

BACHELOR OF SCIENCE (B.Sc.)

Term-End Examination

June, 2006

PHYSICS

**PHE-10 : ELECTRICAL CIRCUITS AND
ELECTRONICS**

Time : 2 hours

Maximum Marks : 50

Note : Question no. 1 is **compulsory**. Attempt any **four** 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 linear and non-linear elements.
Give one example of each. 2
- (b) What is the relation between capacitive reactance and inductive reactance at resonant frequency ? Write the expression of the resonant frequency. 2
- (c) What are the advantages of using negative feedback in amplifiers ? 2
- (d) What is the largest decimal number that can be represented using 10 bits ? 2
- (e) Define slew rate of an op-amp. 2
- (f) List the major components of a general purpose CRT. 2

2. (a) State and prove Norton's theorem. 2+2
- (b) Draw the circuit diagram of a phase-shift oscillator. Write the expression for its frequency. Calculate the frequency of oscillations of a phase-shift oscillator when $R = 200 \text{ k}\Omega$ and $C = 5 \text{ nF}$. 6
3. (a) Show diagrammatically the biasing of n-channel MOSFET. How is amplification achieved in MOSFETs ? 6
- (b) A series *RLC* circuit consists of $50 \text{ }\Omega$ resistance, 0.2 H inductance and $1 \text{ }\mu\text{F}$ capacitance with the applied voltage of 20 V . Calculate the resonance frequency. Find the *Q*-factor of the circuit. Compute the lower and the upper frequency limits and hence find the band-width. 4
4. (a) Draw the circuit diagram of Hartley oscillator and explain its working. Write the expression for the output frequency. 6
- (b) A multistage amplifier consists of three stages. The voltage gain of the stages are 30, 50 and 60. Calculate the overall voltage gain in dB. 2
- (c) Draw the circuit diagram of a bridge rectifier. 2
5. (a) Using 741 operational amplifier, draw the circuit diagram of basic integrator and obtain an expression for the output voltage. 5

- (b) If voltage regulator IC has a ripple rejection of 60 dB and the ripple voltage at the input of the regulator is 4 V, what is the value of the ripple at the regulator output ? 3
- (c) Draw an equivalent circuit of an op-amp. 2
6. (a) Convert the hexadecimal number B2F8 to its equivalent decimal number. 2
- (b) Simplify the Boolean expression
$$Z = \overline{(\overline{A} + C) \cdot (B + \overline{D})}$$
 3
- (c) Design a MOD-7 counter and explain its working. 5
7. (a) What are the output voltages caused by each bit in a 4-bit ladder, if the input levels are 0 = 0 V and 1 = 10 V ? 5
- (b) Design a 3-channel inverting amplifier using op-amp 741C with gains — 10, — 5 and — 20 and draw its circuit diagram. 5