

2019

**PHYSICS**

(Theory)

Full Marks : 70

Pass Marks : 21

Time : Three hours

*Attempt all Questions.*

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

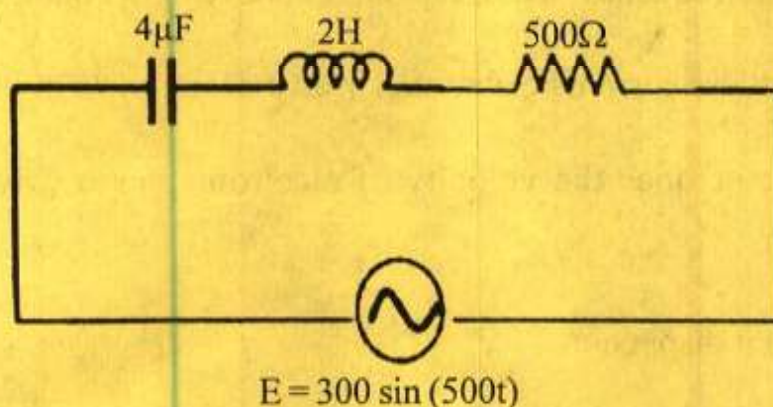
*Question Nos. 1 to 10, are "Very Short Answer" type questions carrying 1 mark each.*

1. Define relative permittivity of a medium on the basis of Coulomb's law. 1
2. A long straight thin-walled copper tube of radius  $R$  carries a current  $I$  along its length. What is the magnetic field along the axis of the tube? Give reason. 1
3. At a very high frequency of a.c. capacitor behaves as a conductor. Why? 1
4. How can wattless current be obtained in an a.c. circuit? 1
5. On what factor does the velocity of electromagnetic wave in a medium depend? 1
6. Define angular dispersion. 1

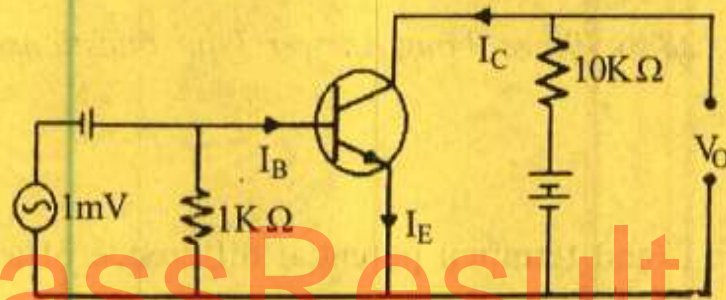
7. What is threshold frequency ? 1
8. What will happen if electron revolving around the nucleus comes to rest ? 1
9. What is mass defect ? 1
10. Give the bandwidth of TV signal for transmission. 1

Question Nos. 11 to 20 are 'Short Answer Type-II' questions carrying 2 marks each.

11. A glass rod held by hand can be charged by rubbing it with a silk cloth but an iron rod cannot be charged in a similar way. Explain this reason. 2
12. If two point charges  $8 \mu\text{C}$  and  $2 \mu\text{C}$  are separated by a distance 1 m in air. At what point on the line joining the two charges is the electric field intensity zero ? 2
13. A 6 ohm non insulated wire is bent  $180^\circ$  in the middle and the two halves are twisted together. What will be its new resistance? 2
14. Give two points of difference between diamagnetic and ferromagnetic substances. 2
15. In the given circuit, calculate phase difference between the current and the supply voltage. 2



16. How are gamma rays produced ? Give one example of its uses. 2
17. Draw a neat and label diagram of human eye. 2
18. If the Young's double slit experiment is performed in water instead of air, what would happen to the interference pattern obtained in the experiment? Explain. 2
19. In the given common emitter configuration, the current gain of the transistor is 100. Find the output voltage of the amplifier. 2



20. For faster action n-p-n transistor is used. Explain why ? 2

Question Nos. 21 to 27 are 'Short Answer Type-I' questions carrying 3 marks each.

21. What is meant by equipotential surface? Show that electric field is always perpendicular to the equipotential surface. 1+2=3
22. Derive an expression for self inductance of an air cored solenoid of length  $l$ , cross-section area  $A$  and having number of turns  $N$ . 3
23. Show that lateral displacement depends upon the angle of incidence and thickness of the glass slab. 3

24. Obtain the expression for de-Broglie wavelength of an electron when it is accelerated by a potential difference  $V$ . 3
25. Mention three points of difference between alpha and beta particles. 3
26. Explain with neat labelled circuit diagram, how zener diode is used as a voltage regulator? 3
27. Define the terms transducer, attenuation and repeater.  $1 \times 3 = 3$

*Question Nos. 28 to 30 are 'Long Answer Type' questions carrying 5 marks each.*

28. What are e.m.f. and terminal potential difference of a cell? Derive the expressions for equivalent e.m.f. and internal resistance when two different cells are connected in parallel.  $2+3=5$

OR

State Kirchhoff's laws of an electrical network. Using the Kirchhoff's laws, deduce the condition for which Wheatstone Bridge is balanced.  $2+3=5$

29. Draw a schematic labelled diagram of a cyclotron. Deduce an expression for the cyclotron frequency and show that it does not depend on the speed of the charged particle.  $1+3+1=5$

OR

Draw a neat labelled diagram of a moving coil galvanometer. Prove that the deflection produced in the galvanometer is directly proportional to the current flowing through it and define current sensitivity. 1+3+1=5

30. Derive thin lens formula for a convex lens when real image is formed by using the necessary ray diagram.

A convex lens of refractive index  $\frac{3}{2}$  has a focal length of 20 cm in air. Calculate the change in its focal length when it is immersed in water of refractive index  $\frac{4}{3}$ . 3+2=5

OR

Verify Snell's law of refraction using Huygen's principle with the help of diagram.

The intensity of light for maxima and minima in an interference pattern is 100:64. Calculate the ratio of intensities of the coherent sources producing this pattern.

3+2=5

*Question Nos. 31 to 34 are 'Multiple Choice Type' questions carrying 1 mark each. Choose the correct answer out of the four alternatives and rewrite the correct answer.*

31. A coil having an area  $A$  is placed perpendicularly in a magnetic field which changes from  $B$  to  $3B$  in time interval  $t$ , the emf induced in the coil is 1

A. 0

B. BA

C.  $\frac{BA}{t}$

D.  $\frac{2BA}{t}$

32. For constructive interference, path difference between the waves at the point of observation will be 1

A. odd multiple of  $\frac{\lambda}{2}$

B. even multiple of  $\frac{\lambda}{2}$

C. odd multiple of  $\lambda$

D. even multiple of  $\lambda$ .

33. In which region of electromagnetic spectrum does the Balmer series of hydrogen atom belongs to? 1

A. visible

B. infra-red

C. ultraviolet

D. X-rays.

34. The term LOS communication means

1

- A.* loss of signal
- B.* line of signal
- C.* loss of sight
- D.* line of sight.

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