Integrated M.Sc. (PHY & CHEM)
PHYSICS-II

Full Marks: 70
Time: 3 hours

Question No. 1 is compulsory. Answer any *five* from the rest.
The figures in the right hand margin indicate marks. *Symbols carry usual meaning.*

1. a. Find the curl of a position vector. [2x10]
b. What is the dimension of Poynting vector?
c. Express the electric and magnetic field in terms of vector potential and scalar potential.
d. Evaluate the divergence of the vector $\mathbf{A}= xy\,\mathbf{i} + y^2\,\mathbf{j} + 2yz\,\mathbf{k}$ at the point (2,1,0).
e. What is the significance of displacement current?
f. State stokes theorem.
g. What are the disadvantages of half wave rectifier?
h. Write the truth table for NAND and NOR gates.
i. What do you mean by irrotational vector?
j. What do you mean by sinusoidal oscillator? Write the advantages of it.

2. a. State and Explain Gauss Law. [5]
b. Calculate the electric field at a point due to a solid charge sphere for all possible conditions. [5]

3. a. Find the value of a, for which the vector field $\mathbf{V}= a(x+y)\,\mathbf{i} + 4y\,\mathbf{j} + 3\,\mathbf{k}$ is solenoidal. [5]
b. Prove that for every field **V**, div curl **V**=0. [5]

4. a. State and prove Ampere's circuital law in electromagnetism. [5]
b. Derive an expression for magnetic field produced by a long straight current carrying wire. [5]

5. a. Obtain the wave equations in terms of scalar and vector potentials. [5]
b. A current distribution gives rise to magnetic vector potential $\mathbf{A}= x^2y\,\mathbf{i} + y^2x\,\mathbf{j} + yz^2\,\mathbf{k}$. Calculate the magnetic induction at the point (1, 2, 3). [5]

6. Draw the circuit of Hartley oscillator and derive an expression for its frequency of oscillation

7. a. Explain the difference between class A and class B amplifier. [5]
b. Discuss how a push-pull amplifier can be used as power amplifier. [5]

8. a. A half-wave rectifier has a load resistance of 3.5 KΩ. If the diode and secondary of the transformer have a total resistance of 800KΩ and the ac input voltage has 240 V (peak value), determine: (i) Peak, rms and average values of current through load
(ii) DC power output
(iii) AC power input
(iv) Rectification efficiency [5]
b. In an amplifier with negative feedback, the gain of the basic amplifier is 100 and it employs a feedback factor of 0.02. If the input signal is 40mV, determine
(i) Voltage gain with feedback (ii)Value of output voltage. [5]