DIPLOMA IN NAUTICAL SCIENCE

Term-End Examination

June, 2006

BNA-013 : ELECTRICITY AND ELECTRONICS

Time : 2 hours *Maximum Marks : 70*

Note :

(i) Non-programmable scientific calculator is allowed.

*(ii) Attempt **three** questions from each section.*

*(iii) Questions no. 1 and 5 are **compulsory**.*

SECTION A (Electricity)

Note : *Attempt any **three** questions from this section. Question no. 1 is **compulsory**.*

1. (a) With the help of neat diagram explain the principle, construction and working of a transformer. Can we use a transformer for D.C. voltage supply ? *10*

(b) A galvanometer of resistance 200 Ω has 100 divisions on its scale. When a potential difference of 30 mV is applied to its terminal, it deflects by 15 divisions. How can it be converted into a voltmeter to read 50 V ? *5*

2. (a) Derive the expression for the magnetic field due to a straight solenoid carrying current. 5

(b) A resistance of 9 Ω is connected to a cell. A voltmeter connected across the cell reads 1·8 V. When a resistance of 10 Ω is connected in series with 9 Ω, the voltmeter reading changes to 1·9 V. Calculate the emf and internal resistance of the cell. 5

3. (a) Explain the principle and working of a capacitor. 5

(b) The energy stored in the system consisting of two capacitors connected in series and connected across a 2 kV line is 4 joules. When the same two capacitors are in parallel across the same line, the energy stored is 18 joules. Calculate the capacitances of the two capacitors. 5

4. (a) Explain the construction and working of a D.C. generator. Can a D.C. generator be converted into an A.C. generator ? 5

(b) A transformer has an efficiency of 95%. It works at 5 kilowatt and 100 volts. If the secondary voltage is 230 V, calculate the primary and secondary currents. 5

SECTION B (Electronics)

Note : *Attempt any* ***three*** *questions from this section. Question no. 5 is* ***compulsory****.*

5. (a) Explain CE amplifier using NPN transistor with necessary circuit diagram. 5

(b) The common base current gain of a transistor is 0·918. If the emitter current is 9 mA, what is the value of base current ? 5

(c) Explain the working of a basic transistor oscillator with a neat circuit diagram. 5

6. (a) Explain full wave bridge rectifier with necessary circuit diagram. 5

(b) A half wave rectifier supplies 30 V D.C. to a load of 1000 Ω. The forward resistance of the diode is 15 Ω. Calculate the rms value and peak value of alternating voltage required. 5

7. (a) What is the need for modulation ? Explain modulation index, upper and lower side band frequencies and amplitude of each side band frequency in case of amplitude modulation. 5

(b) A sinusoidal carrier voltage of frequency 1300 kHz is amplitude modulated by a sinusoidal voltage of frequency 15 kHz resulting in maximum and minimum modulated carrier amplitudes of 100 V and 80 V respectively. Calculate

(i) Frequency of lower and upper side bands

(ii) Unmodulated carrier amplitude

(iii) Modulation index and amplitude of each side band 5

8. Write short notes on any ***four*** of the following : 10

(a) Temperature transducer

(b) N-type semiconductor

(c) NAND gate

(d) Light Dependent Resistor (LDR)

(e) p – n junction

(f) Sky wave