| Code No. | N – 3580 |
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# Entrance Examination for Admission to the P.G. Courses in the Teaching Departments, 2022

## CSS

## PHYSICS (APPLIED ELECTRONICS/SPACE PHYSICS/ RENEWABLE ENERGY/NANO SCIENCE

**General Instructions**

1. The Question Paper is having two Parts — Part 'A' Objective type (60%) & Part 'B' Descriptive type (40%).
2. Objective type questions which carry 1 mark each are to be (✓) 'tick marked' in the response sheets against the appropriate answers provided.
3. 8 questions are to be answered out of 12 questions carrying 5 marks each in Part 'B'.
4. **Negative marking** : 0.25 marks will be deducted for each wrong answer in Part 'A'.

**Time : 2 Hours** **Max. Marks : 100**

| To be filled in by the Candidate | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Register Number | in Figures | | | | | | | | |
| | in words | | | | | | | | |

PART – A

(Objective Type)

Choose appropriate answer from the options in the questions. **One** mark **each**.

**(60 × 1 = 60 marks)**

1. Which of the statement is correct?
   In photoelectric effect,
   a) Photons are generated when electrons fall on a metal surface.
   b) Photons are generated when electrons fall on a dielectric surface.
   c) Electrons are generated when photons fall on a metal surface.
   d) Electrons are generated when photons fall on a dielectric surface.

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2. The energy of the photoelectron depends on
   a) The velocity of the photon.
   b) The frequency of the photon.
   c) Both the velocity and frequency of the photon.
   d) Intensity of the incident light.

3. Photoelectric effect can be explained only by ————————
   a) Wave nature of light
   b) Particle nature of light
   c) Both wave and particle nature of light
   d) None of the above

4. If *hv* is the energy of the incident photon, the energy of the photoelectron will be _____

a) Equal to *hv*
b) Greater than *hv*
c) Less than *hv*
d) Any of the above

5. Einstein's coefficients of absorption and stimulated emission. $B_{12}$ and $B_{21}$, are related by

a) $B_{12}=B_{12}$
b) $B_{12}<B_{12}$
c) $B_{12}>B_{12}$
d) Any of the above

6. Which one of the following statements best describes stimulated emission in a laser?

a) Photons interact with atoms in a metastable state and cause electrons to be emitted
b) Photons interact with atoms in a metastable state and cause photons to be emitted
c) Atoms in a metastable state de-excite and cause electrons to be emitted
d) Electrons collide with atoms in a metastable state and cause photons to be emitted

7. Which characteristic of LASER allows it to be used in holography?

a) Monochrormaticity
b) Intensity
c) Directionality
d) Coherence

8. A light beam spreads out when it travels through a narrow slit. This is due to _____

a) Interference
b) Polarization
c) Diffraction
d) Reflection

9. If N1 and N2 the populations of lower and upper levels respectively, and A21, B12 and B21 Einstein's coefficients, which of the following equations is correct in thermal equilibrium?

a) A21N2 = B12N1 $\rho(\gamma)$ +B21N2 $\rho(\gamma)$
b) A21N2 = B12N1 $\rho(\gamma)$ – B21N2 $\rho(\gamma)$
c) B12N1 $\rho(\gamma)$ – A21N2 + B21N2 $\rho(\gamma)$
d) B2IN2 $\rho(\gamma)$ = A21N2+ B12N2 $\rho(\gamma)$

10. Bohr quantum condition for a stable atom is

a) L = nh
b) Ln = h/2
c) L = nh/2
d) L= $2\pi$ n/c

11. The de Broglie wavelength of matter is given by the expression ————————

a) = hmv
b) =h/mv
c) = h /2mv
d) = h/2 $\times$ mv

12. When there are no external forces, the shape of a liquid drop is determined by

a) Surface Tension of the liquid
b) The density of the liquid
c) The viscosity of the liquid
d) The temperature of air only

13. If T is the surface tension of the soap solution, the amount of work done in blowing a soap bubble from diameter D to a diameter 2Dis ————————.

a) $2\pi$ $D^2T$
b) 4 $\pi$ $D^2T$
c) 6 $\pi$ $D^2T$
d) 8 $\pi$ $D^2T$

14. If the surface of a liquid is plane, then the angle of contact of the liquid with the walls of the container is

a) Acute angle
b) Obtuse angle
c) 90º
d) 0º

15. Bernaulli's equation is applied to ————————

a) Venturimeter
b) Orifice meter
c) Pitot tube meter
d) All the above

16. Which one of the following substances is not elastic?

a) Iron
b) Copper
c) Brass
d) Modelling clay

17. With rise in temperature, Young's modulus of elasticity, ————————

a) Increases
b) Decreases
c) Remains constant
d) May increase or decrease.

18. The property of a body by which it tends to regain its original size and shape when the applied force is removed, is known as

a) Elasticity
b) Plasticity
c) Viscosity
d) Rigidity

19. For a harmonic oscillator, the zero-point energy is

a) $hv$
b) $2\,hv$
c) $\frac{1}{2}\,hv$
d) $2\pi hv$

20. Which of the following is the energy operator?

a) $i\hbar\partial/\partial t$
b) $-i\hbar\partial/\partial t$
c) $-i\hbar\partial/\partial x$
d) $I\hbar v$

21. Hamiltonian I-I is given by ————————.

a) T+V
b) T-V
c) V-T
d) 2T+V

22. Moment of inertia of a square of side b about an axis through its centre of gravity is ————————

a) $b^3/4$
b) $b^4/12$
c) $b^4/4$
d) $b^4/8$

23. The moment of inertia of an area is

a) kg/m
b) $kg/m^2$
c) $m^4$
d) $m^3$

24. Moment of linear momentum is ————————.

a) r x mv
b) r x m
c) r x v
d) r/mv

25. In a simple harmonic oscillation represented by the equation $X = A\,Cos(\omega t + \varphi), \omega$ represents

a) Displacement
b) Amplitude
c) Angular frequency
d) Phase

26. A simple harmonic oscillation which dies out after some time is called ————————

a) Damped oscillation
b) Free oscillation
c) Undamped oscillation
d) Dependent oscillation

27. The amount of energy a wave carries corresponds with its ————————

a) Crest
b) Amplitude
c) Wavelength
d) Period

28. The graph between volume and temperature in Charles' law is ————————

a) an ellipse
b) a circle
c) a straight line
d) a parabola

29. When a uniform rod is heated, which of the following quantity of the rod will increase?

a) Mass
b) Weight
c) Center of mass
d) Moment of inertia

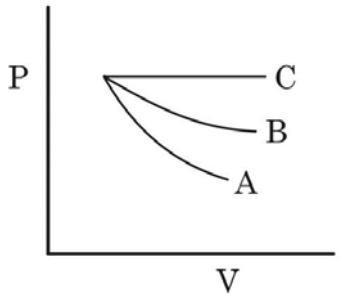
30. ———————— of thermodynamics is used to understand the concept of energy conservation.

a) Zeroth law
b) First law
c) Second law
d) None of the above

31. In which thermodynamic process is there no heat flow between the system and the surroundings?

a) Isothermal
b) Adiabatic
c) Isochoric
d) Isobaric

32. It is known that curves A, B, C are Isobaric. Isothermal, Adiabatic process then when one is correct




a) A - Adiabatic, B - Isothermal, C - Isobaric
b) A- Isothermal, B- Adiabatic, C - Isobaric
c) A - Isobaric, B - Isothermal, C - Adiabatic
d) None of these

33. Lagrangian L of a system is given by ————————

a) T+V
b) 2T+V
c) T-V
d) T-2V

34. Lagrangian bracket is ————————

a) Canonical invariant
b) Canonical variant
c) Non-invariant
d) None of these

35. Poisson's bracket is ————————

a) Invariant under canonical transformation
b) Variant under canonical transformation
c) Both a & b
d) None of these.

36. The Langrangian equation of motion are order differential equations.

a) First
b) Second
c) Third
d) Fourth

37. Canonical transformations are transformation of ————————

a) Phase space
b) Minkowski space
c) Hilber space
d) None of these

38. A rod of proper length $l_0$ moves with velocity $v$ such that its length becomes $l/2$. What is the value of $v$? (in terms of c, the velocity of light in vacuum).

a) $c$
b) $c\sqrt{2}$
c) $c/\sqrt{2}$
d) $\sqrt{2/c}$

39. A body of rest mass $m_0$ is travelling with a velocity 0.8c What is its mass in motion?

a) $m_0/0.6$
b) $0.6\ m_0$
c) $m_0/0.06$
d) $0.06m_0$

40. The quantum analogue of the classical expression p (momentum) is ————————

a) h/k
b) $\hbar$/k
c) hk
d) $\hbar$k

41. The surface temperature of a star is determined using ————————

a) Planck's law
b) Wien's law
c) Stefan's law
d) Kirchoff's law

42. Calculate the acceptance angle of fiber with a core index of 1.52 and a cladding index of 1.50

a) 24°14'
b) 14°14'
c) 18°14'
d) 28°14

43. The basic principle of working of an optical fiber is ————————

a) Diffraction
b) Interference
c) Total internal reflection
d) Refraction

44. *Sine* of the acceptance angle of the fibre is ————————.

a) Angle of incident
b) Angle of reflection
c) Numerical aperture
d) None of these

45. Calculate the numerical aperture of fiber with a core index of 1.52 and a cladding index of 1.50

a) 0.246
b) 0.346
c) 0.126
d) 0.175

46. Raman effect is due to change of ———————— of a molecule, during vibration.

a) Polarizability
b) Dipole moment
c) Molecular radius
d) Molecular weight

47. Two charges are placed at a certain distance. If the magnitude of each charge is doubled the force will become,

a) 1/4th of its original value
b) 1/8th of its original value
c) 4 times of its original value
d) 8 times of its original value

48. Two positive point charge are placed at the distance a apart have sum Q. What values of the charges, coulomb force between them is maximum?

a) $q_1=q_1=Q/2$
b) $q_1= 3\ Q/4,\ q_2=Q/4$
c) $q_1= 5\ Q/6,\ q_2=Q/6$
d) None of the above

49. The Boolean expression for $\overline{A}\ \overline{B} + \overline{A} + AB$ is equivalent to ————————.

a) A
b) $\overline{A}$
c) 1
d) 0

50. 8086 is a ———————— microprocessor.

a) 16 bit
b) 8bit
c) 4bit
d) 64bit

51. Which of the following language is used in 8085 microprocessor?

a) Machine language
b) High level language
c) Low level language
d) Assembly language

52. The open loop gain of an operational amplifier is

a) Infinity
b) Zero
c) One
d) Any of the above.

53. Which of the following statement is correct in the case of a Common Emitter amplifier?

a) Both the base-collector and base-emitter junctions are reverse biased.
b) Both the base-collector and base-emitter junctions are forward biased.
c) The base-collector junction is reverse biased and base-emitter junction is forward biased.
d) The base-collector junction is forward biased and base-emitter junction is reverse biased.

54. A geostationary satellite revolves around the earth from ————————.

a) East to west
b) West to east
c) North to south
d) South to north.

55. Fermions are particles with spin = ————————

a) 0
b) 1
c) ½
d) 3/2

56. Vectors which are in the same direction are called

a) Planar vectors
b) Coplanar vectors
c) Collinear vectors
d) Null vector

57. Null vectors are vectors ————————

a) With zero magnitude
b) With infinite magnitude
c) With no direction
d) None of the above.

58. The curl of a vector $(xi + yj + zk)$ is ————————.

a) Zero
b) $i + j + k$
c) $-(i+j+k)$
d) $(i-j-k)$

59. Which of the statement is not correct?

a) The curl operator is operated on a scaler and the result is a vector
b) The curl operator is operated on a vector and the result is a vector
c) The gradient operator is operated on a scaler and the result is a vector
d) The divergence operator is operated on a vector and the result is a scaler

60. Which of the following vectors is not orthogonal to the vector $(a\boldsymbol{i} + b\boldsymbol{j})$?

a) $(b\boldsymbol{i} + a\boldsymbol{j})$
b) $(b\boldsymbol{i} - a\boldsymbol{j})$
c) $(-b\boldsymbol{i} + a\boldsymbol{j})$
d) None of the above

ANSWER SHEET — PART – A

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | B | C | D | E | 21 | A | B | C | D | E | 41 | A | B | C | D | E |
| 2 | A | B | C | D | E | 22 | A | B | C | D | E | 42 | A | B | C | D | E |
| 3 | A | B | C | D | E | 23 | A | B | C | D | E | 43 | A | B | C | D | E |
| 4 | A | B | C | D | E | 24 | A | B | C | D | E | 44 | A | B | C | D | E |
| 5 | A | B | C | D | E | 25 | A | B | C | D | E | 45 | A | B | C | D | E |
| 6 | A | B | C | D | E | 26 | A | B | C | D | E | 46 | A | B | C | D | E |
| 7 | A | B | C | D | E | 27 | A | B | C | D | E | 47 | A | B | C | D | E |
| 8 | A | B | C | D | E | 28 | A | B | C | D | E | 48 | A | B | C | D | E |
| 9 | A | B | C | D | E | 29 | A | B | C | D | E | 49 | A | B | C | D | E |
| 10 | A | B | C | D | E | 30 | A | B | C | D | E | 50 | A | B | C | D | E |
| 11 | A | B | C | D | E | 31 | A | B | C | D | E | 51 | A | B | C | D | E |
| 12 | A | B | C | D | E | 32 | A | B | C | D | E | 52 | A | B | C | D | E |
| 13 | A | B | C | D | E | 33 | A | B | C | D | E | 53 | A | B | C | D | E |
| 14 | A | B | C | D | E | 34 | A | B | C | D | E | 54 | A | B | C | D | E |
| 15 | A | B | C | D | E | 35 | A | B | C | D | E | 55 | A | B | C | D | E |
| 16 | A | B | C | D | E | 36 | A | B | C | D | E | 56 | A | B | C | D | E |
| 17 | A | B | C | D | E | 37 | A | B | C | D | E | 57 | A | B | C | D | E |
| 18 | A | B | C | D | E | 38 | A | B | C | D | E | 58 | A | B | C | D | E |
| 19 | A | B | C | D | E | 39 | A | B | C | D | E | 59 | A | B | C | D | E |
| 20 | A | B | C | D | E | 40 | A | B | C | D | E | 60 | A | B | C | D | E |

## PHYSICS

PART – B

(Descriptive Type)

Answer **any eight** questions. **(8 × 5 = 40 Marks)**

1. Define Stress and Strain. Explain Different types of modulus of elasticity.

2. State and explain Newton's law of cooling.

3. Derive Time independent Schrodinger equation.

4. Deduce Kepler's laws of planetary motion.

5. Derive Poisson's and Laplace's equation.

6. Derive expression relativistic variation of mass. Explain why matter cannot travel with velocity more than *c*.

7. Explain different types of charge distributions, and obtain equations for electric field due to these charge distributions.

8. Explain Hall effect and derive expression for Hall constant.

9. Explain the postulates of vector atom model, and explain the different quantum numbers involved and their significance.

10. State and briefly explain first law of thermodynamics. Obtain equation for specific heat of gas and their relation.

11. Explain, with the help of a circuit diagram, the working of an astable multivibrator.

12. Explain the principle and construction of a hologram.

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