

MANMOHAN TECHNICAL UNIVERSITY
OFFICE OF THE CONTROLLER OF EXAMINATIONS
Model Question, 2080, Asar

Level: Bachelor
Faculty: School of Engineering
Program: Electrical & Electronics
Subject: Modern Physics (EG454SH)

Year/Part: I/II
F.M.: 50
P.M.: 20
Time: 3 Hours

Group A

***Attempt ALL Questions* [10 × 1 = 10]**

Instructions:

- Choose one answer out of four options.
- Use black ball pen for shading only one circle for correct option of a question in Answer Sheet which you have provided.
- No mark will be awarded for cutting, erasing, over writing and multiple circles shading

1. Nuclear forces are mediated by
a. Proton b. Neutron c. Meson d. Electron
2. The wavelength of the matter waves is independent of
a. Mass b. Velocity c. Momentum d. Charge
3. In nuclear reaction, there is conservation of
a. mass only b. energy only
c. mass energy and momentum d. momentum only
4. The mass energy relation is the outcome of
a. special theory of relativity b. quantum theory
c. field theory of relativity d. general theory of relativity
5. The mass defect per nucleon is called
a. binding energy b. packing energy
c. ionization energy d. excitation energy
6. Metastable state in laser is
a. short lived state of atoms in the ground state
b. long lived state of atoms in the ground state
c. short lived state of atoms in the excited state
d. long lived state of atoms in the excited state
7. An atom at the ground level is carried to the excited level by photon. It is known as
a. spontaneous absorption b. induced emission
c. induced radiation d. induced absorption
8. Neutron was discovered by
a. Rutherford b. James Chadwick c. J. J. Thomson d. Henry Becquerel
9. The main source of solar energy is
a. combustion b. nuclear fission
c. nuclear fusion d. none of the above
10. The fuel used in nuclear power plant is
a. U- 235 b. U-236 c. U-238 d. U-239

Group B

Attempt any EIGHT questions [[8 × 2 = 16]

11. How fast would a rocket have to go relative to an observer for its length to be contracted?
12. Prove the Einstein's mass energy relation for the body at rest to be: $E = mc^2$.
13. Derive a relation between group and phase velocity.
14. State and explain the tunnel effect.
15. Explain main features of a continuous X-Ray spectra.
16. Define the magnetic orbital quantum number and magnetic spin quantum number associated with the vector atom model.
17. Explain a ruby laser with diagram.
18. What is a nuclear fission? Show the fission process of an uranium atom and explain it in brief.
19. Discuss about the result obtained by Rutherford's α –particle scattering experiment.

Group C

Attempt any SIX questions [6 × 4 = 24]

20. State and explain the Michelson-Morley experiment. Explain with examples about the relationship between theory of relativity at modern and Vedic era.
21. Enlist and discuss about the types of nuclear reactors. Explain the pressurized water reactor (PWR) in detail.
22. Explain Davisson-Germer's experiment with the obtained result. Calculate the observed wavelength for a single crystal of nickel. If the electron KE is 54 eV, find the electron wavelength too.
23. Write about the characteristics assigned by Yukawa to the nuclear forces. Enlighten about the meson theory of nuclear forces and find the relation between mass of meson and mass of electron.
24. State the properties of a wave function. Prove: $i\hbar \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \left(\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2} \right) + V\psi$
25. What is a nuclear size? Write about binding energy with appropriate relation and hence illustrate it.
26. Define an X-Ray Spectra and hence state and explain Duane-Hunt law. Explain Moseley's law with explanation in accordance to Bohr's theory.
