A

Paper Code : 18 Sr. No. 851

PHYSICAL SCIENCES [Paper-II]

Signature and Name of Invigilator

1. (Signature) _____
   (Name) _____
2. (Signature) _____
   (Name) _____

OMR Sheet No. : .....
(To be filled by the candidate)

Roll No. | | | | | | | | | | |
(In Figures as per admission card)

Roll No. _____
(In words)

Time : 1¼ Hours] **[Maximum Marks : 100**

Number of Pages in this Booklet : 16 **Number of Questions in this Booklet : 50**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of fifty multiple-choice type of questions.
3. At the commencement of examination, the question bookelt will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Fault booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   (ii) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the oval as indicated below on the correct response against each item.
   Example : (A) (B) ● (D)
   where (C) is the correct response.
5. Your responses to the items are to be indicated in the Answer Sheet given inside the Paper I Booklet only. If you mark at any place other than in the ovals in the Answer Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the test booklet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. You have to return the test question booklet and OMR Answer sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall.
10. Students can take home carbon copy of this OMR answer sheet.
11. Use only Blue/Black Ball point pen.
12. Use of any calculator or log table etc., is prohibited.
13. There is no negative marks for incorrect answers.

परीक्षार्थियों के लिए निर्देश

1. पहले पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए।
2. इस प्रश्न-पत्र में पचास बहुविकल्पीय प्रश्न हैं।
3. परीक्षा प्रारम्भ होने पर, प्रश्न-पुस्तिका आपको दे दी जायेगी। पहले पाँच मिनट आपको प्रश्न-पुस्तिका खोलने तथा उसकी निम्नलिखित जाँच के लिए दिये जायेंगे, जिसकी जाँच आपको अवश्य करनी है :
   (i) कवर पृष्ठ पर छपे निर्देशानुसार प्रश्न-पुस्तिका के पृष्ठ तथा प्रश्नों की संख्या को अच्छी तरह चैक कर लें कि ये पूरे हैं। दोषपूर्ण पुस्तिका जिनमें पृष्ठ/प्रश्न कम हों या दुबारा आ गये हों या सीरियल में न हों अर्थात् किसी भी प्रकार की त्रुटिपूर्ण पुस्तिका स्वीकार न करें तथा उसी समय उसे लौटाकर उसके स्थान पर दूसरी सही प्रश्न-पुस्तिका ले लें। इसके लिए आपको पाँच मिनट दिये जायेंगे। उसके बाद न तो आपको प्रश्न-पुस्तिका वापस ली जायेगी और न ही आपको अतिरिक्त समय दिया जायेगा।
   (ii) इस जाँच के बाद OMR पत्रक की क्रम संख्या इस प्रश्न-पुस्तिका पर अंकित कर दें।
4. प्रत्येक प्रश्न के लिए चार उत्तर पत्रक विकल्प (A), (B), (C) तथा (D) दिये गये हैं। आपको सही उत्तर के दीर्घवृत्त को पेन से भरकर काला करना है जैसा कि नीचे दिखाया गया है।
   उदाहरण : (A) (B) ● (D)
   जबकि (C) सही उत्तर है।
5. प्रश्नों के उत्तर केवल प्रश्न पत्र I के अन्दर दिये गये उत्तर-पत्रक पर ही अंकित करने हैं। यदि आप उत्तर पत्रक पर दिये गये दीर्घवृत्त के अलावा किसी अन्य स्थान पर उत्तर चिह्नांकित करते हैं, तो उसका मूल्यांकन नहीं होगा।
6. अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें।
7. कच्चा काम (Rough Work) इस पुस्तिका के अन्तिम पृष्ठ पर करें।
8. यदि आप उत्तर-पुस्तिका पर अपना नाम या ऐसा कोई भी निशान करते हैं तो परीक्षा के लिये अयोग्य घोषित कर दिये जायेंगे।
9. आपको परीक्षा समाप्त होने पर प्रश्न-पुस्तिका एवं OMR उत्तर-पत्रक निरीक्षक महोदय को लौटाना आवश्यक है और परीक्षा समाप्ति के बाद उसे अपने साथ परीक्षा भवन से बाहर न लेकर जायें।
10. परीक्षा समाप्ति पर परीक्षार्थी OMR उत्तर-पत्रक की कार्बन कापी अपने साथ ले जा सकते हैं।
11. केवल नीले/काले बाल प्वाईंट पेन का ही इस्तेमाल करें।
12. किसी भी प्रकार का संगणक (केलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है।
13. गलत उत्तरों के लिए कोई अंक काटे नहीं जाएँगे।

Paper Code : [18]

Paper-II [PHYSICAL SCIENCES]

Note : • **This paper contains Fifty (50) multiple choice questions, each question carrying two (2) marks.**

नोट : • **इस प्रश्नपत्र में पचास (50) बहुविकल्पीय प्रश्न हैं। प्रत्येक प्रश्न के दो (2) अंक हैं।**

1. If grad $r^m = \frac{-\vec{r}}{r^3}$, then the value of m is :

(A) One (B) Two

(C) Three (D) –1

2. For what value of m do the following transformation equations present a cononical transformation ?

$Q = q^m \cos 2p$; $P = q^m \sin 2p$

(A) 1 (B) 2

(C) $\frac{1}{2}$ (D) $\frac{3}{2}$

3. What is the condition of validity of first Born approximation for the potential $V(r) = \frac{V_0 e^{-\alpha r}}{\alpha r}$

where the length $\frac{1}{\alpha} = r_0$ is the range of potential :

(A) $|V_0| r_0^2 = \frac{\hbar^2}{2m}$ (B) $|V_0| r_0^2 << \frac{\hbar^2}{2m}$

(C) $|V_0| r_0^2 >> \frac{\hbar^2}{2m}$ (D) $|V_0| << \frac{\hbar^2 r_0^2}{2m}$

4. Find the charge parity of positronium (a hydrogen-line) system consisting of an electron and a positron :

(A) $CP = (-1)^S$ (B) $CP = (-1)^{S+1}$

(C) $CP = (-1)^{S+\frac{1}{2}}$ (D) $CP = (-1)^{l+S+1}$

5. The motion of a system can be represented by a differential equation

$$\frac{d^2y}{dt^2} + 2k\frac{dy}{dt} + w_0^2 = 0$$

what is the time period of motion ?

(A) $T = \frac{2\pi}{K}$ (B) $T = \frac{2\pi}{W_0}$

(C) $T = \frac{2\pi}{\left(W_0^2 + K^2\right)^{1/2}}$ (D) $T = -\frac{2\pi}{\left(W_0^2 - K^2\right)^{1/2}}$

6. For a system with the Lagrangian $L=\frac{1}{2z}q^2-\frac{1}{2}\left[X-\frac{Y^2}{Z}\right]-\frac{Y}{Z}q\dot{q}$ where X, Y and Z are time dependent, which of the following relations is wrong ?

(A) H = T + V

(B) $\dot{q}=Zq+Yq$

(C) $P=\frac{1}{z}(\dot{q}-Yq)$

(D) $\dot{p}=-(Yp+Xq)$

7. Diffstion current in a P-n junction is greater than the drift current in magnitude :

(A) If the junction is forward-biased.

(B) If junction is reverse-biased.

(C) If the junction is unbiased.

(D) It can not happen.

8. In a transistor :

(A) Emitter has the least concentration of impurity.

(B) Collector has the least concentration of inpurity.

(C) Base has the least concentration of impurity.

(D) All the three regions have equal concentration of impurity.

9. What is the nature of four-wave vector $\{K_m\}$ for electromagnetic fields ?

(A) Space-like

(B) Light-like

(C) Time-like

(D) None of these

10. The change in entropy is :

(A) Positive in a reversible change

(B) Negative in an irreversible change

(C) Positive in an irreversiblechange

(D) Negative in a reversible change

11. For what values of α is the following transformation canonical ?

$Q=\sqrt{2q}\,e^{\alpha}\cos p;\quad P=\sqrt{2q}\,e^{-\alpha}\sin p$

(i) $\frac{1}{2}$

(ii) $-\frac{1}{2}$

(iii) 2

(iv) 0

(A) (i), (ii) & (iv) are correct.

(B) (ii), (iii) & (iv) are correct.

(C) (i), (iii) & (iv) are correct.

(D) (i), (ii) & (iii) are correct.

12. In an electromagnetic wave propagating along unit vector $\vec{n}$ in an anistropic dielectric, which of the following set of vectors do not consist all coplanar vectors ?

(i) $\left(\vec{P}, \vec{D}, \vec{E} \text{ and } \vec{x}\right)$ (ii) $\left(\vec{P}, \vec{D}, \vec{H} \text{ and } \vec{x}\right)$

(iii) $\left(\vec{P}, \vec{D}, \vec{E} \text{ and } \vec{H}\right)$ (iv) $\left(\vec{D}, \vec{E}, \vec{H} \text{ and } \vec{E} \times \vec{H}\right)$

(A) (i), (ii) & (iv) are correct. (B) (ii), (iii) & (iv) are correct.

(C) (ii) & (iv) are correct. (D) (i) & (iii) are correct.

13. Which of the following properties are essential for bound states of one dimensional time independent schrodinger equation ?

(i) reality of eigen values (ii) orthogonality of eigen fluctions

(iii) non-degeneracy (iv) dicreteness of spectrum

(A) (i), (iii) & (iv) are correct. (B) (ii), (iii) & (iv) are correct.

(C) (i), (ii) & (iii) are correct. (D) (ii) & (iv) are correct.

14. A cylinder has length *l*cm which is measured with a probable error ± a and has a radius r cm which is measured with probable error ± b. The probable errors in the calculation of area of the curved surface and in volume ?

(i) $A = \pm 2\pi\sqrt{l^2b^2 + a^2r^2},\ V = \pi r\sqrt{a^2 + l^2}$ (ii) $A = \pm\sqrt{l^2b^2 + a^2r^2}, V = \pi r\sqrt{a^2 + 4l^2l^2}$

(iii) $A = \pm 2\pi\sqrt{l^2b^2 + a^2r^2}, V = \pi r\sqrt{a^2 + 4l^2l^2}$ (iv) $A = \pm\sqrt{l^2b^2 + a^2r^2}, V = \pi r\sqrt{a^2 + l^2}$

(A) (i) & (ii) are correct. (B) only (iv) is correct.

(C) Only (iii) is correct. (D) (iii) & (iv) are correct.

15. A D/A converter has 6 bits and a reference voltage of 10V. The minimum value of R and the smallest quantized value of output current will be if the maximum value of output current does not exceed 10 mA.

(i) Rmin = 2 KΩ and current with LSB = 156 μA

(ii) Rmin = 20 KΩ and current with LSB = 156 μA

(iii) Rmin = 2 KΩ and current with LSB = 100 μA

(iv) Rmin = 20 KΩ and current with LSB = 100 μA

(A) only (i) & (ii) are correct. (B) only (iii) & (iv) are correct.

(C) only (ii) is correct. (D) only (i) is correct.

16. Which of the following statements are true for fermi. Divac distribution of particles :

(i) particles are distinguishable.

(ii) dparticles are found to have odd half integral spins $\left(\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \ldots\right)$.

(iii) particles obey Pauli's exclusion principle.

(iv) protons and neutrons are the examples.

(A) (i) & (ii) are correct.
(B) (i), (ii) & (iii) are correct.
(C) (ii) & (iii) are correct.
(D) (iii) & (iv) are correct.

17. Following statements are true for first law of thermodynamics :

(i) It is the law of conservation of energy.

(ii) In mathematical form : $dQ = dU + dW$.

(iii) It is associated with internal energy of system.

(iv) none of these.

(A) (i), (ii) & (iii) are correct.
(B) (iv) is correct.
(C) (ii) & (iii) are correct.
(D) (i) & (iii) are correct.

18. Following statements are correct for a well behaved wave function :

(i) $\bar{\psi}$ must be single valued & continuous everywhere.

(ii) $\bar{\psi}$ must be normalizable.

(iii) $\bar{\psi}$ must be single valued & continuous but not normalizable.

(iv) $\int |\bar{\psi}|^2 dv$ over all space should be a finite constant.

(A) (i) & (ii) are correct.
(B) (i) & (iv) are correct.
(C) (i), (iii) & (iv) are correct.
(D) (i), (ii) & (iv) are correct.

19. Following are true for an electromagnetic wave in free space :

(i) Wave equation : $\nabla^2 \vec{E} - \frac{1}{C^2} \cdot \frac{\partial^2 \vec{E}}{\partial t^2} = 0$
(ii) $C = 1/\sqrt{\epsilon_0 \mu_0}$

(iii) these are transverse waves.
(iv) these are longitudinal waves.
(A) (i) & (ii) are correct.
(B) (i), (ii) (iv) are correct.
(C) (i), (ii) & (iii) are correct.
(D) (ii) & (iii) are correct.

20. Following are true in case of mass-energy equivalence :

(i) mass and energy are different aspects of same thing.

(ii) Total energy : $E = \frac{mc^2}{\sqrt{1+v^2/c^2}}$

(iii) rest energy : $E_0 = mc^2$

(iv) Kinetic Energy : $KE = mc^2\left[\frac{1-\sqrt{1-v^2/c^2}}{\sqrt{1-v^2/c^2}}\right]$

(A) (i), (ii) & (iii) are correct. (B) (ii), (iii) & (iv) are corect.

(C) (i), (iii) & (iv) are correct. (D) all are correct.

21. The derivative of a vector of fixed direction is :

(A) Parallel to vector (B) Perpendicular to vector

(C) along the vector (D) independent of the direction of vector

22. What is the nature of the matrix $\begin{pmatrix} a & b \\ -b^* & a^* \end{pmatrix}$, where * denotes complex conjugate and $|a|^2 + |b|^2 = 1$?

(A) Unitary with positive determinant. (B) Unitary with negative determinant.

(C) Hermitian. (D) Skew-Hermitian.

23. In a Maxwell-Boltzmann system with two states of energy ϵ and 2ϵ respectively and a degeneracy of 2 for each, the partition function is :

(A) $e^{-\epsilon/kT}$ (B) $2e^{-2\epsilon/kT}$

(C) $e^{-\epsilon/kT} + e^{-2\epsilon/kT}$ (D) $2\left(e^{-\epsilon/kT} + e^{-2\epsilon/kT}\right)$

24. The eigenvalues of a Hermitian operator are always :

(A) real (B) imaginary

(C) digenerate (D) linear

25. A free particle with initial kinetic energy E and de Broglie wavelength λ enters a region in which it has potential energy V. What is the particle's new De Broglie wavelength ?

(A) $\lambda\left(1+\frac{E}{V}\right)$ (B) $\lambda\left(1-\frac{E}{V}\right)^{-1}$

(C) $\lambda\left(1+\frac{V}{E}\right)^{\frac{1}{2}}$ (D) $\lambda\left(1-\frac{V}{E}\right)^{-\frac{1}{2}}$

26. Heat Q is added to a monoatomic ideal gas under conditions of constant volume, resulting in a temperature change ΔT. How much heat will be requried to produce the same temperature change, if it is added under conditions of constant pressure ?

(A) $\frac{3Q}{5}$ (B) Q

(C) $\frac{5Q}{3}$ (D) $\frac{10Q}{3}$

27. Which of the following CANNOT be used as a dopart in germanium to make an n-type conductor ?

(A) As (B) N

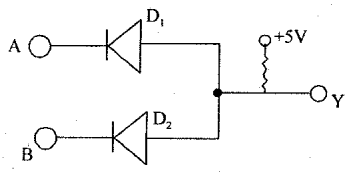
(C) Sb (D) B

28. In a dielectric medium, the phase difference between field vectors $\vec{E}$ and $\vec{H}$ is :

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$

(C) ZERO (D) any value

29.



Above figure represents the circuit diagram of :

(A) OR gate (B) AND gate

(C) NOR gate (D) NAND gate

30. An eigenfunction of the operator $\frac{d^2}{dx^2}$ is $\psi = e^{2x}$. Find the correponsind eigenvalue :

(A) 4 (B) 2

(C) 0 (D) 1

Find the solution of question 31 and 32 on the basis of following statement.

"$\vec{r}$ is a position vector and $\vec{e}$ is a unit vector"

31. The curl of which of the following vectors is non-vanishing :

(A) $\vec{r}$ (B) $\frac{\vec{r}}{r^3}$

(C) $\vec{e} \times \vec{r}$ (D) $\left(\vec{e} \times \vec{r}\right) \times \vec{e}$

32. Divergence of which of the following vectors is vanishing :

(A) $\vec{r}$ (B) $\vec{e} \times \vec{r}$

(C) $\left(\vec{e} \cdot \vec{r}\right)\vec{e}$ (D) $\left(\vec{e} \times \vec{r}\right) \times \vec{e}$

Find the solution of question 33 and 34 on the basis of following statement :

The displacement of a moving particle at any time is

$x = a \cos wt + l \sin wt$

33. What is the maximum velocity of particle ?

(A) $w(a + l)$ (B) $w\left(a^2 + l^2\right)^{1/2}$

(C) $w(al)$ (D) $\frac{w}{a+l}$

34. What is the maximum acceleration ?

(A) $w^2(a + l)$ (B) $w^2\left(a^2 - l^2\right)^{1/2}$

(C) $w^2\sqrt{a^2 + l^2}$ (D) w^2ab

Find the solution of questions 35 and 36 on the basis of following statement :

Consider the propagation of electromagnetic waves in a linear, homogeneous and isotropic material medium with electric permittivity ϵ, and magnitude permebility as :

35. For a plane wave of angular frequency w and propagation vector $\vec{k}$ propagating in the medium Maxwell's equations reduce to :

(A) $\vec{k}.\vec{E}=0;\ \vec{k}.\vec{H}=0;\ \vec{k}\times\vec{E}=w\epsilon\vec{H};\ \vec{k}\times\vec{H}=-w\mu\vec{E}$

(B) $\vec{k}.\vec{E}=0;\ \vec{k}.\vec{H}=0;\ \vec{k}\times\vec{E}=-w\epsilon\vec{H};\ \vec{k}\times\vec{H}=-w\mu\vec{E}$

(C) $\vec{k}.\vec{E}=0;\ \vec{k}.\vec{H}=0;\ \vec{k}\times\vec{E}=-w\mu\vec{H};\ \vec{k}\times\vec{H}=w\epsilon\vec{E}$

(D) $\vec{k}.\vec{E}=0;\ \vec{k}.\vec{H}=0;\ \vec{k}\times\vec{E}=w\mu\vec{H};\ \vec{k}\times\vec{H}=-w\epsilon\vec{E}$

36. If ϵ and μ assume negative values in a certain frequency range, Then the directions of the propagation vector $\vec{k}$ and the poynting vecotr $\vec{S}$ in that frequency range are related as :

(A) $\vec{k}$ and $\vec{S}$ are parallel. (B) $\vec{k}$ and $\vec{S}$ are anti-parallel.

(C) $\vec{k}$ and $\vec{S}$ are perpendicular to each other. (D) $\vec{k}$ and $\vec{S}$ make an angle that depends on the magnitude of $|\epsilon|$ and $|\mu|$.

Find the solution of questions 37 and 38 on the basis of following statement :

A free particle of mass m moves along the x direction. At $\epsilon = 0$, the normalized wave function of the particle is given by $\psi(X,0)=\frac{1}{(2\cap\alpha)^{1/4}}C\times P\left[-\frac{x^2}{4\alpha^2}+ix\right]$, where α is a real constant.

37. The expectation value of the momentum, in this state is :

(A) $\hbar\alpha$ (B) $\hbar\sqrt{\alpha}$

(C) α (D) $\hbar\ /\ \sqrt{\alpha}$

38. The expectation value of the particle energy is :

(A) $\frac{\hbar^2}{2m}\frac{1}{2\alpha^{1/2}}$ (B) $\frac{\hbar^2}{2m}\alpha^2$

(C) $\frac{\hbar^2}{2m}\frac{4\alpha^2+1}{4\alpha^{1/2}}$ (D) $\frac{\hbar^2}{8m\,\alpha^{1/2}}$

Ultraviolet catastrophe of classical physics was resolved by Max Planck in 1900, by introducing a constant (h) named after him :

39. According to Planck the oscillators in the cavity walls have the following distribution of energies:

(A) $\epsilon_n=\left(n+\frac{1}{2}\right)h\nu;\ n=0,1,2,....$ (B) $\epsilon_n=n\,h\,\nu;\ n=1,2,3,...$

(C) $\epsilon_n=n\,h\,\nu;\ n=0,1,2,....$ (D) $\epsilon_n=\left(n+\frac{1}{2}\right)h\nu;\ n=1,2,3,....$

40. According to Planck actual average energy per standing wave :

(A) $\epsilon = kT$ (B) $\epsilon = h\nu$

(C) $\epsilon=\frac{h\nu}{e^{h\nu/kT}+1}$ (D) $\epsilon=\frac{h\nu}{e^{h\nu/kT}-1}$

41. Match the following :

(i) Dimensionless constant
(ii) Dimensionless variables
(iii) Dimensional Constant
(iv) Dimensional Variables

(m) Specific gravity
(n) Gravitational Constant
(o) Impulse
(p) π

	(i)	(ii)	(iii)	(iv)
(A)	p	o	n	m
(B)	m	n	p	o
(C)	o	m	n	p
(D)	p	m	n	o

42. Match the following units of :

(i) Boltzmann Constant — (m) N/A^2

(ii) Planck's Constant — (n) C^2/Nm^2

(iii) Permittivity of free space — (o) J/K

(iv) Permeability of free space — (p) Js

	(i)	(ii)	(iii)	(iv)
(A)	m	n	o	p
(B)	o	p	n	m
(C)	p	n	m	o
(D)	o	n	m	p

43. Match List-I with (Fourier transform) with List-II (Functions of Time) and select the correct answer using the codes given below the lists :

List-I	List-II
(i) $\frac{\sin kw}{w}$	(m) A constant
(ii) e^{-jwd}	(n) Exponential function
(iii) $\frac{1}{(jw+2)^2}$	(o) t-multiplied exponential fucntion
(iv) k δ(w)	(p) Rectangular Pulse
	(q) Impluse function

	(i)	(ii)	(iii)	(iv)
(A)	p	q	o	m
(B)	p	q	o	n
(C)	o	p	n	m
(D)	o	p	n	q

44. Match the following :

(i) Conservative Force
(ii) Non-Conservative Force
(iii) Harmonic and Conservative Force
(iv) Anharmonic and conservative

(m) Simple pendulum under going small oscillations
(n) Simple pendulum under going Large oscillations
(o) Frictional Forces
(p) Coulombian Force

	(i)	(ii)	(iii)	(iv)
(A)	p	o	m	n
(B)	o	p	m	n
(C)	p	o	n	m
(D)	o	p	n	m

45. Match the following :

(i) $\left[\hat{A}, \hat{B}+\hat{C}\right]$

(ii) $\left[\hat{A}+\hat{B}, \hat{C}\right]$

(iii) $\left[\hat{A}, \hat{B}\,\hat{C}\right]$

(iv) $\left[\hat{A}\,\hat{B}, \hat{C}\right]$

(m) $\left[\hat{A}, \hat{B}\right]+\left[\hat{A}, \hat{C}\right]$

(n) $\left[\hat{A}, \hat{C}\right]+\left[\hat{B}, \hat{C}\right]$

(o) $\left[\hat{A}, \hat{C}\right]\hat{B}+\hat{A}\left[\hat{B}, \hat{C}\right]$

(p) $\left[\hat{A}, \hat{B}\right]\hat{C}+\hat{B}\left[\hat{A}, \hat{C}\right]$

	(i)	(ii)	(iii)	(iv)
(A)	m	n	o	p
(B)	m	n	p	o
(C)	n	m	o	p
(D)	n	m	p	o

46. Match the following :

(i) Lorentz condition

(ii) Coulomb gauge condition

(iii) The differential form of Gouss's in C.G.S. system is

(iv) Poisson's equation

(m) $\nabla^2 V = -4\pi\rho$

(n) $\vec{\nabla}.\vec{E} = 4\pi\rho$

(o) $div\,\vec{A} = 0$

(p) $div\,\vec{A}+\mu\in\frac{\partial\phi}{dt} = 0$

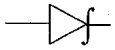
	(i)	(ii)	(iii)	(iv)
(A)	p	o	n	m
(B)	p	o	m	n
(C)	m	n	o	p
(D)	m	n	p	o

47. Match the following :

(i) Rn Junction diode (m) 

(ii) Zener diode (n) 

(iii) pnp Transistor (o) 

(iv) npn transistor (p) 

	(i)	(ii)	(iii)	(iv)
(A)	p	o	n	m
(B)	p	o	m	n
(C)	o	p	m	n
(D)	o	p	n	m

48. Match the following; where F is Helmholtz Free enerrgy, H is enthalpy and other terms have their usual meaning :

(i) P (m) $-\left(\frac{\partial F}{\partial T}\right)_V$

(ii) T (n) $\left(\frac{\partial H}{\partial p}\right)_S$

(iii) V (o) $\left(\frac{\partial H}{\partial S}\right)_V$

(iv) S (p) $-\left(\frac{\partial F}{\partial V}\right)_T$

	(i)	(ii)	(iii)	(iv)
(A)	m	p	n	o
(B)	n	m	p	o
(C)	o	p	n	m
(D)	p	o	n	m

49. Match the Lagrangian of the following physical systems :

(i) Linear Harmonic Oscillator — (m) $\frac{1}{2}mr^2\left(\dot{\theta}^2+\sin^2\theta\dot{\phi}^2\right)-mgr\cos\theta$

(ii) Simple pendulum — (n) $\frac{1}{2}m\dot{x}^2-\frac{1}{2}kx^2$

(iii) Spherical pendulum — (o) $\frac{1}{2}m\dot{r}^2+\frac{1}{2}mr^2\dot{\theta}^2+\frac{k}{r}$

(iv) Particle moving under a central force — (p) $\frac{1}{2}ml^2\dot{\theta}^2=mgl(1-\cos\theta)$

	(i)	(ii)	(iii)	(iv)
(A)	m	p	n	o
(B)	m	o	p	n
(C)	n	p	m	o
(D)	n	p	o	m

50. Match the Boolean expression of column I with corresponding logic operator on Column II :

Column I	Column II
(i) $(A^1B^1)^1$	(m) XOR
(ii) $(A+B^1)(A^1+B)$	(n) AND
(iii) $(A+B)(A^1+B^1)$	(o) XNOR
(iv) $(A^1+B^1)^1$	(p) OR

	(i)	(ii)	(iii)	(iv)
(A)	o	m	p	n
(B)	p	o	m	n
(C)	n	m	o	p
(D)	m	n	p	o