

# ASSIGNMENT-2

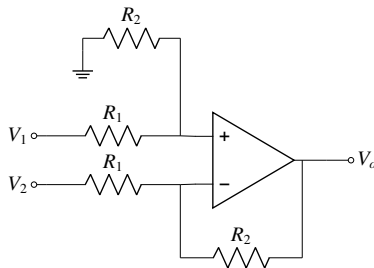
## GATE XE-2008

EE24BTECH11019 - DWARAK A

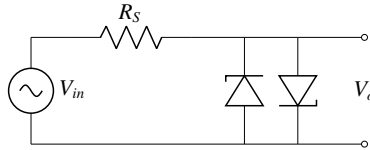
C : ELECTRICAL SCIENCES

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

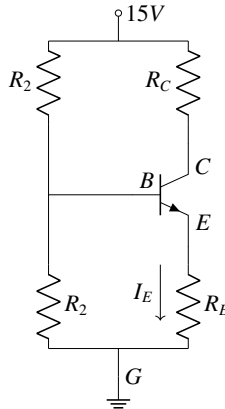
- 1) In an induction motor the phase-difference,  $\phi$ , between the voltage applied at the stator terminals and the magnetizing current is
  - a)  $\phi = 0^\circ$
  - b)  $0^\circ < \phi < 90^\circ$
  - c)  $\phi = 90^\circ$
  - d)  $90^\circ < \phi < 180^\circ$
- 2) A voltage of  $+5V$  is applied (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



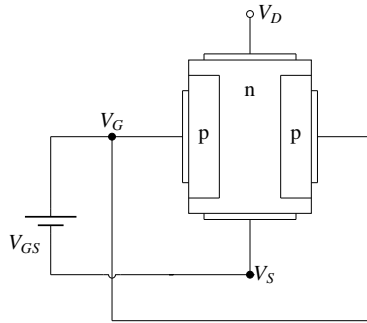
- a)  $-5V$
  - b)  $0V$
  - c)  $5V$
  - d)  $20V$
- 3) A pair of zener diodes each with a forward drop of  $0.7V$  and a zener voltage of  $4.7V$  is connected as shown in the figure. The input voltage is  $v_{in} = 10\sin(2t)$ . The peak-to-peak output voltage,  $v_o$ , is
    - a)  $5.4V$
    - b)  $4.7V$
    - 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



- $10.1k\Omega$
  - $90.9k\Omega$
  - $100.1k\Omega$
  - $150.2k\Omega$
- 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
- $70mW$
  - $140mW$
  - $143mW$
  - $147mW$
- 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
- $0V$
  - $2V$
  - $5V$
  - $8V$
- 7) The Boolean function corresponding to the truth table shown is



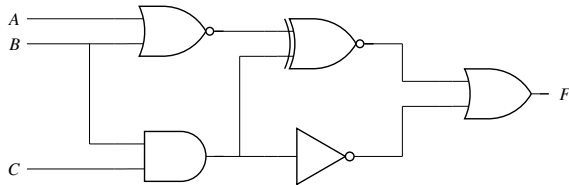
A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

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

8) The decimal number 328 when converted to the base of 9 is equivalent to

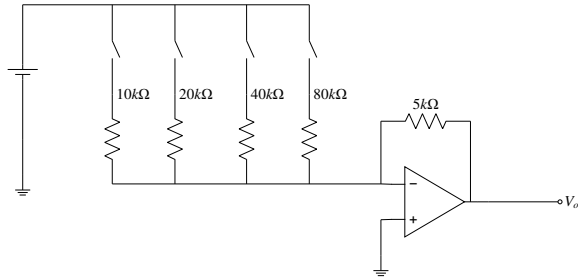
- a)  $(434)_9$   
 b)  $(424)_9$   
 c)  $(404)_9$   
 d)  $(304)_9$

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)  $F = \overline{(B + C)}$   
 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  $90^\circ$  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 corners of a faint square
- 12) CRO that is used in X – Y mode displays a line inclined at an angle of  $135^\circ$ . 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  $80W$ .

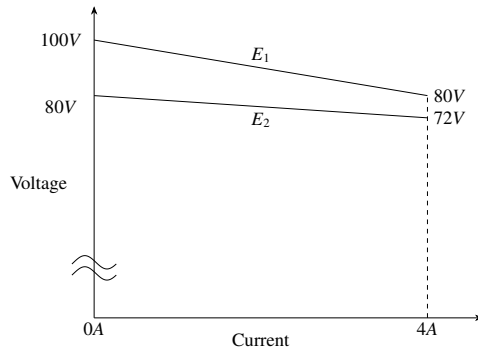
- 13) The speed of the rotating magnetic field in the motor and the frequency of the rotor induced voltage are
- a)  $120rpm, 1.5Hz$   
b)  $120rpm, 28.5Hz$   
c)  $240rpm, 3.0Hz$   
d)  $240rpm, 57.0Hz$
- 14) The rotor copper loss of this induction motor is

- 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  $200\Omega$  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)  $F = \overline{AC} + \overline{AD} + AB + BD$

b)  $F = AC + AD + \overline{AB} + \overline{BD}$

c)  $F = AC + \overline{AD} + \overline{AB} + \overline{BD}$

d)  $F = \overline{AC} + \overline{AD} + \overline{AB} + BD$