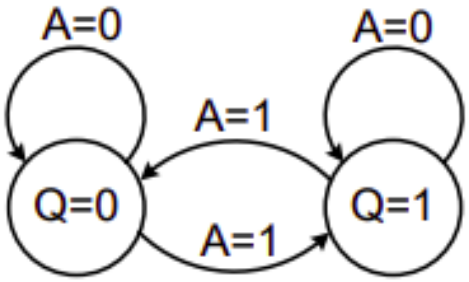

Fig. 13.

b)

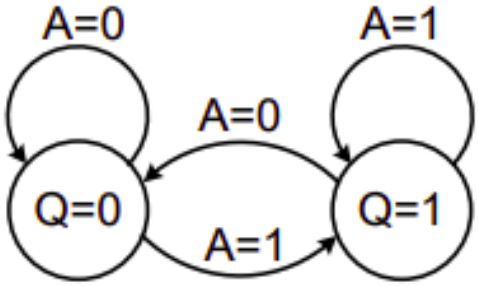

Fig. 14.

c)

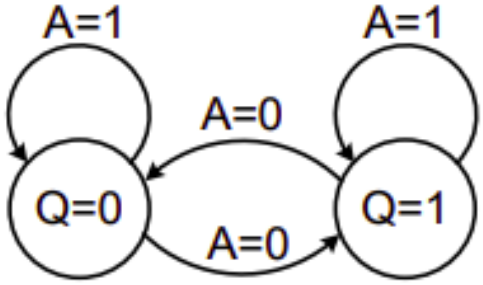

Fig. 15.

d)

(GATE EE 2012)

Q.31 Let $y[n]$ denote the convolution of $h[n]$ and $g[n]$, where $h[n] = (1/2)^n u[n]$ and $g[n]$ is a causal sequence. If $y[0] = 1$ and $y[1] = 1/2$, then $g[1]$ equals

a) 0 b) 1/2 c) 1 d) 3/2

(GATE EE 2012)

Q.32 The circuit shown is a

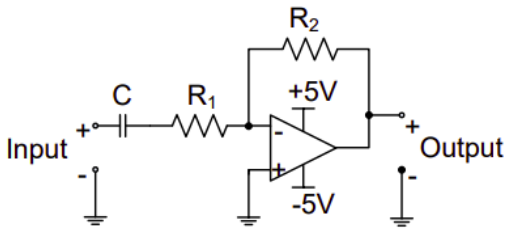

Fig. 16.

a) low pass filter with $f_{3dB} = \frac{1}{(R_1+R_2)C}$rad/s
b) high pass filter with $f_{3dB} = \frac{1}{R_1C}$rad/s
c) low pass filter with $f_{3dB} = \frac{1}{R_1C}$rad/s
d) high pass filter with $f_{3dB} = \frac{1}{(R_1+R_2)C}$rad/s

(GATE EE 2012)

Q.33 For the system shown below, S_{D1} and S_{D2} are complex power demands at bus 1 and bus 2 respectively. If $|V_2|$ = 1pu, the VAR rating of the capacitor (Q_{G2}) connected at bus 2 is

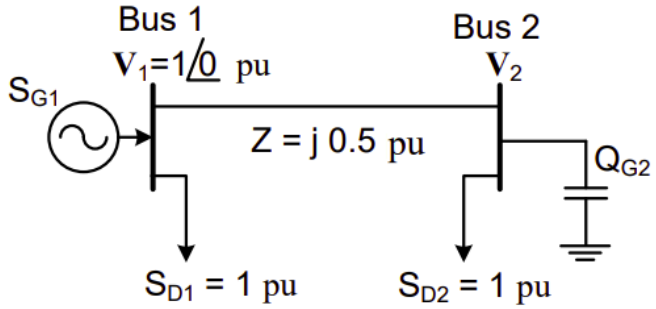

Fig. 17.

a) 0.2 pu b) 0.268 pu c) 0.312 pu d) 0.4 pu

(GATE EE 2012)

Q.34 A cylindrical rotor generator delivers 0.5 pu power in the steady-state to an infinite bus through a transmission line of reactance 0.5 pu. The generator no-load voltage is 1.5 pu and the infinite bus voltage is 1 pu. The inertia constant of the generator is 5 MW-s/MVA and the generator reactance is 1 pu. The critical clearing angle, in degrees, for a three-phase dead short circuit fault at the generator terminal is

a) 53.5 b) 60.2 c) 70.8 d) 79.6

(GATE EE 2012)

Q.35 In the circuit shown, an ideal switch S is operated at 100 kHz with a duty ratio of 50%. Given that Δi_c is 1.6 A peak-to-peak and I_0 is 5 A dc, the peak current in S is

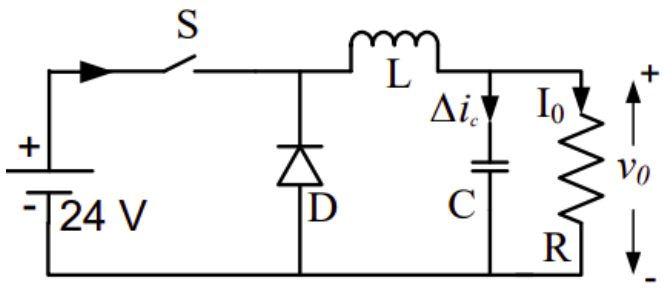

Fig. 18.

a) 6.6 A b) 5.0 A c) 5.8 A d) 4.2 A

(GATE EE 2012)

Q.36 A 220 V, 15 kW, 1000 rpm shunt motor with armature resistance of 0.25 Ω, has a rated line current of 68 A and a rated field current of 2.2 A. The change in field flux required to obtain a speed of 1600 rpm while drawing a line current of 52.8 A and a field current of 1.8 A is

a) 18.18% increase
b) 18.18% decrease
c) 36.36% increase
d) 36.36% decrease

(GATE EE 2012)

Q.37 A fair coin is tossed till a head appears for the first time. The probability that the number of required tosses is odd, is

a) 1/3 b) 1/2 c) 2/3 d) 3/4

(GATE EE 2012)

Q.38 The direction of vector A is radially outward from the origin, with $|A| = kr^n$ where $r^2 = x^2 + y^2 + z^2$ and k is a constant. The value of n for which $\nabla \cdot A = 0$ is

a) -2 b) 2 c) 1 d) 0

(GATE EE 2012)

Q.39 Consider the differential equation $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = \delta(t)$ with $y(t)|_{t=0^-} = -2$ and $\frac{dy}{dt}|_{t=0^-} = 0$. The numerical value of $\frac{dy}{dt}|_{t=0^+}$ is

a) -2 b) -1 c) 0 d) 1

(GATE EE 2012)

Q.40 Assuming both the voltage sources are in phase, the value of R for which maximum power is transferred from circuit A to circuit B is

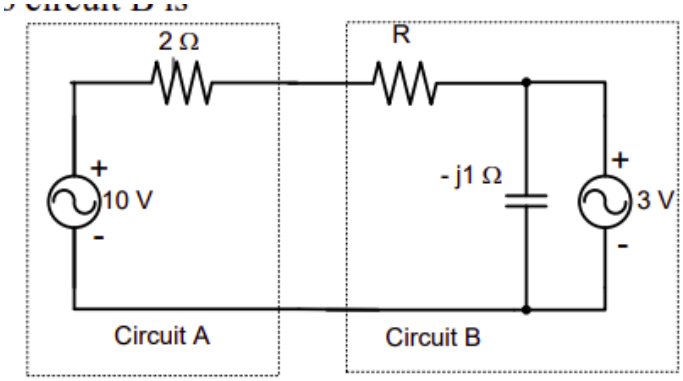

Fig. 19.

a) 0.8 Ω
b) 1.4 Ω
c) 2 Ω
d) 2.8 Ω

(GATE EE 2012)

Q.41 The state variable description of an LTI system is given by $\begin{pmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{pmatrix} = \begin{pmatrix}0 & a_1 & 0\\ 0 & 0 & a_2\\ a_3 & 0 & 0\end{pmatrix}\begin{pmatrix}x_1\\ x_2\\ x_3\end{pmatrix} + \begin{pmatrix}0\\ 0\\ 1\end{pmatrix}u$ $y = \begin{pmatrix}1 & 0 & 0\end{pmatrix}\begin{pmatrix}x_1\\ x_2\\ x_3\end{pmatrix}$ where y is the output and u is the input. The system is controllable for

a) $a_1 \neq 0,\ a_2 = 0,\ a_3 \neq 0$
b) $a_1 = 0,\ a_2 \neq 0,\ a_3 \neq 0$
c) $a_1 = 0,\ a_2 \neq 0,\ a_3 = 0$
d) $a_1 \neq 0,\ a_2 \neq 0,\ a_3 = 0$

(GATE EE 2012)

Q.42 The Fourier transform of a signal $h(t)$ is $H(j\omega) = (2\cos\omega)(\sin 2\omega)/\omega$. The value of $h(0)$ is

a) 1/4
b) 1/2
c) 1
d) 2

(GATE EE 2012)

Q.43 The feedback system shown below oscillates at 2 rad/s when

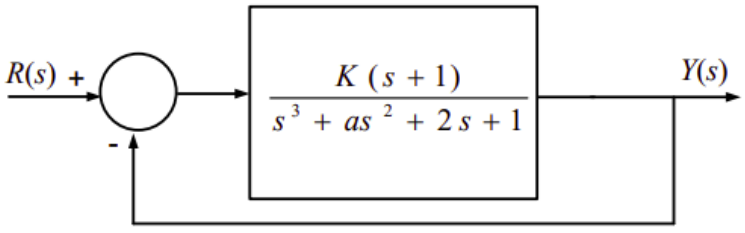

Fig. 20.

a) $K = 2$ and $a = 0.75$
b) $K = 3$ and $a = 0.75$
c) $K = 4$ and $a = 0.5$
d) $K = 2$ and $a = 0.5$

(GATE EE 2012)

Q.44 The input $x(t)$ and output $y(t)$ of a system are related as $y(t) = \int_{-\infty}^{t} x(\tau)\cos(3\tau)d\tau$. The system is

a) time-invariant and stable
b) stable and not time-invariant
c) time-invariant and not stable
d) not time-invariant and not stable

(GATE EE 2012)

Q.45 An analog voltmeter uses external multiplier settings. With a multiplier setting of 20 $k\Omega$, it reads 440 V and with a multiplier setting of 80 $k\Omega$, it reads 352 V. For a multiplier setting of 40 $k\Omega$, the voltmeter reads

a) 371 V b) 383 V c) 394 V d) 406 V

(GATE EE 2012)

Q.46 The locked rotor current in a 3-phase, star connected 15 kW, 4-pole, 230 V, 50 Hz induction motor at rated conditions is 50 A. Neglecting losses and magnetizing current, the approximate locked rotor line current drawn when the motor is connected to a 236 V, 57 Hz supply is

a) 58.5 A b) 45.0 A c) 42.7 A d) 55.6 A

(GATE EE 2012)

Q.47 A single phase 10 kVA, 50 Hz transformer with 1 kV primary winding draws 0.5 A and 55 W, at rated voltage and frequency, on no load. A second transformer has a core with all its linear dimensions $\sqrt{2}$ times the corresponding dimensions of the first transformer. The core material and lamination thickness are the same in both transformers. The primary windings of both the transformers have the same number of turns. If a rated voltage of 2 kV at 50 Hz is applied to the primary of the second transformer, then the no load current and power, respectively, are

a) 0.7 A, 77.8 W
b) 0.7 A, 155.6 W
c) 1 A, 110 W
d) 1 A, 220 W

(GATE EE 2012)

Common Data for Questions 48 and 49:
In the 3-phase inverter circuit shown, the load is balanced and the gating scheme is 180°-conduction mode. All the switching devices are ideal.

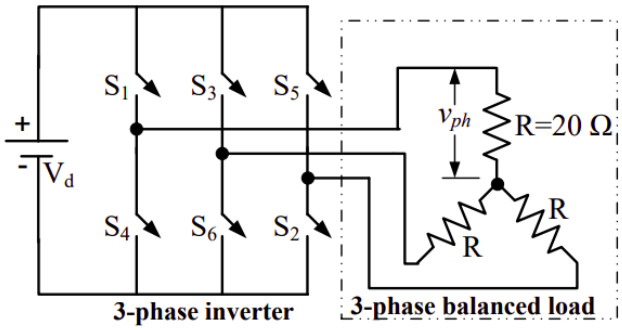

Fig. 21.

Q.48 The rms value of load phase voltage is

a) 106.1 V b) 141.4 V c) 212.2 V d) 282.8 V

(GATE EE 2012)

Q.49 If the dc bus voltage Vd =300 V, the power consumed by 3-phase load is

a) 1.5 kW b) 2.0 kW c) 2.5 kW d) 3.0 kW

(GATE EE 2012)

Common Data for Questions 50 and 51:

With 10 V dc connected at port A in the linear nonreciprocal two-port network shown below, the following were observed:

i 1 Ω connected at port B draws a current of 3 A

ii 2.5 Ω connected at port B draws a current of 2 A

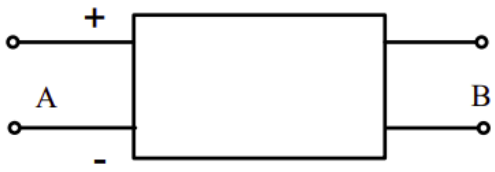

Fig. 22.

Q.50 For the same network, with 6 V dc connected at port A, 1 Ω connected at port B draws 7/3 A. If 8 V dc is connected to port A, the open circuit voltage at port B is

a) 6 V b) 7 V c) 8 V d) 9 V

(GATE EE 2012)

Q.51 With 10 V dc connected at port A, the current drawn by 7 Ω connected at port B is

a) 3/7 A b) 5/7 A c) 1 A d) 9/7 A

(GATE EE 2012)

Statement for Linked Answer Questions 52 and 53:

In the circuit shown, the three voltmeter readings are $V_1 = 220V$, $V_2 = 122V$, $V_3 = 136V$.

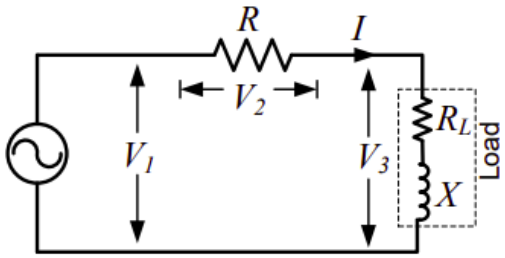

Fig. 23.

Q.52 The power factor of the load is

a) 0.45 b) 0.50 c) 0.55 d) 0.60

(GATE EE 2012)

Q.53 If $R_L = 5\ \Omega$, the approximate power consumption in the load is

a) 700 W b) 750 W c) 800 W d) 850 W

(GATE EE 2012)

Statement for Linked Answer Questions 54 and 55:

The transfer function of a compensator is given as $G_c(s) = \frac{s+a}{s+b}$.

Q.54 $G_c(s)$ is a lead compensator if

a) a = 1, b = 2
b) a = 3, b = 2
c) a = -3, b = -1
d) a = 3, b = 1

(GATE EE 2012)

Q.55 The phase of the above lead compensator is maximum at

a) $\sqrt{2}$ rad/s
b) $\sqrt{3}$ rad/s
c) $\sqrt{6}$ rad/s
d) $1/\sqrt{3}$ rad/s

(GATE EE 2012)

General Aptitude (GA) Questions

Q.56 One of the parts (A, B, C, D) in the sentence given below contains an ERROR. Which one of the following is INCORRECT? *I requested that he should be given the driving test today instead of tomorrow.*

a) requested that
b) should be given
c) the driving test
d) instead of tomorrow

(GATE EE 2012)

Q.57 If $(1.001)^{1259} = 3.52$ and $(1.001)^{2062} = 7.85$, then $(1.001)^{3321} =$

a) 2.23 b) 4.33 c) 11.37 d) 27.64

(GATE EE 2012)

Q.58 Choose the most appropriate alternative from the options given below to complete the following sentence: *If the tired soldier wanted to lie down, he _____ the mattress out on the balcony.*

a) should take
b) shall take
c) should have taken
d) will have taken

(GATE EE 2012)

Q.59 Choose the most appropriate word from the options given below to complete the following sentence: *Given the seriousness of the situation that he had to face, his _____ was impressive.*

a) beggary
b) nomenclature
c) jealousy
d) nonchalance

(GATE EE 2012)

Q.60 Which one of the following options is the closest in meaning to the word given below? *Latitude*

a) Eligibility
b) Freedom
c) Coercion
d) Meticulousness

(GATE EE 2012)

Q.61 A and B are friends. They decide to meet between 1 PM and 2 PM on a given day. There is a condition that whoever arrives first will not wait for the other for more than 15 minutes. The probability that they will meet on that day is

a) 1/4 b) 1/16 c) 7/16 d) 9/16

(GATE EE 2012)

Q.62 One of the legacies of the Roman legions was discipline. In the legions, military law prevailed and discipline was brutal. Discipline on the battlefield kept units obedient, intact and fighting, even when the odds and conditions were against them. Which one of the following statements best sums up the meaning of the above passage?

a) Thorough regimentation was the main reason for the efficiency of the Roman legions even in adverse circumstances.
b) The legions were treated inhumanly as if the men were animals.
c) Discipline was the armiesâ inheritance from their seniors.
d) The harsh discipline to which the legions were subjected to led to the odds and conditions being against them.

(GATE EE 2012)

Q.63 Raju has 14 currency notes in his pocket consisting of only Rs. 20 notes and Rs. 10 notes. The total money value of the notes is Rs. 230. The number of Rs. 10 notes that Raju has is

a) 5 b) 6 c) 9 d) 10

(GATE EE 2012)

Q.64 There are eight bags of rice looking alike, seven of which have equal weight and one is slightly heavier. The weighing balance is of unlimited capacity. Using this balance, the minimum number of weighings required to identify the heavier bag is

a) 2 b) 3 c) 4 d) 8

(GATE EE 2012)

Q.65 The data given in the following table summarizes the monthly budget of an average household.

Category	**Amount (Rs.)**
Food	4000
Clothing	1200
Rent	2000
Savings	1500
Other expenses	1800

TABLE I

*

The approximate percentage of the monthly budget NOT spent on savings is

a) 10% b) 14% c) 81% d) 86%

(GATE EE 2012)