PHE-10

BACHELOR OF SCIENCE (B.Sc.)

Term-End Examination

December, 2005

PHYSICS

PHE-10 : ELECTRICAL CIRCUITS AND ELECTRONICS

Time : 2 hours *Maximum Marks : 50*

Note : *Question no. 1 is **compulsory**. Attempt any **four** questions from the rest. Use of log tables and non-programmable calculators is allowed. Symbols have their usual meanings.*

1. Attempt any ***five*** parts.

(a) Differentiate between lumped and distributed elements. Give one example of each. 2

(b) What do you understand by non volatile memories ? 2

(c) Define rise time and fall time of a signal. 2

(d) Why is D-latch called a transparent latch ? 2

(e) Define ripple factor and give its physical significance. 2

(f) Why is operational amplifier also called a comparator ? 2

2. (a) State and prove reciprocity theorem. 2+2

(b) Draw the circuit diagram of a Wien-Bridge oscillator. Explain its working and write down the expression for output frequency. 6

3. (a) Draw and explain the $I - V$ characteristics of a $p - n$ junction with external voltage. 5

(b) Design a T-pad attenuator to give an attenuation of 80 dB and to work on a line of 100 Ω impedance. 5

4. (a) Explain with the help of a suitable diagram how the two stages of an amplifier are coupled using a resistance and a capacitor. How does this coupling affect the frequency response ? 5

(b) In a centre tap full wave rectifier, the load resistance, R_L = 1·2 kΩ. Each diode has a forward-bias dynamic resistance r_d of 8 Ω. The voltage across half the secondary winding is 220 sin 314 t. Find the peak value, dc value, the rms value of the current, ripple factor and rectification efficiency. 5

5. (a) Using IC 741 C operational amplifier draw the circuit diagram of the basic differentiator and obtain an expression for the output voltage. 5

(b) Using an IC LM 317, design an adjustable voltage regulator for an output voltage of 5 V to 18 V. 5

6. (a) Convert decimal 872 to its BCD (8421) code equivalent. 2

(b) Simplify the Boolean expression

$$Z = (B + \overline{C})(\overline{B} + C) + \overline{(\overline{A} + B + \overline{C})}$$ 3

(c) Design a MOD-6 counter using JK flip-flop and explain its working. 5

7. (a) Explain the concept of feed-back in an op-amp with the help of a suitable diagram. What do you understand by positive and negative feed-backs ? List one application of each. 5

(b) Explain the working of a cathode ray oscilloscope with the help of a block diagram. List two of its applications. 5