

2/EH-24 (ii) (Syllabus-2015)

2019

(April)

PHYSICS

(Elective/Honours)

(Electromagnetism, Electronics-I)

[PHY-02 (T)]

Marks : 56

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

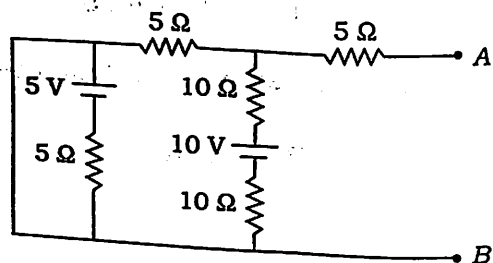
Answer Question No. 1 and any four from the rest

1. (a) A current of 10 amp is flowing through a coil having 10 turns and of radius 0.5 m. Calculate the magnetic moment of the coil. 3
- (b) A magnetising field of 1000 A/m produces a magnetic flux of 2×10^5 weber in a bar of iron of cross-section 0.2 cm^2 . Calculate the permeability and susceptibility of the bar. 3

(2)

- (c) A transistor has a collector current of 5 mA and a base current of $20 \mu\text{A}$. Find the values of α and β . 3

- (d) Find the Thevenin's equivalent of the circuit given below between the terminals A and B. 3



2. (a) State Gauss's theorem. Using Gauss's theorem, find the electric field \vec{E} near a charged infinite plane of a non-conducting material of uniform surface charge density. 2+5=7

- (b) Prove that the line integral of the electric field due to a point charge between two points is independent of the path. 4

3. (a) A solid sphere of radius R has a uniform volume charge density ρ . Calculate the potential at any point outside the sphere. 4

(3)

- (b) What is an electrical image? A point charge $+Q$ is placed at a distance d from the centre of an earthed conducting sphere of radius a ($a < d$). Using the method of electrical images, calculate the field at any point on the sphere. 2+5=7

4. (a) Define magnetic susceptibility and permeability. Establish a relation between them to show that

$$B = \mu_0(1 + \chi_m) \vec{H} \quad 6$$

- (b) Explain what you understand by hysteresis, remanence (retentivity) and Coercivity. How will you determine the values of remanence and coercivity from a loop? 3+2=5

5. (a) Derive an expression for the growth and decay of an electric current in a circuit having a resistance R and self-inductance L . What is meant by time constant of the circuit? 3+3+2=8

- (b) Write down Maxwell's equations in a medium and identify the various symbols and the laws they represent. 3

(Turn Over)

(4)

6. (a) Explain the operation of a full-wave rectifier with a suitable diagram. Calculate the efficiency of rectification and ripple factor for a full-wave rectifier.

$$3+1+1=5$$

- (b) State and explain Norton's theorem. $1+5=6$

7. (a) What is an amplifier? Draw a circuit of typical single-stage CE amplifier and explain the functions of various circuit elements. Show that there is a phase difference of 180° between the input and output voltages in case of CE amplifier.

$$1+1+3+1=6$$

- (b) Define the four h -parameters for a transistor in CE mode. Draw the small signal low frequency hybrid parameter equivalent circuit of a CE amplifier and derive an expression for current gain.

$$2+3=5$$

8. (a) Explain the following terms/parameters associated with an op-amp :

$$1\frac{1}{2}\times 2=3$$

(i) Slew rate

(ii) CMRR

- (b) Design a NOR gate using NAND gate only. Write down the truth table of NAND and NOR logic gates.

$$1+1+1=3$$

(5)

- (c) What are clamping circuits? Draw diagram of positive peak clamping circuit. $1+1=2$
- (d) Write down the characteristics of an ideal op-amp. 3
