MAHATMA GANDHI UNIVERSITY, KOTTAYAM

MGU-UGP (HONOURS)

SECOND SEMESTER EXAMINATION

(2024 ADMISSION ONWARDS)

MG2DSCPHY100 – Modern Physics

Duration: 1.5 hrs Maximum Marks: 50

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

Part A

Short Answer Type Questions

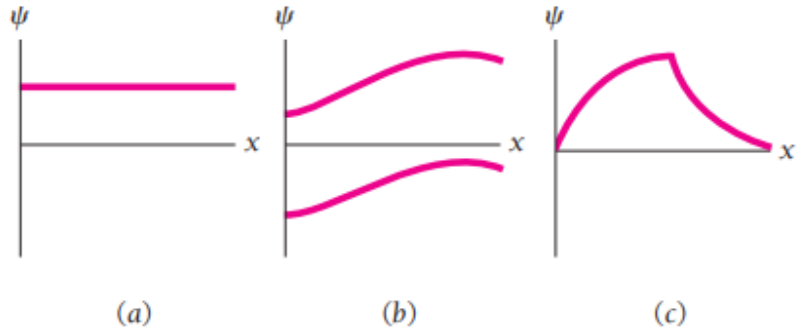
Answer any **10** questions

Each question carries **2** Mark

1	Distinguish between inertial and non-inertial frames of reference	[U][1]
2	State the two postulates of special relativity.	[R][1]
3	What will be the shape of a spherical ball moving with a relativistic velocity in the x direction as observed by an observer at rest? Explain.	[A][1]
4	Calculate the energy equivalent of 1 kg of coal.	[R][1]
5	What is meant by the work function of a metal?	[U][2]
6	In the photoelectric effect, what happens if the frequency of incident light is increased while keeping intensity constant.	[U][2]
7	What is meant by ultraviolet catastrophe?	[U][2]
8	Define matter waves. Also give the equation for wavelength of a matter wave.	[R][2]
9	What is called a wave function? What is its significance?	[R][2]
10	Distinguish between continuous spectra and line spectra.	[U][3]
11	Which series of Hydrogen spectrum lies in the visible region? write the transitions.	[U][3]
12	What is called pumping in a laser system?	[R][4]

13 Write Steady state form of Schrodinger wave equation. [R][5]

14 Given the following wavefunctions, which are not admissible wave functions? Explain. [U][5]



(2x10=20)

Part B

Short Essay Type Questions

Answer any **6** questions

Each question carries **5** marks

15 A particle moving at $0.95c$ has a proper lifetime of 2 μs. What is its observed lifetime in the laboratory frame? [U][1]

16 Calculate the length of a meter scale moving in x-direction with a velocity $0.8c$, where c is the velocity of light in vacuum. [U][1]

17 The minimum frequency for photoelectric emission in copper is 1.1×10^{15} Hz. Find the maximum energy of the photoelectrons when light of frequency 1.5×10^{15} Hz is directed on a copper surface. [U][2]

18 Derive the expression for energy density of blackbody radiation using Planck's law. [R][2]

19 Show how Heisenberg's uncertainty principle prevents an electron from existing inside a nucleus by estimating the minimum uncertainty in energy for an electron confined within a nuclear radius ($\sim 10^{-15} m$). [A][2]

20 Find the shortest and longest wavelengths in the Balmer series spectrum of Hydrogen. [U][3]

21 Expand the acronym LASER. Explain four properties of LASER light [U][4]

22 Find the probability that a particle trapped in a box L wide can be found between 0.45L and 0.55L for the ground and first excited states. [U][5]

(5x6=30)

MAHATMA GANDHI UNIVERSITY, KOTTAYAM

MGU – UGP (HONOURS)

SECOND SEMESTER EXAMINATION

(2024 ADMISSION ONWARDS)

MG2MDCPHY100 – Observational Astronomy

Duration: 1 hr Maximum Marks: 35

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

PART A

Multiple Choice Questions

Answer **ALL** questions. Each question carries **1** mark.

1. Which of the following is the smallest? [R] [1]

   a) Earth b) Universe c) Galaxy d) Sun

2. Astronomical Unit (AU) is defined as the average distance between: [R] [1]

   a) Earth and the Moon b) Earth and Mars c) Earth and the Sun d) Sun and Jupiter

3. According to Ptolemaic model, which among the following is correct? [U] [1]

   a) Earth is one of the planets orbiting the Sun b) The Earth is at the center of the universe c) The Earth revolves around the Sun d) The Earth revolves around the Moon

4. Which astronomer challenged the Ptolemaic model and proposed a new model? [R] [1]

   a) Galileo Galilei b) Nicolaus Copernicus c) Johannes Kepler d) Isaac Newton

5. Which instrument did Galileo improve to make astronomical discoveries? [R] [1]

   a) Microscope b) Telescope c) Barometer d) Sextant

6. What do you mean by celestial sphere? [U] [4]

   a) A real sphere surrounding the earth b) An imaginary sphere used for mapping celestial objects c) The outermost layer of earth's atmosphere d) A solid structure in space

7. The apparent path of the Sun against the background stars is known as: [R] [4]

a) Equator b) Ecliptic c) Equinox d) Zodiac

8. Which among the following represents the order of the seasons? [R] [4]

a) Winter-Summer-Autumn-Spring b) Spring-Summer-Autumn-Winter c) Winter-Summer-Autumn-Spring d) There is no order

9. Which animal represents the zodiac sign Leo? [R] [4]

a) Lamb b) Bear c) Tiger d) Lion

10. The average surface temperature of Sun is 6000 K. Sun belongs to which spectral class? [An] [3]

a) G b) O c) B d) A

11. Which one represents the primary component of most nebula? [R] [3]

a) Hydrogen and Helium b) Iron and Nickel c) Carbon Dioxide and Methane d) Uranium and Lead

12. What is the primary fuel used by main sequence stars for energy production? [R] [3]

a) Helium b) Hydrogen c) Carbon d) Oxygen

13. Which star is most likely to become a supernova? [U] [3]

a) The Sun b) A small star c) A very big star d) A comet

14. What is the typical diameter of a neutron star? [R] [3]

a) 10000 km b) 1000 km c) 100000 km d) 10-20 km

15. Milky way galaxy belongs to: [R] [4]

a) Elliptical Galaxy b) Spiral Galaxy c) Irregular Galaxy d) Lenticular Galaxy

(1 x 15 = 15)

PART B

Multiple Choice Questions

Answer **ALL** questions. Each question carries **2** marks.

16. Lunar eclipse occurs when: [R] [5]

a) Earth's shadow is cast on Moon
b) Moon comes in between Sun and Earth
c) Moon and earth is at nearest distance from earth
d) Sun is between earth and Moon

17. Choose one advantage of the Hubble Space Telescope over ground-based telescopes? [U] [2]
a) Large mirror
b) No atmospheric loses
c) It is closer to planets
d) Bigger telescope

18. Which among the following describes the orbital motion of James Webb telescope? [R] [2]
a) Orbits around moon
b) Orbits around sun
c) Orbits around earth
d) Fixed at space

19. What do refractive telescopes use to focus light? [R] [2]
a) Mirrors
b) Lenses
c) Prisms
d) Filters

20. Which of the following is NOT a type of galaxy? [R] [4]
a) Elliptical
b) Spiral
c) Circular
d) Irregular

21. Which process is responsible for energy production in sun? [U] [5]
a) Nuclear Fusion
b) Nuclear Fission
c) Dispersion
d) Interference

22. Which among the following is the hottest planet in the solar system? [R] [5]
a) Earth
b) Mars
c) Mercury
d) Venus

23. Asteroids are primarily composed of: [R] [5]
a) Ice and gas
b) Rock and metal
c) Dust and organic material
d) Frozen gases

24. What causes a meteor to glow? [U] [5]
a) Nuclear fusion
b) Chemical reactions
c) Friction with the atmosphere
d) Solar radiation

25. The main source of information about celestial bodies are obtained from: [R] [2]
a) electromagnetic spectrum
b) electrochemical spectrum
c) geomagnetic spectrum
d) none of the above

(2 x 10 = 20)