Gate EE-2023
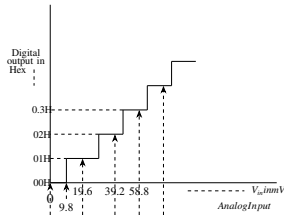
## AI24BTECH11032 Shreyansh Sonkar

40) An 8 bit ADC converts analog voltage in the range of 0 to +5 V to the corresponding digital code as per the conversion characteristics shown in figure. For $V_{in} = 1.9922V$, which of the following digital output, given in hex, is true ?

a) 64H

b) 65H

c) 66H

d) 67H

41) The three-bus power system shown in the figure has one alternator connected to bus 2 which supplies 200 MW and 40 MVAr power. Bus 3 is infinite bus having a voltage of magnitude $|V_3| = 1.0$p.u and angle of $-15°$. A variable current source, $|I| \angle \phi$ is connected at bus 1 and controlled such that the magnitude of the bus 1 voltage is maintained at 1.05 p.u. and the phase angle of the source current $\phi = \theta_1 \pm \frac{\pi}{2}$, where θ_1 is the phase angle of the bus 1 voltage. The three buses can be categorized for load flow analysis as
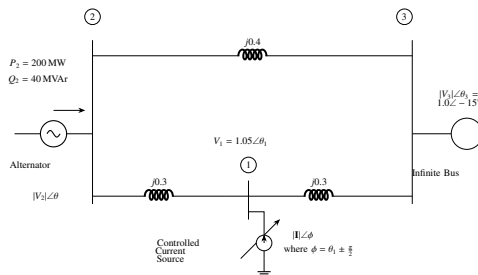
a) Bus 1 Slack bus

Bus 2 $P - |V|$ bus

Bus 3 $P - Q$ bus

b) Bus 1 $P - |V|$ bus
   Bus 2 $P - |V|$ bus
   Bus 3 Slack bus

c) Bus 3 $P - Q$ bus
   Bus 2 $P - Q$ bus
   Bus 3 Slack bus

d) Bus 1 $P - |V|$ bus
   Bus 2 $P - Q$ bus
   Bus 3 Slack bus

42) Consider the following equation in a 2-D real-space.
    $|x_1|^p + |x_2|^p = 1$ for $p > 0$
   Which of the following statement(s) is/are true.

    a) When $p = 2$, the area enclosed by the curve is π.
    b) When p tends to∞ the area enclosed by the curve tends to 4.
    c) When p tends to 0, the area enclosed by the curve is1.
    d) When $p = 2$, the area enclosed by the curve is 2.

43) In the figure , the electric field E and the magnetic field B point to x and z directions, respectively and have constant magnitude . A positive charges 'q' is released from rest at the origin. Which of the following statement(s) is/are true
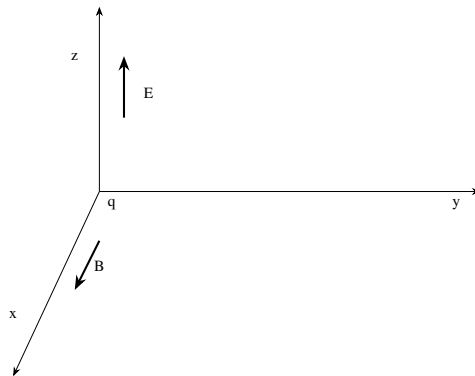
    a) The charge will move in the direction of z with constant velocity.
    b) The charge will always move on the y-z plane only.
    c) The trajectory of the charge will be a circle.
    d) The charge will progress in the direction of y.

44) All the elements in the circuit shown in the following figure are ideal. Which of the following statements is/are true?
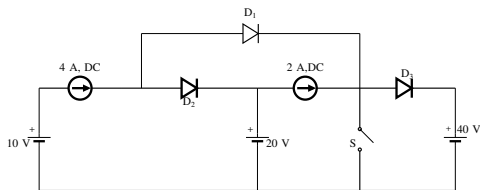
a) When switch S is ON, both D_1 and D_2 conducts and D_3 is reverse biased

b) When switch S is ON, D_1 conducts and both D_1 and D_2 are reverse biased

c) When switch S is OFF, D_1 is reverse biased and both D_1 and D_2 conduct

d) When switch S is OFF, D_1 conducts, D_2 is reverse biased and D_3 conducts

45) The expected number of trails for first occurrence of a " head " in a biased coin is known to be 4. The probability of first occurrence of a " head " in the second trial is _____ . (Round off to three decimal places)

46) Consider the state-space description of an LTI system with matrices

$$A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \quad C = \begin{bmatrix} 3 & -2 \end{bmatrix}, \quad D = 1$$

for the input $\sin(\omega t), \omega > 0$ the value of ω for which the steady-state output of the system will be zero, is _____ . (Round off to the nearest integer)

47) A three-phase synchronous motor with synchronous impedance of $0.1 + j0.3$ per unit per phase has a static stability limit of 2.5 per unit. The corresponding excitation voltage in per unit is _____ . (Round off to two decimal place)

48) A three phase 415 V , 50 Hz , 6 − pole , 960 RPM , 4 HP squirrel cage induction motor drives a constant torque load at rated speed operating from rated supply and delivering rated output. If the supply voltage and frequency are reduced by 20%, the resultant speed of the motor in RPM (neglecting the stator leakage impedance and rotational losses) is _____ . (Round off to the nearest integer)

49) The period of the discrete-time signal x [n] described by the equation below is N = _____ . (Round off to the nearest integer)

$$x[n] = 1 + 3 \sin\left(\frac{15\pi}{8}n + \frac{3\pi}{4}\right) - 5 \sin\left(\frac{\pi}{3}n - \frac{\pi}{4}\right)$$

50) The discrete-time Fourier transform of a signal x [n] is $X(\Omega) = (1 + \cos\Omega) e^{-j\Omega}$. Consider that $x_p[n]$ is a periodic signal of period N= 5 such that

$$x_n[n] = x[n], \text{ for } n = 0, 1, 2$$
$$= 0, \text{ for } n = 3, 4$$

Note that $x_p[n] = \sum_{k=0}^{N-1} \alpha_k e^{j\frac{2\pi}{N}kn}$. The magnitude of the Fourier series coefficient α_3 is = _____. (Round off to three decimal places)

51) For the circuit shown, if $i = \sin 1000t$, the instantaneous value of the Thevenin's equivalent voltage (in Volts) across the terminals $a - b$ at time $t = 5$ is = _____. (Round off to two decimal places)
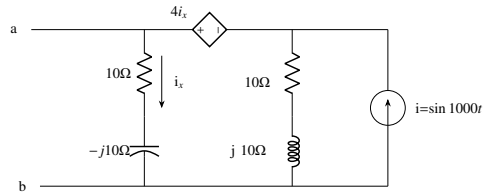
52) The admittance parameters of the passive resistive two-port network shown in the figure are

$$y_{11} = 5S, y_{22} = 1, y_{12} = y_{21} = -2.5S$$

The power delivered to the load resistor R_L in Watt is = _____. (Round off to two decimal places)