(2) **10.** Consider the two cascaded 2×1 multiplexers as shown below in **Fig. Q10**. Determine the minimal sum of products expression for the output $f(P,Q,R)$ if I_0 of MUX_1 and MUX_2 are $\overline{R}$ and 0 respectively. [2]

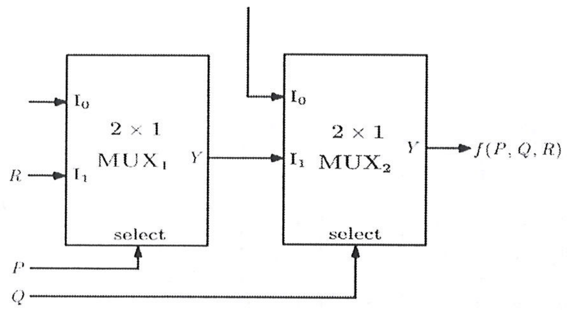

Fig. Q10

Solution: $f(P,Q,R) = \sum m(2,7) = \overline{P}Q\overline{R} + PQR$

(3) **11.** A synchronous counter has three J K flip-flops with the input functions $J_2=\overline{Q_1}$; $K_2=Q_0$; $J_1=Q_2+Q_0$; $K_1=\overline{Q_2}$; $J_0=Q_1$ and $K_0=0$. (a) Assuming that initially $Q_2Q_1Q_0=000$, determine the number of clock pulses are required before the counter begins as a modulo-N counter? (b) What is N?

[1+ 2]

Solution: (a) 3 **(b)** 3

(2) **12.** A three bit pseudo random number generator is shown in **Fig. Q12**. Initially the value of output $Y_2Y_1Y_0$ is set to 111. What is the value of the outputs $Y_2Y_1Y_0$ after 600 clock cycles? [2]

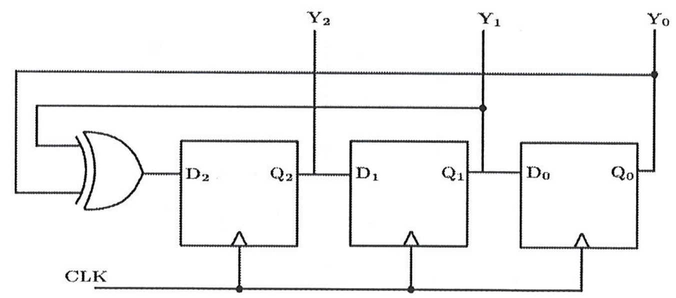

Fig. Q12

Solution: 101

27.5

EE-101: Basic Electronics
End semester Examination

Set Code: **EE-101/2019/ES-SD** Max. Time: **180 min** Max. Marks: **30**

Tutorial Group: T- 18 **Roll no.:** 190123046 **Name:** Pradnesh P. Kalkar

Invigilator's Signature: 29/11/19

Instructions

- Write answers neatly with **appropriate SI units** in the spaces provided
- All answers should be rounded up to the **third decimal point**.
- **Exchange** of Calculators or any other material is not allowed.
- **Mobile phones** are not allowed inside the examination hall.
- **Write answers neatly in the space below the question marked as Solution**

(3) **1.** A balanced three-phase system has star connected loads, star connected sources and nonzero line impedances. At the source end, the nomenclature of the three lines are with small letters **a, b, c** and at the load end, the nomenclatures are with capital letters **A, B, C**. The line voltage V_{AB} has a value of **500** $\angle 0^o$ V (rms). Voltage coil of one wattmeter (**W**) is connected between the lines **A** & **B** and the current coil is in series with the line **aA**. If the line and the load impedances per phase are $Z_L = 1 + j0$ and $Z_P = 12 + j5$. Find, (a) V_{bn}(rms) (answer in phasor form) and (b) the reading of the wattmeter in kW. **[1+2]**

(2) **Solution: (a)** V_{bn} = $309{\cdot}285 \angle -151{\cdot}582^\circ$ V **(b) W =** 6·741 **kW**

2. A **400 V** rms (line voltage) balanced three-phase system supplies **1500 W** to a balanced Y-connected load at a lagging PF of **0.9**. What are the values of (a) the per phase load resistance (***R_P***) and (b) the per phase load reactance (***X_P***)? **[1+1]**

Solution: (a) R_P = ~~28·800 Ω~~ 86·400 Ω **(b)** X_P = ~~13·939 Ω~~ 41·8817 Ω

(2) **3.** Find the equivalent inductances seen at terminals 1 and 2 in the network of **Fig. Q3** if the following terminals are connected together: (a) none and (b) A to B. **[1+1]**

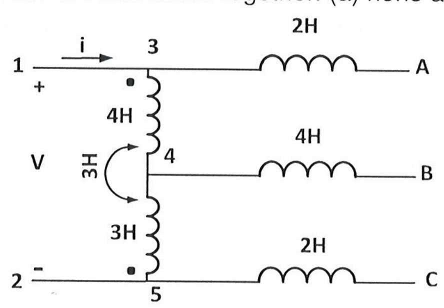

Fig.Q3

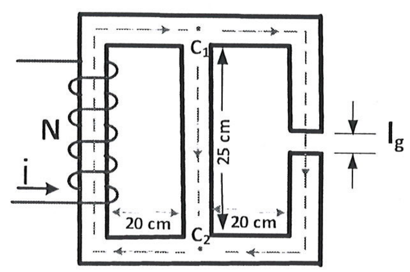

Fig.Q4

Solution: (a) 1·000 H **(b)** 0·900 H

2

4. **Fig. Q4** shows a parallel magnetic circuit. The core material has a relative permeability of 4000. The number of turns is given as $N = 800$ and the cross-sectional area of the core is $A_c = 3 \times 3\ cm^2$. The length of the air gap is $l_g = 0.02\ cm$ and the flux in the central limb is **0.01 Wb**. Find (a) the flux in the right limb and (b) the required exciting current. [1+2]

Solution: (a) 0.002 Wb (b) 3.186 A

2

5. Let i_S = **3 cos (10t)** A in the circuit shown in **Fig. Q5**. Find the total energy stored when the current i_s is maximum if (a) a-b is open-circuited, (b) a-b is short-circuited. [1+1]

Solution: (a) 49.500 J (b) 41.401 J

3

6. Determine (a) the value of the resonant frequency (f_0) in **Hz** and (b) the magnitude of the impedance seen from the source at half power frequencies for the network shown in **Fig. Q6**. [2+1]

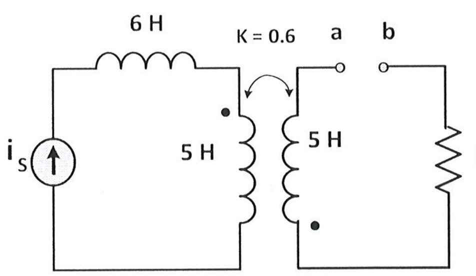

Fig. Q5

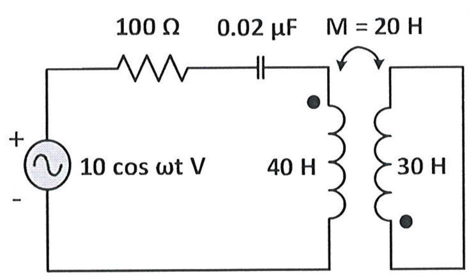

Fig. Q6

Solution: (a) 217.392 Hz (b) 141.421 Ω

2

7. Given the network of figure shown in **Fig. Q7**, express the functions $f_2(w,x,y,z)$ and $f_3(w,x,y,z)$ using minimum possible number of minterms if $f_1 = w\bar{y} + \bar{w}y$ and the overall transmission function is to be $f(w,x,y,z) = \sum m(0,4,9,10,11)$. Given that $f_2(w,x,y,z) \neq 0$. [1+1]

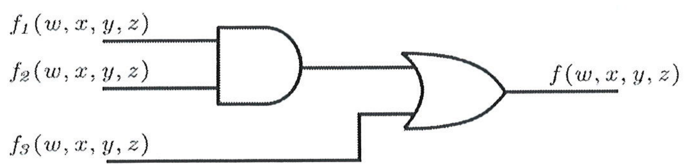

Fig. Q7

Solution: $f_2(w,x,y,z) = \sum m($ 9 $)$; $f_3(w,x,y,z) = \sum m($0, 4, 10, 11$)$

1.5

8. The literal count of a Boolean expression is the sum of the number of times each literal appears in the expression. For example, the literal count of ($xy + x\bar{z}$) is 4. What are the minimum possible literal counts of the (a) product-of-sum and (b) sum-of-product representations respectively of the function given by the following K-map (**Fig. Q8**)? Here, X denotes "don't-care". [1.5+1.5]

yz \ wx	00	01	11	10
00	X	1	0	1
01	0	1	X	0
11	1	1	X	0
10	X	0	0	X

Fig. Q8

Solution: (a) 9 (b) 10

3

9. The borrow obtained from the operation $x - y - z$ of a full subtractor can be realized using two 2×4 decoders as shown in **Fig. Q9**. For feasible realization, the input and enable signals of the decoders can be connected to one of the six signals $\{x, \bar{x}, y, \bar{y}, z, \bar{z}\}$. The appropriate choice for A_0, A_1, E_0, B_0, B_1 and E_1 are respectively. [3]

Solution: $A_0 =$ z ; $A_1 =$ y ; $E_0 =$ x ; $B_0 =$ z ; $B_1 =$ y ; $E_1 = \bar{x}$

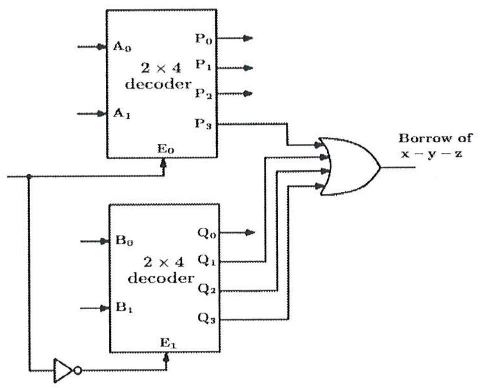

Fig. Q9