

Tribhuvan University  
Institute of Science and Technology  
2075  
☆

Bachelor Level / First Year/ First Semester/ Science  
Computer Science and Information Technology (PHY. 113)  
(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 figures in the margin indicate full marks.

Attempt any two questions:

*Handwritten notes:*  $q_1$   $\odot$   $q_2$

(10×2=20)

1. Explain the process of semiconductor purification by describing the terms Zone refining, Single crystal growth, and scheme of IC production. Give an account of electronic component fabrication on a chip. (10)
2. Set up differential equation for an oscillation of a spring using Hooke's and Newton's second law. Find the general solution of this equation and hence the expressions for period, velocity and acceleration of oscillation.  $\omega = 2\pi f$   $2\pi \sqrt{\frac{k}{m}}$  (10)
3. Describe Frank Hertz experiment. Discuss its result and outline limitations.  $E = \frac{h\nu}{\lambda}$  (10)

Attempt any eight questions:

*Handwritten notes:*  $E = \frac{h\nu}{\lambda}$

(5×8=40)

4. Discuss magnetic dipole moment. What is its effect on atom and on molecules? Explain. (5)
5. Explain Bloch theorem? Discuss its use in Kronig-Penny model and hence in band theory. (5)
6. Explain the construction and working of bipolar junction transistor (BJT). (5)
7. A large wheel of radius 0.4 m and moment of inertia 1.2 kg-m<sup>2</sup>, 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 (a) what is its downward velocity? (b) what is the rotational velocity of the wheel?  $2.48$   $6.22$   $4.5$  (5)
8. An electron is placed midway between two fixed charges,  $q_1 = 2.5 \times 10^{-10}$  C and  $q_2 = 5 \times 10^{-10}$  C. If the charges are 1 m apart, what is the velocity of the electron when it reaches a point 10 cm from  $q_2$ ?  $3.125 \times 10^{-19}$   $19.76 \times 10^{-5} \text{ m/s}$  (5)
9. A small particle of mass  $10^{-6}$  gm moves along the x axis; its speed is uncertain by  $10^{-6}$  m/sec. (a) What is the uncertainty in the x coordinate of the particle? (b) Repeat the calculation for an electron assuming that the uncertainty in its velocity is also  $10^{-6}$  m/sec. Use the known values for electrons and Planck's constant.  $5.154 \times 10^{-19} \text{ m}$   $115.78 \text{ m}$  (5)
10. What is the probability of finding a particle in a well of width  $a$  at a position  $a/4$  from the wall if

$n = 1$ , if  $n = 2$ , if  $n = 3$ . Use the normalized wavefunction  $\psi(x, t) = \left(\frac{2}{a}\right)^{\frac{1}{2}} \sin\left(\frac{n\pi x}{a}\right) e^{\frac{iE_n t}{\hbar}}$ .

(5)



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11. Assuming that atoms in a crystal structure are arranged as close-packed spheres, what is the ratio of the volume of the atoms to the volume available for the simple cubic structure? Assume a one-atom basis. (5)

12. The output of a digital circuit (y) is given by this expression:

*W* 
$$y = (CB + \bar{C}A)(\bar{B}A)$$

where A, B and C represent inputs. Draw a circuit of above equation using OR, AND and NOT gate and hence find its truth table. (5)