ASSIGNMENT-2
GATE XE-2008

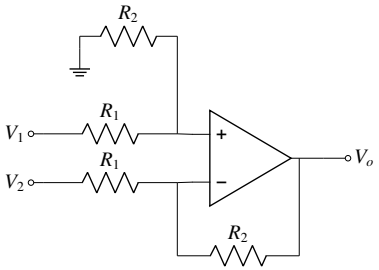
EE24BTECH11019 - DWARAK A

C : ELECTRICAL SCIENCES

Q.9 to Q.30 carry two marks each.

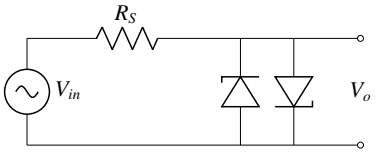
1) In an induction motor the phase-difference, ϕ, between the voltage applied at the stator terminals and the magnetizing current is
   a) $\phi = 0^\circ$
   b) $0^\circ < \phi < 90^\circ$
   c) $\phi = 90^\circ$
   d) $90^\circ < \phi < 180^\circ$

2) A voltage of $+5V$ is applied (with respect to ground) to both the inputs V_1 and V_2 of an operational amplifier circuit shown in the figure. $R_1 = 20k\Omega$ and $R_2 = 10k\Omega$. The output voltage, V_o is

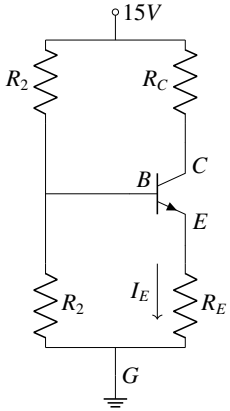


   a) $-5V$
   b) $0V$
   c) $5V$
   d) $20V$

3) A pair of zener diodes each with a forward drop of $0.7V$ and a zener voltage of $4.7V$ is connected as shown in the figure. The input voltage is $v_{in} = 10sin(2t)$. The peak-to-peak output voltage, v_o, is
   a) $5.4V$
   b) $4.7V$
   c) $1.4V$
   d) $0.7V$



4) The npn transistor shown in figure has $h_{fe} = 99$ and $V_{BE} = 0.7V$. Under quiescent condition, $V_{EG} = 4.3V$ and $I_E = 1mA$, and the current in R_2 is $0.1mA$. The value of R_1, required for biasing the circuit is



a) $10.1k\Omega$
b) $90.9k\Omega$
c) $100.1k\Omega$
d) $150.2k\Omega$

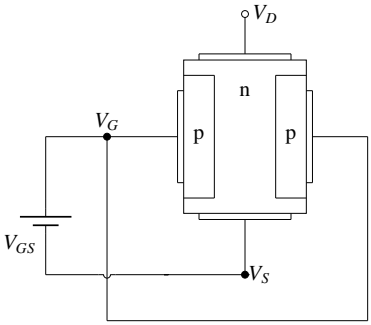
5) The forward characteristics of a p-n diode is given by $i = I_s e^{\frac{v}{(nV_T)}}$ with $n = 2$ and $V_T = 25mV$. If the diode current is measured to be $100mA$ at $0.7V$ drop, the diode power dissipation at a diode current of $200mA$ is

a) $70mW$
b) $140mW$
c) $143mW$
d) $147mW$

6) For the n-channel JFET shown in the figure the pinch-off voltage, $V_p = -5V$, and gate source voltage, $V_{GS} = -3V$. The minimum required drain to source voltage, V_{DS} to operate at pinch-off condition is

a) $0V$
b) $2V$
c) $5V$
d) $8V$

7) The Boolean function corresponding to the truth table shown is

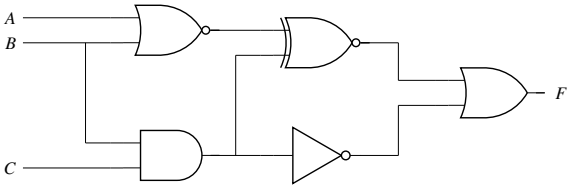


A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

a) $F = A\overline{B}C + \overline{A}BC + \overline{A\overline{B}C} + \overline{\overline{A}BC}$
b) $F = ABC + AB\overline{C} + \overline{A}BC$
c) $F = ABC + AB\overline{C} + A\overline{B}C + \overline{A}B\overline{C}$
d) $F = A\overline{B}C + \overline{A}BC + \overline{A}\overline{B}C + \overline{A}BC$

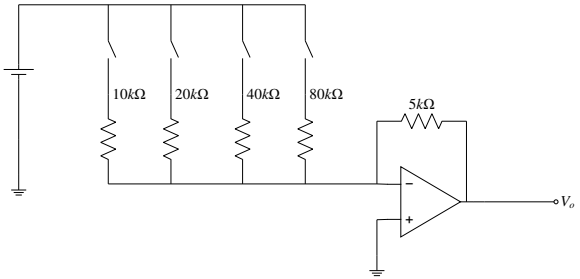
8) The decimal number 328 when converted to the base of 9 is equivalent to
a) $(434)_9$
b) $(424)_9$
c) $(404)_9$
d) $(304)_9$

9) The following logic circuit can be represented by the Boolean expression



a) $F = \overline{B} + BC + \overline{C}$
b) $F = \overline{B} + \overline{C}$
c) $F = \left(\overline{B + C}\right)$
d) $F = \overline{A} + \overline{B} + \overline{C}$

10) A 4-bit resistor network based D/A converter is shown in the figure. The output corresponding to the number 1010 is



a) $5.0V$
b) $6.25V$
c) $7.25V$
d) $10.0V$

11) Two $10V$ square waves of same frequency but 90° out-of-phase to each other are applied to X and Y deflecting plates of a CRO. Both channels are set at $5V$/division and the CRO is operating in the $X-Y$ mode. The display on CRO will be

a) A bright circle
b) A bright ellipse
c) Two bright spots at the diagonal of a faint square
d) Four bright spots at the comers of a faint square

12) CRO that is used in $X-Y$ mode displays a line inclined at an angle of 135°. The X-channel gain is $5V$/division and the Y-channel gain is $10V$/division. If the display point at a given instant corresponds to +3 divisions on the X-axis, the input voltage to the Y-channel at that instant is

a) $-30V$
b) $-15V$
c) $+15V$
d) $+30V$

Common Data Questions

Common Data for Questions 29 and 30:
A $1.0kW$ induction motor has 15 pole-pairs and is supplied from a $60Hz$ source. The motor runs at 0.05 slip. The stator loss is $80W$.

13) The speed of the rotating magnetic field in the motor and the frequency of the rotor induced voltage are

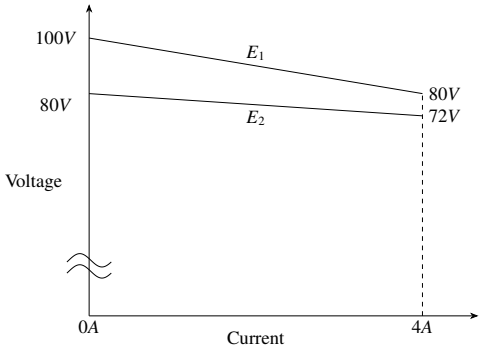
a) $120rpm, 1.5Hz$
b) $120rpm, 28.5Hz$
c) $240rpm, 3.0Hz$
d) $240rpm, 57.0Hz$

14) The rotor copper loss of this induction motor is

a) $120rpm, 1.5Hz$
b) $120rpm, 28.5Hz$
c) $240rpm, 3.0Hz$
d) $240rpm, 57.0Hz$

Linked Answer Questions: Q.31 to Q.34 carry two marks each.

Statement for Linked Answer Questions 31 and 32:
A practical dc voltage source is represented as an ideal dc voltage source in series with an internal resistance. The $V-I$ characteristics of two such sources, E_1 and E_2, are shown in the figure.



15) The respective internal resistances of E_1 and E_2 are
a) $20\Omega, 8\Omega$
b) $5\Omega, 2\Omega$
c) $8\Omega, 20\Omega$
d) $2\Omega, 5\Omega$

16) If the two sources, E_1 and E_2, in question Q.31 are connected in parallel to feed a load of 200Ω resistance, then the load current is in the range
a) $0.0A$ to $0.5A$
b) $0.5A$ to $2.0A$
c) $2.0A$ to $4.0A$
d) $4.0A$ to $8.0A$

Statement for Linked Answer Questions 33 and 34:
A function F, in "Sum of Product (SOP)" form is described by

$$F = \sum m(0, 1, 3, 4, 5, 6, 7, 13, 15)$$

17) The Karnaugh Map for F is given by (X being don't care)

a)

$AB \setminus CD$	00	01	11	10
00	X	X	X	1
01	X	X	X	X
11	1	X	X	1
10	1	1	1	1

b)

$AB \setminus CD$	00	01	11	10
00	1	1	1	X
01	1	1	1	1
11	X	1	1	x
10	X	X	X	X

c)

$AB \setminus CD$	00	01	11	10
00	1	X	1	X
01	X	1	X	1
11	1	X	X	X
10	X	1	X	1

d)

$AB \setminus CD$	00	01	11	10
00	1	1	X	X
01	X	X	X	X
11	X	1	1	1
10	X	1	1	X

18) Using the Karnaugh Map obtained in question Q.33, the function, F reduces to

a) $F = \overline{AC} + \overline{A}D + AB + BD$
b) $F = AC + AD + \overline{AB} + \overline{BD}$
c) $F = AC + \overline{A}D + \overline{AB} + \overline{BD}$
d) $F = \overline{AC} + \overline{A}D + \overline{A}B + BD$