

Tribhuvan University
Institute of Science and Technology

2080



Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (PHY118)
(Physics)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.
The questions are of equal value.

Section A

Long Answer Questions:

Attempt any TWO questions

[2×10=20]

1. Distinguish rigid and non-rigid body. Derive an expression for rotational kinetic energy and discuss the conditions for conservation of energy. A wheel of radius 0.4 m and moment of inertia 1.2 kg-m^2 , pivoted at the center, is free to rotate without friction. A rope is wound around it and a 2-kg weight is attached to the rope. When the weight has descended 1.5 m from its starting position, find the rotational velocity of the wheel. [10]
2. Setup Schrodinger equation for Hydrogen atom using spherical polar coordinates. Separate radial and angular part of this equation using appropriate separation constant. Discuss the separation constant and hence the quantum numbers associated with these two equations. What information can be drawn from the angular part of the Schrodinger equation? Explain. [10]
3. What are RTL and TTL gates? How memory and clock circuits can be made by using these gates? Show it. Explain their working scheme. Is it true that TTL logic gates are typically fabricated onto a single integrated circuit (IC)? [10]

Section B

Short Answer Questions:

[8×5=40]

Attempt any EIGHT questions:

4. Describe classical free electron model. [5]
5. How electric and magnetic fields are incorporated in electromagnetic wave? Explain. [5]
6. Describe the following process of IC production: (a) Oxidation and (c) Doping. Explain Photolithography in brief. [5]
7. An oscillating block of mass 250 g takes 0.2 sec to move between the endpoints of the motion, which are 50 cm apart. Find the frequency and amplitude of the motion. What is the force constant of the spring? [5]
8. A potential difference of 100 V is applied between the two plates one being at the high potential. An alpha particle of charge $q = 3.2 \times 10^{-19} \text{ C}$ is released from one plate to another plate. What will be the velocity of the alpha-particle when it reaches the plate? The mass of the alpha particle is $6.70 \times 10^{-19} \text{ kg}$. [5]

9. Calculate the uncertainty in the momentum of an electron if uncertainty in its position is 1 \AA (10^{-10} m). [5]
10. A current of 50 A is supplied in a slab of copper 0.5 cm thick and 2 cm wide which is placed in a magnetic field B of 1.5 T . The magnetic field is perpendicular to the plane of the slab and to the current. If the free electron concentration in copper is $8.4 \times 10^{28} \text{ electrons/m}^3$, what will be the magnitude of the Hall voltage across the width of the slab? [5]
11. Sodium has a body-centered cubic structure with a one-atom basis. The density and the atomic weight of sodium are 0.971 g/cm^3 and 23 g/mole , respectively. What is the length of the unit cube of the structure? [5]
12. The output of a digital circuit (y) is given by this expression:
$$y = (C + \bar{B}A)(\overline{A + B + D})$$
where A, B, C and D represent inputs. Draw a circuit of above equation using OR, AND and NOT gate and hence find its truth table. [5]