DIPLOMA IN NAUTICAL SCIENCE

Term-End Examination

December, 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) (i) Obtain the expressions of current and phase angle, and between current and voltage of LCR series circuit using vector diagrams. 5

(ii) Explain "electrical resonance" in LCR series circuit and give the expression of resonant frequency. 5

(b) A 220 V, 50 Hz supply is applied to a choke coil of negligible resistance and the circuit current is measured to be 2·5 amp. Find the inductance of the coil and the active power dissipated. 5

2. (a) Define the following terms : 5

(i) Henry

(ii) Farad

(iii) Resistivity

(iv) RMS value of a.c. voltage

(v) Reactive power in a.c. circuit

(b) Two cells of emf 3 V and 4 V having internal resistances 1 Ω and 2 Ω respectively are connected in parallel to an external resistance of 15 Ω. Calculate the current in each branch. 5

3. (a) How do you convert a given galvanometer into an ammeter and a voltmeter ? Explain with necessary circuit diagrams. 5

(b) A 4 μF capacitor is connected in series with parallel combination of two capacitors 5 μF and 2 μF.

(i) Determine the capacitance of the combination.

(ii) If a potential difference of 12 V is maintained across the combination, determine the charge on 4 μF capacitor and energy stored in the 5 μF capacitor. 5

4. Write short notes on any ***two*** of the following : 10

(a) Transformer

(b) Variation of resistance with temperature

(c) Navigation lights

SECTION B (Electronics)

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

5. (a) Explain input and output characteristics of a transistor in common base configuration. *10*

(b) A transistor in common emitter mode has collector supply voltage of 10 V and the voltage drop across the 1·5 kΩ load resistance is 0·75 V. Determine the collector to emitter voltage and the base current, if α is 0·93. *5*

6. (a) Explain construction and working of a Cathode Ray Tube (CRT) with necessary diagram. *5*

(b) An oxide-coated thermionic emitter has a surface area of 0·25 cm^2. If the operating temperature is 1400° K, find the emission current.

(Given : $A = 65 \times 10^4$ amp/m^2/°K^2 and work function = 3·15 eV) *5*

7. (a) What is demodulation ? Explain the function of an AM diode detector with necessary circuit diagram. *5*

(b) A sinusoidal carrier voltage of frequency 1200 kHz is amplitude modulated by a sinusoidal voltage of frequency 10 kHz resulting in maximum and minimum modulated carrier amplitudes of 90 V and 60 V respectively. Calculate

(i) Frequency of lower and upper side-bands

(ii) Modulation index and amplitude of each side-band *5*

8. (a) Explain the functioning of a half wave rectifier circuit and derive the expression for its efficiency. 5

(b) A half wave rectifier in a life board battery charger circuit supplies 30 V d.c. to a load of 900 Ω. The forward resistance of the diode is 5 Ω. Calculate the rms value of alternating voltage required. 5