Ref: Ex/M.Sc./INST/I/I/103/39/2017

# M. Sc (Instrumentation) Examination, 2017
## (1st Year, 1st Semester)
## Paper-III(T-103)

**Subject: Analog and Digital Electronics and Electricals & Electronics Measurements**

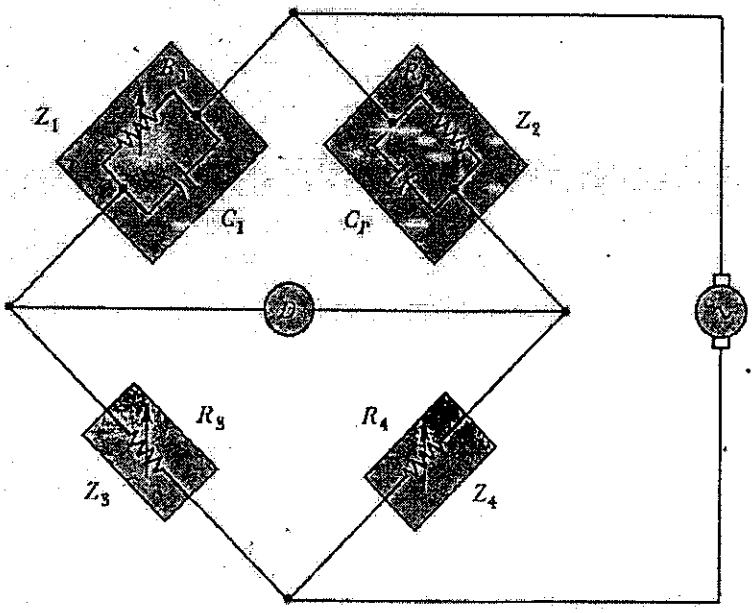
Full Marks: 100 Time: 4 Hours

Group-A

**Section –I**

(Attempt Q1 and any three from rest. Each question Nos. 2 to 6, carries 8 marks )

1. Define: Accuracy, Resolution , linearity and Precision. 4
2. Derive amplitude response of a first order system when unit step signal is an input signal
3. Derive the sensitivity of cathode Ray Oscilloscope. What is Convex Lens Effect? Draw the block diagram of Digital Storage Oscilloscope. Explain each elements of block diagram.
4. Draw and explain the working principle of AnalogMultimeter.
5. How does spectrum analyser work? Explain the construction and applications of Digital Spectrum Analyser.
6. A parallel-resistance capacitance bridge (as in Figure below) has a standard capacitance value of $C_1$ = 0. I pF and $R_1$: = 10 k ohm. Balance is achieved at a supply frequency of 100 Hz when $R_1$ = 3'75 k ohm, $R_3$ = 10 k ohm, and $R_4$ = 14.7 k ohm. Calculate the resistive and capacitive components of the measured capacitor and its dissipation factor.



**Section-II**

Answer question No. 7 and any two from the rest

7. (i) Draw logic diagram for magnitude comparator. 1 X 12

(ii) Draw logic circuit for generating 8 bit output word with odd parity.

(iii) Write the values of worst case input voltages & worst case output voltages of a standard TTL circuit.

(iv) Draw circuit diagram of a 4 bit adder-subtractor by 7483 and 7486 chip.

(v) How SR latch can be used for switch de-bouncer ?

(vi) Draw timing diagram of a 4 bit ripple counter.

(vii) Write down the advantages of A/D conversion in successive approximation method compared to counter method.

(viii) Explain the meaning of digital family.

(ix) Why ladder type R-2R network is superior than normal weighted registers techniques of D/A converter ?

(x) Draw circuit of a negative edge-triggered D-Latch with Pre-set and Clear switch.

(xi) Explain normally open and normally closed tri-state switch.

(xii) Write De-Morgan's First and Second theorem with logic diagram.

8. What is multiplexer ? Draw logic diagram for cascading of two 8 X 1 multiplexer to get a 16 bit multiplexer. 1 + 4

9. What is low power Schottky TTL ? What is loading rules for TTL ? Draw and explain circuit of a two input TTL NOR GATE. 1+ 2 + 2

10. Draw logic diagram of a 4 bit up-dn counter .Explain, how it work ? 5

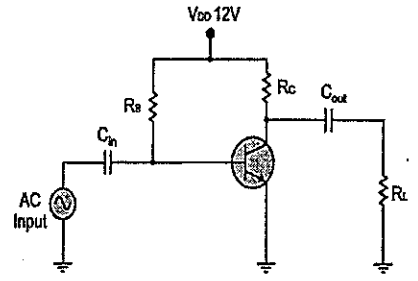
11. Define fundamental product . What is redundant group in a Karnaugh map ? A truth table with four variables has output 1's for these inputs ABCD = 0000, 0011, 0101, 0110, 0111, 1010, 1110, 1111. Derive the simplified equation using Karnaugh map and draw its logic circuit. 1+1½+2½

Group-B

1. Write short notes: (any two) 2×5=10
   (a) Light emitting diode, (b) Zener diode as a voltage regulator (c) Application of Timer-555,
   (d) Filter as circuit element

**Answer any four questions:** 4×10=40

2. What is a depletion region of a p-n junction? Explain depletion region and potential barrier with appropriate diagram. For a p-n junction diode proof $I = I_0(e^{\frac{ev}{\square kt}} - 1)$, where symbol has their usual meanings. 1+3+6
3. Define CMRR and slew rate of an op-amp. Show that OP AMP can be use as differentiator. The 741C op-amp having the following parameters is connected as a non-inverting amplifier with $R_1$=1KΩ, $R_f$=12KΩ, A=175000, $R_i$=2MΩ, $R_0$=75Ω and $f_0$ =7Hz. Supply voltage +15V to-15V. Compute $A_F$, $R_{0F}$, and $f_F$. 2+2+6
4. Draw the output characteristic of p-channel FET and explain the working principle. Explain the pinch-off. Compare enhance and depletion type of MOSFET .What are the advantages of FET over transistor. 5+1+2+2
5. What is an amplifier? Compare between class-A and Class-AB amplifier. Compare between CE and CB mode of transistor amplifier. Explain how fixed bias transistor amplifier circuits work. 1+2+3+4
6. Find $I_B$,$I_C$ and stability factor in the given circuit.Find Q-point for a self bias configuration of transistor. 5+5




$R_B$=20KΩ
$R_C$=35KΩ
α=0.98
$I_{CBO}$=20nA

7. Compare between Ohmic and Schottky contact. Draw the schematic band diagram of Ohmic and Schottky contact for n-type semiconductor. Draw input and output characteristics of a Schottky diode. 8+2