

**PHYSICS**  
**(312)**

Time : 3 Hours

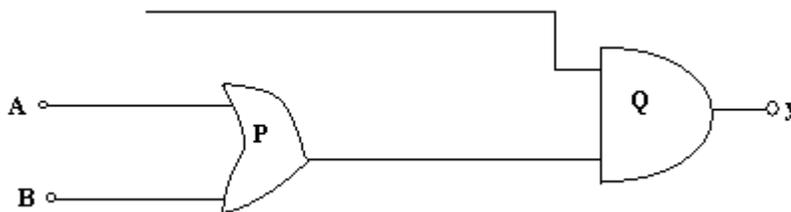
Maximum Marks : 100

- Note : (i) This question paper consists of two Sections, viz., 'A' and 'B'.  
(ii) All questions from Section 'A' are to be attempted.  
(iii) Section 'B' has got more than one option. Candidates are required to attempt questions from one option only.

**SECTION – A**

1. To what physical quantity does the area under velocity-time graph represent ? 1
2. State the law of parallelogram of vectors. 1
3. Why are steel bridges declared unsafe after a long use ? 1
4. Sketch lines of force due to a small negatively charged sphere. 1
5. The closed end of a pipe is always a node. Why ? 1
6. Name the physical quantity which has the same value for the waves belonging to different parts of electromagnetic spectrum. 1
7. What is the lateral displacement of light beam incident normally on a glass slab? 1
8. Out of the following nuclides, write the pair of isotones : 1  
 ${}^3_2\text{He}$ ;  ${}^{198}_{80}\text{Hg}$ ;  ${}^{12}_6\text{C}$ ;  ${}^3_1\text{H}$ ;  ${}^{197}_{79}\text{Au}$ ;  ${}^{12}_6\text{C}$
9. A ship of mass  $3 \times 10^7$  kg initially at rest is pulled by a force of  $5 \times 10^4$  N through a distance of 3 m. Assuming that the resistance due to water is negligible, calculate the speed of the ship. 2
10. Show that the value of acceleration due to gravity at a height  $h$  from the earth's surface is the same as the value of acceleration due to gravity at a depth  $d(=2h)$ , when  $h$  is very small compared to the radius of earth. 2
11. Check dimensionally the accuracy of the equation  $E=mgh + \frac{1}{2}mv^2$ , where  $E$  is the total energy. 2
12. Three capacitors have their capacitance in the ratio of 2:3:6 when they are connected in series across a 100 V battery, the combination acquires a charge of  $2\text{mC}$ . Calculate the capacitance of each capacitor. 2

13. How do (a) pole strength and (b) magnetic moment of a bar magnet change, if it is cut into two identical pieces transverse to its length ? 2
14. State Faraday's laws of electrolysis. Define the term 'Faraday constant'. 2
15. Distinguish between 'forced vibration and 'resonant vibration'. Give one example of each. 2
16. Explain the effect on the interference pattern observed in Young's double slit experiment, when the coherent sources are (a) infinitely close to each other and (b) far apart from each other. 2
17. What is nuclear force ? Mention its any three characteristic features. 2
18. An a.c. input signal of frequency 60 Hz is rectified by (a) half-wave and (b) full-wave rectifier. Draw the output waveform and write the output frequency in each case. 2
19. Identify logic gates P and Q in the given figure. 2



Write down the truth table to find the output at y.

20. What is an elastic collision ? In a one-dimensional elastic collision, when a body of mass ( $m_1$ ) with an initial velocity ( $u_1$ ) strikes another of mass ( $m_2$ ) which is at rest, find the expressions for the final velocities of the two bodies. Show that for the case of equal masses, they simply interchange their velocities. Give an example of such a type of collision. 3
21. The wheel of a car is completing 1200 rotations per minute. On pressing the accelerator of the car, the wheel makes 4500 rotations per minute in a time interval of 10 seconds. Calculate (a) angular acceleration and (b) number of rotations in 10 seconds. 3
22. State Pascal's law of transmission of liquid pressure. With the help of a diagram, explain the working principle of hydraulic lift. Write an expression for its mechanical advantage. 3
23. What is meant by the term entropy of a system ? Write mathematical expression for it in a reversible process. Discuss its physical significance. 3

24. A cubical thermacole box, full of ice, has side 30 cm and thickness 50 cm. If the outside temperature is 45°C, find the amount of ice melted in 6 hours . (Thermal conductivity (k) for thermacole is 0.01 Js<sup>-1</sup>m<sup>-1</sup>°C<sup>-1</sup> and latent heat of fusion of ice is 335 Jg<sup>-1</sup>). 3
25. An alternating e.m.f. by  $\pi/2$  or 90°. Define the inductive reactance and write its unit. Draw a graph showing the variation of inductive reactance with frequency. 3
26. Draw the diagrams showing the formation of harmonics in an open organ pipe. Show that the frequencies of harmonics are in the ratio of 1:2:3 of the fundamental note. 3
27. Draw a labeled circuit diagram to study the characteristics curves of a transistor (p-n-p) in common base configuration. Draw the graphs showing the input, output characteristics in this configuration. 3
28. Deduce (a) Graham's law of diffusion of gases and (b) Avogadro's law on the basis of kinetic theory of gases. 4
29. Write the principle of a potentiometer. Draw a labeled circuit diagram and explain how you compare the e.m.f.'s of two primary cells using the potentiometer. Write the formula used. Write two advantages of a potentiometer. 4
30. Show with the help of a diagram, the formation of the image of a point object placed on the principal axis of a thin convex lens. Derive the formula
- $$\frac{1}{v} - \frac{1}{u} = (\mu - 1) \left[ \frac{1}{R_1} - \frac{1}{R_2} \right]$$
- Where  $\mu$  is the refractive index of material of lens. State the sign convention used. 4
31. Define the terms (a) half-life period and (b) average-life period of any radioactive element.
- The decay constant of a radioactive nuclide has the value of 1.386 day<sup>-1</sup>. After how much time will a given sample of this radioactive nuclide get reduced to only 6.25% its present amount ? 4

**SECTION-B**  
**OPTION-I**  
**(Astrophysics)**

32. Write two technical difficulties in constructing an X-ray telescope. 1
33. What are pulsars ? 1

34. The light collecting power of a telescope is 75000 and its transmission efficiency is 75%. Calculate the diameter of refracting telescope. 2
35. What are periodic comets ? Name one periodic comet and write its period of revolution around the sun. How does a comet develop a tail ? In which direction does the tail point ? 3
36. What are meant by the terms (a) magnetic axis, (b) magnetic pole and (c) magnetic equator in respect to the magnetic field of the earth ? Indicate these on a diagram. 3

OPTION-II  
**(Electronics in Daily Life)**

32. What is the effect of ripple on TV sets ? 1
33. What is a passive transducer ? Give its one example. 1
34. Write the basic difference LED and LCD. Which of the two consumes less power and why ? 2
35. Mention (a) three advantages of IC over a discrete circuit and (b) three limitations of IC technology. 3
36. Draw a labeled block diagram showing the basic structure of a micro-computer. 3

OPTION-III  
**(Photography and Audio-Videography)**

32. What is the focal length of a normal lens of 35 mm camera ? 1
33. Name the type of camera used to produce photographs almost instantaneously. 1
34. Distinguish between the terms 'analogue' and 'digital'. Give one example each of analogue and digital devices. 2
35. With the help of a block diagram, describe the recording process in a tape recorder. Mention the two other functions of tape recorder. 3
36. What is the action of film developer on the exposed film ? What is sodium thiosulphate commonly known as ? What role does it play in the film processing ? 3