PG/IIS/ELC-202/13

M.Sc. 2nd Semester Examination, 2013

ELECTRONICS

(*Digital Electronics*)

(Theory)

PAPER—ELC - 202

Full Marks : 50

Time : 2 hours

Answer Q. No. 1 and any three from the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. Answer the following : 2 × 5

(*a*) Draw 'NOT' gate circuit using transistor.

(*b*) How D/A converter is specified ?

(*c*) What is sampling theorem ?

(*d*) Implement the OR function A + B using a 2-to-1MUX.

(*e*) What is the difference in the connection between Johnson and Ring counter ?

2. (*a*) What is the function of Astable multivibrator ?

(*b*) What are the advantages of Astable multivibrator over Monostable multivibrator ?

(*c*) Draw the schematic diagram of an Astable multivibrator using IC 555 and explain its working principle.

(*d*) If the values of the resistances $R_A = R_B = 1\,k\Omega$ and the value of the capacitor, C is 10 μF in Astable multivibrator circuit, find the frequency of the signal generated. 1 + 2 + 5 + 2

3. (*a*) Implement the following multi-output combinational logic circuit using 4 to 16 line decorder.

$F_1 = \Sigma m\,(2, 4, 8)$

$F_2 = \Sigma m\,(1, 3, 5, 7, 9, 11, 13)$

$F_3 = \Sigma m\ (5, 10, 12, 14)$
$F_4 = \Sigma m\ (2, 3, 9, 11, 12, 13)$.

(*b*) What do you mean by 'Quantization' and 'Encoding' ?

(*c*) To obtain 16 × 8 memory using 16 × 4 memory ICs, find the number of ICs required.
Draw the schematic diagram of the above memory system. 4 + 2 + 4

4. (*a*) State and prove the Shannon's theorem for getting the cannonical SOP form for any *n*-variable Boolean function.

(*b*) Find cannonical POS form of the Boolean function $F = AB + BC + CA$ using Shannon's theorem. 6 + 4

5. (*a*) Design a combinational circuit using 4 - to - 1 MUX and other necessary logic gates that detects an error by outputting 1 for six non BCD codes and 0 for the BCD codes.

(*b*) Show that the following circuit designed using MUX can realise any 2-variable function $f(X_1, X_2)$ where $f_0 = f(0, 0)$, $f_1 = f(0, 1), f_2 = f(1, 0)$ and $f_3 = f(1, 1)$. 5 + 5

6. (*a*) For a n-digit number in base r, the decimal equivalent value is N_1. If the two digits of positions i and $j (j = i - 1)$ are interchanged then the value becomes N_2. If the sum of the two interchanged digits is N_3 then show that the digits

$$a_i = \frac{N_3}{2} + \frac{(N_1 - N_2)}{2(r^i - r^{i-1})}$$

and $$a_j = \frac{N_3}{2} - \frac{(N_1 - N_2)}{2(r^i - r^{i-1})}.$$

(*b*) Explain with suitable diagram the working principle of an R-2R Ladder D/A converter. Find out an expression of output analog voltage as a function of digital inputs.

5 + (2 + 3)

[*Internal Assessment* : 10 Marks]