



HEB-003-1203006

Seat No. _____

M. Sc. (Physics) (Sem. III) (CBCS) Examination

November / December – 2017

Physics : Elective Paper - ET-4

(Analog & Digital Systems)

Faculty Code : 003

Subject Code : 1203006

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) All questions are compulsory.
(2) Number on right margin indicates marks.

1 Attempt any seven : 14

- (a) Define band-width and break frequency with reference to gain versus frequency plot of 741 C op-amp.
- (b) In what way op-amp is superior as compared to transistor amplifier?
- (c) What do you mean by first and second order filters?
- (d) Define filter. What are the applications of filter circuit?
- (e) Draw schematic diagram and label each pin of 8-pin mini DIP 741 C op-amp IC.
- (f) What are the types of ADCs ? Which one is the fastest and expensive ADC?
- (g) Express Boolean function $F = A + B \cdot C$ in sum of minterms.
- (h) Draw the circuit of 4-bit shift right register using D-flipflops.
- (i) A 4-bit binary counter is in its reset condition. What will be the output binary number of this counter after 100 clock pulses applied ?
- (j) Convert decimal number 2345 in BCD code and a binary number 1001 in Exces-3 code.

- 2** Answer the following : (any **two**)
- (a) Discuss with necessary "circuit diagram, differential, inverting and non-inverting open-loop op-amp configurations and derive output, voltage equation in each case. **7**
- (b) Discuss in detail, designing steps of differential amplifier circuit from two Identical emitter-biased circuits. **7**
- (c) How one can design low pass filter? Design a low pass filter at a cut off frequency of 1 kHz with a pass band gain of 2. **7**
- 3** (a) Discuss how inverting amplifier with feedback and more than one input can be used as a summing, scaling and averaging amplifier? **7**
- (b) Define comparator. Where they are used? Discuss with neat circuit and wave forms, working principle of zero crossing detector. **7**

OR

- 3** (a) Draw circuit of binary half adder. A binary full adder circuit has three inputs : X_n, Y_n and previous carry C_{n-1} and two outputs SUM and CARRY. Derive canonical Boolean expressions for outputs and prove that
- $$\text{SUM} = X_n \oplus Y_n \oplus C_{n-1}$$
- Implement the circuit by using logic gates. **7**
- (b) Design 4-bit magnitude comparator circuit which compares two binary numbers $A = A_0A_1A_2A_3$ and $B = B_0B_1B_2B_3$ and produces three outputs $A = B, A > B, A < B$. Sketch the circuit neatly. **7**

- 4 Attempt any **two** :
- (a) Draw the circuit of asynchronous (ripple) MOD- 10 counter and explain its operation with counting sequence and timing diagram. 7
 - (b) Write a note on presentable binary counter with neat diagram. 7
 - (c) Distinguish between buffer and shift register. Write brief note on Ring counter. 7
5. Write a short note on any **two** : 14
- (a) Frequency response curves of active Filters
 - (b) Electrical parameters of an operational amplifier.
 - (c) Designing of Binary Coded Decimal to Excess -3 code converter circuit.
 - (d) Tracking Analog to Digital converter.
-