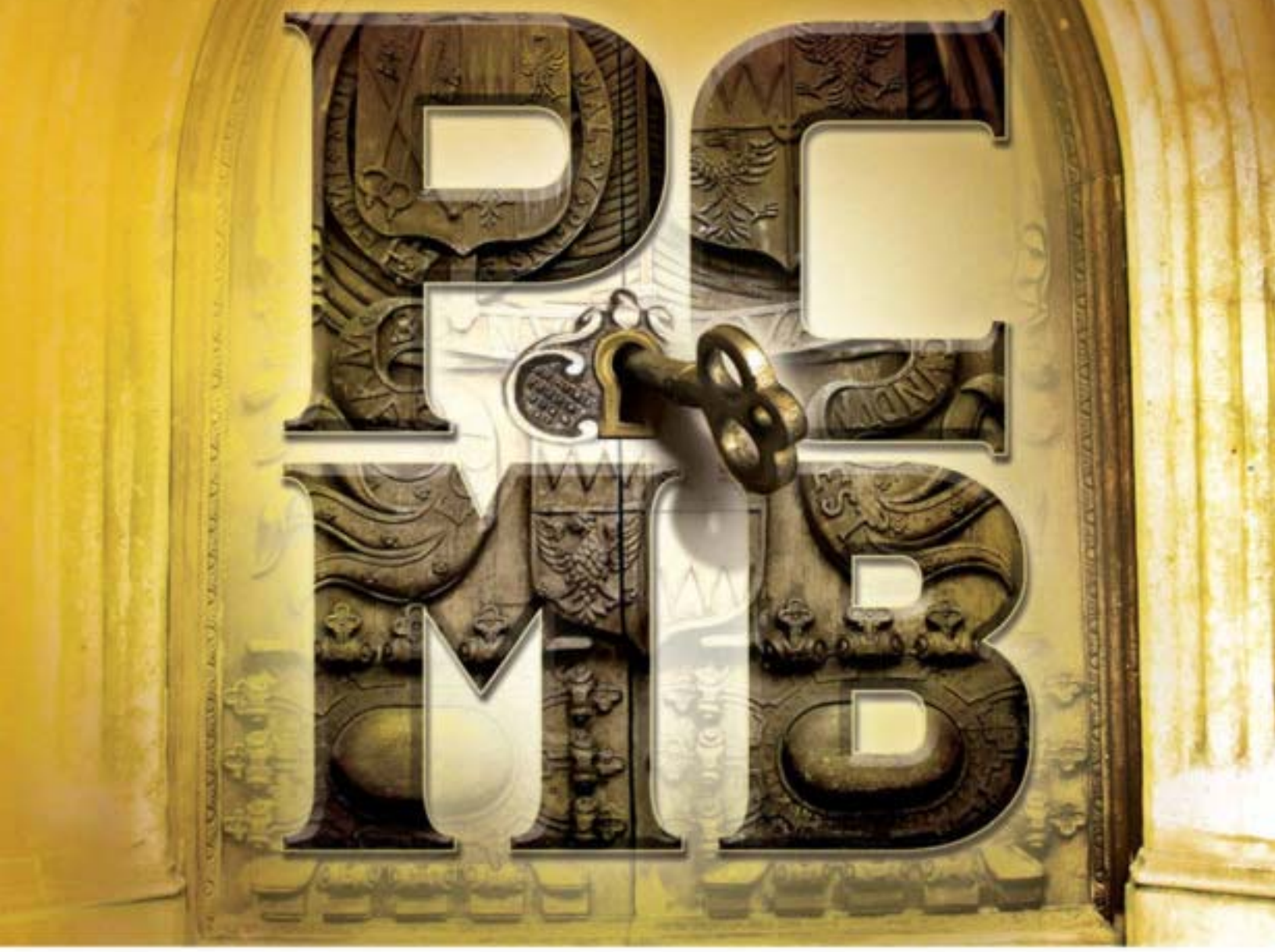
Model

Question Papers

with solutions

Std. XII Sci.



Target Publications Pvt. Ltd.

Model Question Papers

With Solutions

STD. XII Sci.

Third Edition: October 2014

Salient Features

- A set of 4 Question Papers with solutions each for Physics, Chemistry, Maths & Biology (Total 16 Question Papers)
- Prepared as per the new board paper pattern.
- Includes Board Question Papers: March, October 2013 and 2014.
- Complete answers to every question with relevant marking scheme.
- Graphs and diagrams provided wherever necessary.
- Simple and lucid language.
- Self-evaluative in nature.

Solutions with relevant marking scheme to Board Question papers available in downloadable PDF format at ***www. targetpublications.org***

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Preface

HSC is the cornerstone of a student's career as it opens up the doors to turn their dreams into reality. It acts as a platform for students to specialize in a field that interests them the most. However, to achieve this it becomes imperative to get into the details of each subject and to clarify its fundamentals. Adequate knowledge base thus helps kids to boost their self confidence and pave their way up in the final examinations.

It is rightly said, 'practice makes a man perfect'. Keeping this adage in mind, we are proud to introduce "Std XII Science Model Question Papers". This set of question papers provides students thorough practice for preparation of their final examinations. The book consists of 16 question papers in all based on Physics, Chemistry, Maths and Biology (*a set of four question papers for each subject*). Along with the question papers, we've provided model answers with relevant marking schemes so as to make sure that students understand the importance of each question. These question papers reflect the latest changes in content and paper pattern as updated by the Board of Higher Secondary Education.

Furthurmore we have also included Board Question Papers of March, October 2013 and 2014 examinations, solutions to which are available in downloadable PDF format at our website *www. targetpublications.org*. The purpose behind this is to make students familiar with the current question pattern and marking schemes. It also gives them a holistic understanding of the exact nature of the board question papers.

We are sure that, these question papers would provide ample practice to students in a systematic manner and would boost their confidence to face the challenges posed in examinations.

We welcome your valuable suggestions and feedback towards this book.

We wish the students all the best for their examinations.

Yours faithfully
Publisher

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In this book, we have deliberately included the Board Question Papers for March 2013 and October 2013 although it follows the old pattern.

***** marked questions in the above board papers are deleted from the new syllabus as compared to the earlier syllabus.

PHYSICS : MARKING SCHEME

- There will be one single paper of 70 Marks in Physics.
- Duration of the paper will be 3 hours.
- Physics paper will consist of two parts viz: Part-I and Part-II.
- Each part will be of 35 Marks.
- Same Answer Sheet will be used for both the parts.
- Each Part will consist of 4 Questions.
- The sequence of the 4 Questions in each part may or may not remain same.
- The paper pattern for Part–I and Part–II will be as follows:

Question 1: **(7 Marks)**

This Question will be based on Multiple Choice Questions.

There will be 7 MCQs, each carrying one mark.

One Question will be based on calculations.

Students will have to attempt all these questions.

Question 2: **(12 Marks)**

This Question will contain 8 Questions, each carrying 2 marks.

Students will have to answer any 6 out of the given 8 Questions.

4 questions will be theory-based and 4 will be numericals.

Question 3: **(9 Marks)**

This Question will contain 4 Questions, each carrying 3 marks.

Students will have to answer any 3 out of the given 4 Questions.

2 questions will be theory-based and 2 will be numericals.

Question 4: **(7 Marks)**

This Question will contain 2 Questions, each carrying 7 marks.

Students will have to answer any 1 out of the given 2 Questions.

4/5 marks are allocated for theory-based question and 3/2 marks for numerical.

Distribution of Marks According to Type of Questions

Type of Questions	Marks	Marks with option	Percentage (%)
Objectives	14	14	20
Short Answers	42	56	60
Brief Answers	14	28	20
Total	**70**	**98**	**100**

Sr. No.	Unit	Marks Without Option	Marks with option
1	Circular Motion	04	05
2	Gravitation	03	05
3	Rotational Motion	04	06
4	Oscillations	05	07
5	Elasticity	03	04
6	Surface Tension	04	05
7	Wave Motion	03	04
8	Stationary Waves	05	07
9	Kinetic Theory of Gases and Radiation	04	06
10	Wave Theory of light	03	04
11	Interference and Diffraction	04	06
12	Electrostatics	03	04
13	Current Electricity	03	04
14	Magnetic Effects of Electric Current	03	04
15	Magnetism	03	04
16	Electromagnetic Induction	04	06
17	Electrons and Photons	03	04
18	Atoms, Molecules and Nuclei	04	06
19	Semiconductors	03	04
20	Communication Systems	02	03

CHEMISTRY : MARKING SCHEME

- There will be one written paper of 70 Marks in Chemistry.
- Duration of the paper will be 3 hours.
- Chemistry paper will have two parts viz: Part I of 35 marks and Part II of 35 marks
- Same Answer Sheet will be used for both the parts.
- In the question paper, for each part there will be 4 Questions.
- Students have freedom to decide the sequence of answers.
- The sequence of the 4 Questions in each part may or may not remain same.
- The paper pattern as per the marking scheme for Part I and Part II will be as follows:

Question 1: **(7 Marks)**

There will be 7 multiple choice Questions (MCQs), each carrying 1 mark.

Total marks = 7

Question 2: **(12 Marks)**

There will be 8 Questions out of which 6 Questions are to be answered, each carrying 2 marks.

Total marks = 12

Question 3: **(9 Marks)**

There will be 4 Questions out of which 3 Questions are to be answered, each carrying 3 marks.

Total marks = 9

(There will be 3 Questions based on numericals from part I)

Question 4: **(7 Marks)**

There will be 2 Question out of which 1 Question has to be answered.

It will carry 7 marks.

Total Marks = 7

(There will be 2/3 marks Questions based on numericals from Part I)

Distribution of Marks According to Type of Questions

Type of Questions	Marks	Marks with option	Percentage (%)
Objectives	14	14	20
Short Answers	42	56	60
Brief Answers	14	28	20
Total	**70**	**98**	**100**

No.	Topic Name	Marks Without Option	Marks With Option
1	Solid State	04	06
2	Solutions and Colligative Properties	05	07
3	Chemical Thermodynamics and Energetics	06	08
4	Electrochemistry	05	07
5	Chemical Kinetics	04	06
6	General Principles and Processes of Isolation of Elements	03	05
7	p–Block Elements	08	10
8	d and f–Block Elements	05	06
9	Coordination Compounds	03	04
10	Halogen Derivatives of Alkanes and Arenes	04	06
11	Alcohols, Phenols and Ethers	04	06
12	Aldehydes, Ketones and Carboxylic Acids	05	07
13	Compounds Containing Nitrogen	04	06
14	Biomolecules	04	06
15	Polymers	03	04
16	Chemistry in Everyday Life	03	04

MATHEMATICS : MARKING SCHEME

- There will be one single paper of 80 Marks in Mathematics.
- Duration of the paper will be 3 hours.
- Mathematics paper will consist of two parts viz: Part-I and Part-II.
- Each Part will be of 40 Marks.
- Same Answer Sheet will be used for both the parts.
- Each Part will consist of 3 Questions.
- The sequence of the Questions will be determined by the Moderator.
- The paper pattern for Part–I and Part–II will be as follows:

Question 1:

This Question will carry 12 marks and consist of two sections (A) and (B) as follows: **(12 Marks)**

(A) This Question will be based on Multiple Choice Questions.
There will be 3 MCQs, each carrying two marks.

(B) This Question will have 5 sub-questions, each carrying two marks.
Students will have to attempt any 3 out of the given 5 sub-questions.

Question 2:

This Question will carry 14 marks and consist of two sections (A) and (B) as follows: **(14 Marks)**

(A) This Question will have 3 sub-questions, each carrying three marks.
Students will have to attempt any 2 out of the given 3 sub-questions.

(B) This Question will have 3 sub-questions, each carrying four marks.
Students will have to attempt any 2 out of the given 3 sub-questions.

Question 3:

This Question will carry 14 marks and consist of two sections (A) and (B) as follows: **(14 Marks)**

(A) This Question will have 3 sub-questions, each carrying three marks.
Students will have to attempt any 2 out of the given 3 sub-questions.

(B) This Question will have 3 sub-questions, each carrying four marks.
Students will have to attempt any 2 out of the given 3 sub-questions.

Distribution of Marks According to Type of Questions

Type of Questions	Marks	Marks with option	Percentage (%)
Short Answers	24	32	30
Brief Answers	24	36	30
Detailed Answers	32	48	40
Total	**80**	**116**	**100**

Maths – I

Sr. No.	Unit	Marks With Option
1	Mathematical Logic	08
2	Matrices	06
3	Trigonometric Functions	10
4	Pair of Straight Lines	07
5	Vectors	08
6	Three Dimensional Geometry	04
7	Line	05
8	Plane	06
9	Linear Programming	04
	Total	**58**

Maths – II

Sr. No.	Unit	Marks With Option
1	Continuity	06
2	Differentiation	08
3	Applications of Derivatives	08
4	Integration	09
5	Definite Integral	08
6	Applications of Definite Integral	
7	Differential Equations	08
8	Probability Distribution	06
9	Binomial Distribution	05
	Total	**58**

BIOLOGY : MARKING SCHEME

- There will be one written paper of 70 Marks in Biology.
- Duration of the paper will be 3 hours.
- Biology paper will have two parts viz: Part I of 35 marks and Part II of 35 marks
- There will be two separate answer sheets for both the parts.
- In the same question paper, each part will have 4 Questions.
- Sequence of answering the questions can be determined by the students.
- The paper pattern for Part I and Part II will be as follows:

Question 1: **(7 Marks)**

There will be 7 multiple choice Questions (MCQs), each carrying one mark.
Total marks = 7

Question 2: **(12 Marks)**

This will have Questions as 'A', 'B' and 'C'.
In that,

Q.A will be based on : Answer in one sentence.
There will be 6 Questions each carrying 1 mark
Total marks = 6

Q.B will have one Question based on diagrams
Total Marks = 2

Q.C will have 4 Questions, each carrying 2 marks
Students will have to answer any 2 out of given 4 Questions
Total marks = 4
Total Marks (A + B + C) = 12

Question 3: **(9 Marks)**

This will have Questions as 'A' and 'B'

Q.A will have 3 Questions each carrying 3 marks
Students will have to answer any 2 out of given 3 Questions
Total Marks = 6

Q.B will have one Question based on diagrams
Total Marks = 3
Total Marks (A + B) = 9

Question 4: **(7 Marks)**

In this Question, 2 Questions will be asked each carrying 7 marks.
Students will have to answer any one out of given 2 Questions
Total Marks = 7

Distribution of Marks According to Type of Questions

Type of Questions	Marks	Marks with option	Percentage (%)
Objectives	14	14	20
Short Answers	42	56	60
Brief Answers	14	28	20
Total	**70**	**98**	**100**

No.	Topic Name	Marks Without Option	Marks With Option
1	Genetic Basis of Inheritance	08	12
2	Gene: It's Nature, Expression and Regulation		
3	Biotechnology: Process and Application	07	09
4	Enhancement in Food Production		
5	Microbes in Human Welfare	03	05
6	Photosynthesis	07	09
7	Respiration		
8	Reproduction in Plants	07	09
9	Organisms and Environment - I	03	05
10	Origin and Evolution of Life	07	09
11	Chromosomal Basis of Inheritance		
12	Genetic Engineering and Genomics	03	05
13	Human Health and Diseases	05	07
14	Animal Husbandry		
15	Circulation	10	14
16	Excretion and Osmoregulation		
17	Control and Co-ordination		
18	Human Reproduction	07	09
19	Organisms and Environment – II	03	05

MODEL QUESTION PAPER SET - I

PHYSICS

Time: 3 Hours **Total Marks: 70**

Note:

i. All questions are compulsory
ii. Neat diagrams must be drawn wherever necessary.
iii. Figure to the right indicate full marks.
iv. Use of logarithmic table is allowed.
v. All symbols have their usual meaning unless otherwise stated.

SECTION – I

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. A driver of a van travelling with high speed suddenly sees a herd of cows in front at a distance 'd'. To avoid collision he applies brakes instead of taking turn side ways. His action is _____.

(A) inappropriate as centripetal force is lesser than the retarding force
(B) appropriate as centripetal force is lesser than the retarding force
(C) inappropriate as centripetal force is greater than the retarding force
(D) appropriate as centripetal force is greater than the retarding force

ii. The ratio of radius of gyration of hollow cylinder to solid cylinder is _____.

(A) $1 : \sqrt{R}$ (B) $\sqrt{2}$
(C) 2 (D) 1 : 2

iii. Which of the following relationship between the acceleration a and the displacement x of a particle involve simple harmonic motion?

(A) $a = 0.7\ x$ (B) $a = -200\ x^2$
(C) $a = -10\ x$ (D) $a = 100\ x^3$

iv. Dimensions of compressibility are _____.

(A) $[L^1M^1T^2]$ (B) $[L^1M^{-1}T^2]$
(C) $[L^{-1}M^1T^{-2}]$ (D) $[L^1M^{-1}T^{-2}]$

v. A large size drop flattens _____.

(A) to bring centre of gravity lower
(B) to decrease surface area
(C) to maximise potential energy
(D) to decrease volume

vi. The kinetic energy of hydrogen in 1 litre of volume at 2 atmospheric pressure is _____.

(A) 333.9 J (B) 393.3 J
(C) 101.3 J (D) 303.9 J

vii. A stationary wave is _____.

(A) periodic in space only (B) periodic in time only
(C) not periodic (D) periodic in both space and time

Q. 2. Attempt any SIX: **[12]**

i. What is the angle of banking necessary for a curved road of 80 m radius for safe driving at 72 km/h? ($g = 9.8\ m/s^2$)

ii. Calculate the M.I. of a solid sphere of mass 20 kg and radius 0.4 m, rotating about an axis passing through a point of a distance of 0.1 m from the centre of sphere.

iii. Derive differential equation of linear S.H.M. in terms of displacement and angular velocity.

iv. A sphere of mass 2 kg is attached at one end of steel wire having length 1 m and radius 4 mm. It is whirled in vertical circle with angular velocity of 120 r.p.m. Estimate the elongation of wire when sphere is at lowest point in its path.
($Y_{steel} = 20 \times 10^{10}\ N/m^2$)

v. Define capillary action. Give its two applications.

vi. Wavelengths of two notes in air are $\frac{90}{175}$ m and $\frac{90}{173}$ m. Each note produces four beats per second with a third note of fixed frequency. Calculate the frequency of the third note and velocity of sound in air.

vii. Prove that in case of pipe open at both ends, the end correction is $e = \frac{n_2 l_2 - n_1 l_1}{2(n_1 - n_2)}$

viii. State and deduce Boyle's law on the basis of kinetic theory of gases.

Q. 3. Attempt any THREE: **[9]**

i. How much a body of mass 54 kg weighs on the earth at (i) at the equator (ii) the pole (iii) latitude of 60°? (Given: R = 6400 km)

ii. A uniform rod of length L and mass M, pivoted at centre C such that it can rotate freely in vertical plane, is stationary in horizontal position. A blob of mud of same mass as that of rod falls vertically between one end of rod and centre C with speed v and sticks. As a result rod rotates with angular speed ω. Find the value of ω in terms of v and L.

iii. Derive an expression for the height of liquid column when capillary is dipped vertically in liquid.

iv. A conical pendulum has length 1.4 m and a bob of mass 0.2 kg. If the angular speed of the bob is $\sqrt{14}$ rad/s, find linear speed of pendulum and the tension in the string.

Q.4. A. Explain the formation of stationary waves by analytical method. Show that nodes and antinodes are equally spaced in stationary waves. **[4]**

B. Define simple harmonic progressive wave.

The equation of a simple harmonic progressive wave is given by $y = 6 \sin \pi\left(\frac{t}{0.04} - \frac{x}{50}\right)$.

Find the displacement and velocity of particle of 40 cm from origin and at 0.2 second.
(All quantities are expressed in CGS units) **[3]**

OR

Q.4. A. Derive an expression for the potential energy of a particle performing S.H.M. Find its values at extreme position and mean position.
When the displacement in S.H.M. is one third of amplitude, find the ratio of potential energy to kinetic energy. **[4]**

B. Give the statement of Newton's law of cooling. A metal sphere cools at the rate of 5 °C per minute at the temperature of 80 °C. Calculate the rate of cooling at 40 °C, if the temperature of surroundings is 30 °C. **[3]**

SECTION – II

Q. 5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. In a Young's double slit experiment, the fringe width will remain same, if _____ (D = distance between screen and plane of slits, d = separation between two slits and λ = wavelength of light used)

(A) Both λ and D are doubled (B) Both d and D are doubled
(C) D is doubled but d is halved (D) λ is doubled but d is halved

ii. Electrostatic energy of 4.5×10^{-4} J is stored in a capacitor at 900 V. What is the charge on the capacitor?

(A) 10^{-6} μC (B) 2.5×10^{-6} C
(C) 2×10^{-6} C (D) 10^{-6} C

iii. The principle of potentiometer is _____.

(A) potential gradient is directly proportional to length of potentiometer wire.
(B) potential gradient of wire is inversely proportional to length of potentiometer wire.
(C) potential gradient of wire is constant.
(D) potential gradient of wire is maximum at ends of wire.

iv. The net magnetic dipole moment per unit volume is called _____ of the sample.

(A) gyromagnetic ratio (B) magnetisation
(C) magnetic susceptibility (D) magnetic intensity

v. Brightness of light is a measure of _____.

(A) energies of photons (B) frequency of light
(C) number of photons (D) all of the above

vi. Which of the following is true for number of spectral lines in going from Lyman series to P-fund series

(A) Increases (B) Decreases
(C) Unchanged (D) May decrease or increase

vii. When electric field varies with time, _____ is produced.

(A) conduction current (B) diffusion current
(C) displacement current (D) drift current

Q. 6. Attempt any SIX: **[12]**

i. Explain the concept of magnetic flux.

ii. An electron in the atom is moving with a speed of 3.6×10^6 m/s in an orbit of radius 0.72 Å. Calculate the magnetic moment of revolving electron.

iii. Draw neat labelled diagram for the formation of two virtual images in biprism experiment.

iv. The spectral line of λ = 4800 Å in the light coming from a distant star is observed at 4820 Å. Determine the velocity of star relative to earth. Discuss if it is coming closer or moving away.

v. Derive an expression for energy density of a medium near the charged conductor.

vi. Explain sky wave propagation.

vii. A 500 turn rectangular coil 20 cm × 10 cm is placed in uniform magnetic field of induction 10^{-5} T. The coil is suspended by fibre with twist constant of 12×10^{-9} Nm/degree. If the coil is deflected through 30°, compute restoring torque and current flowing through coil.

viii. The energy required to remove an electron from sodium is 2.3 eV. Explain if sodium will show photoelectric effect for wavelength of 7200Å.

Q. 7. Attempt any THREE: **[9]**

i. Define resolving power of a microscope. Sodium light of wavelength 5890Å is used to view an object under a microscope. Find the limit of resolution and resolving power of microscope if the numerical aperture of the objective is 0.1.

ii. Derive an expression for total energy of electron in n^{th} orbit of Bohr's orbit and show that $E_n \propto \frac{1}{n^2}$

iii. A potentiometer wire 12 m long has a resistance of 16 Ω. If the current through it is 0.6 A, calculate the balancing lengths when two cells of emfs 1.7 V and 1.5 V are connected so as to
i. assist
ii. oppose each other

iv. Draw a neat circuit diagram of a transistor CE-amplifier and explain its working.

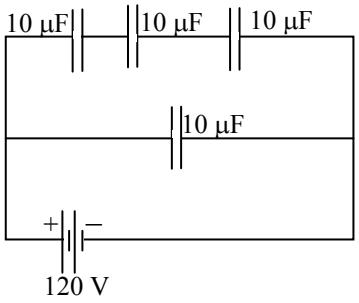
Q.8. A. Obtain an expression for power consumed in LCR series circuit. Also explain its power factor. **[4]**

B. Define current sensitivity of a moving coil galvanometer. Give its units. A galvanometer with coil resistance of 60 Ω gives a full scale deflection for a current of 5 mA. How will you convert it into an ammeter of range of 0 – 2.5 A? **[3]**

OR

Q.8. A. Show that when light is incident at polarising angle i_p, then $\tan i_p = \mu$ where μ is the R.I. of the medium **[2]**

B. A network of four capacitors 10 μF each are connected to a 120 V supply. Determine the equivalent capacitance of the network and the charge on each capacitor. **[3]**



C. Give logic symbol, Boolean expression and truth table of NAND gate. **[2]**

MODEL QUESTION PAPER SET - II

PHYSICS

Time: 3 Hours **Total Marks: 70**

Note:

i. All questions are compulsory
ii. Neat diagrams must be drawn wherever necessary.
iii. Figure to the right indicate full marks.
iv. Use of logarithmic table is allowed.
v. All symbols have their usual meaning unless otherwise stated.

SECTION – I

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. On being churned the butter separates out of milk due to _____.
(A) centrifugal force (B) adhesive force
(C) cohesive force (D) frictional force

ii. If the earth stops rotating, the value of 'g' at the equator will _____.
(A) increase (B) decrease
(C) remain same (D) become zero

iii. If a person, sitting on a rotating table, with his arms outstretched and holding heavy dumb bells in each hand, suddenly lowers his hands, then _____.
(A) his angular velocity decreases (B) his angular velocity does not change
(C) his angular momentum increases (D) his moment of inertia decreases

iv. The average kinetic energy of a gas molecule is _____.
(A) Proportional to pressure of gas
(B) Inversely proportional to volume of gas
(C) Inversely proportional to absolute temperature of gas
(D) Proportional to absolute temperature of gas

v. The time period of a spring of force constant k loaded with mass m is _____.
(A) $T \propto m$ and $T \propto k$ (B) $T \propto \sqrt{m}$ and $T \propto \frac{1}{\sqrt{k}}$
(C) $T \propto \left(\frac{1}{m}\right)$ and $T \propto k$ (D) $T \propto \left(\frac{1}{m}\right)$ and $T \propto \frac{1}{\sqrt{k}}$

vi. Speed of sound in air is 300 m/s. The distance between two successive nodes of a stationary wave of frequency 1000 Hz is _____.
(A) 10 cm (B) 20 cm
(C) 15 cm (D) 30 cm

vii. If a wave enters from air to water, then what remains unchanged?
(A) Frequency (B) Amplitude
(C) Velocity (D) Wavelength

Q. 2. Attempt any SIX: **[12]**

i. What is banking of road? Explain the necessity of banking of the road.

ii. A satellite orbits around the earth at a height equal to R of the earth. Find its period.
[$R = 6.4 \times 10^6$ m, $g = 9.8$ m/s^2]

iii. Four particles of masses 4 kg, 2 kg, 2 kg and 4 kg are placed at corners A, B, C and D of a square ABCD of side 2 m. Find M.I. and radius of gyration of system about AD as axis of rotation.

iv. Define the following terms.
a. Phase of S.H.M
b. Epoch of S.H.M

v. Find the greatest length of a metal wire that can hang vertically without breaking.
[Breaking stress for metal = 6×10^8 N/m^2 and density of metal = 9×10^3 kg/m^3]

vi. A capillary tube 0.12 mm in diameter has its lower end immersed in a liquid of surface tension 0.054 N/m. If the density of liquid is 860 kg/m^3, find the height to which the liquid rises in the tube. [Angle of contact = 30°, $g = 9.8$ m/s^2]

vii. Explain the reflection of transverse waves from a denser medium.

viii. State and derive law of linear density for a vibrating string.

Q. 3. Attempt any THREE: **[9]**

i. A cyclist speeding at 18 km/h on a level road takes a sharp circular turn of radius 4 m without reducing the speed. The co-efficient of static friction between the tyres and the road is 0.2. Will the cyclist slip while taking the turn? Calculate maximum safety speed? Will it be constant always?

ii. State and prove law of conservation of angular momentum. Give 2 examples.

iii. A brass wire of radius 2 mm is loaded by a mass of 32.8 kg. What would be the decrease in its radius?
[$Y = 9 \times 10^{10}$ N/m^2, Poisson's ratio $\sigma = 0.36$]

iv. What is a heat engine? Explain working and efficiency of heat engine.

Q.4. A. Two organ pipes, open at both ends, are sounded together and 5 beats are heard per second. The length of shorter pipe is 0.24 m, find the length of the other pipe. (Given: velocity of sound in air = 350 m/s, end correction at one end = 0.02 m same for both pipes) **[4]**

B. Explain surface tension on the basis of molecular theory. **[3]**

OR

Q.4. A. Discuss analytically the composition of two S.H.M's of same period and parallel to each other. Obtain their resultant amplitude. Also find the resultant amplitude when phase difference of two S.H.M's is
a. 0 b. π **[4]**

B. Find the height of a geostationary satellite (communication satellite) from the surface of the earth. [Mass of the earth = 6×10^{24} kg, radius of the earth = 6400 km,
$G = 6.67 \times 10^{-11}$ N.m^2/kg^2] **[3]**

SECTION II

Q. 5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. The plane of vibration and the plane of polarisation of a beam of light _____.
(A) are identical to each other.
(B) are orthogonal to each other.
(C) make an angle, which depends on the colour of the light.
(D) rotate with respect of each other along the path of the beam.

ii. To obtain pronounced diffraction with single slit illuminated by light, the slit width should be of the order of _____.
(A) 10^{-2} m (B) 10^{-7} m
(C) 10^{7} m (D) 10^{-9} m

iii. Dimensions of electric flux is _____.
(A) $[L^1 M^1 T^3 A^{-1}]$ (B) $[L^0 M^{-1} T^{-3} A^1]$
(C) $[L^{-1} M^1 T^{-3} A^{-1}]$ (D) $[L^3 M^1 T^{-3} A^{-1}]$

iv. The accuracy of M.C.G can be increased by _____.
(A) taking large deflection (B) decreasing number of turns
(C) decreasing area of the coil (D) all of these

v. For a given transistor β_{dc} is 99, then the corresponding value of α_{dc} for same transistor is _____.
(A) 0.92 (B) 0.98
(C) 0.99 (D) 1

vi. The energy equivalent of mass 1 u is _____.
(A) 931 MeV (B) 1.6×10^{-19} J
(C) 0.511 eV (D) 13.6 eV

vii. A modem acts as a _____ in receiving mode.
(A) modulator (B) demodulator
(C) amplifier (D) oscillator

Q. 6. Attempt any SIX: **[12]**

i. Explain why microscopes of high magnifying power have oil-immersion objectives.

ii. Write any two points of difference between amplitude modulation and frequency modulation.

iii. Four resistances 5Ω, 5Ω, 5Ω and 15Ω form a Wheatstone's network. Find the resistance which when connected across the 15Ω resistance, will balance the network.

iv. A solenoid of 100 turns per unit length and cross-sectional area 2×10^{-4} m^2 carries a current of 6 A. It is placed in horizontal axis at 30° with direction of uniform magnetic field of 0.3 T. Calculate magnetic moment of solenoid and torque experienced by solenoid due to the field.

v. An alternating emf E = 250 sinωt V is connected to a 1250 Ω resistor. Calculate the rms current through the resistor and the average power dissipated in one cycle.

vi. Define cut off potential. Show graphically variation of photoelectric current with collector plate potential for different intensity of incident radiation.

vii. Calculate the de Broglie wavelength of proton if it is moving with speed of 8×10^6 m/s. [$m_p = 1.67 \times 10^{-27}$ kg].

viii. Explain I – V characteristics of zener diode with suitable graph.

Q. 7. Attempt any THREE: **[9]**

i. State and prove Gauss' theorem of electrostatics.

ii. State the principle of working of cyclotron. Also calculate how rapidly should the electric field between the Dees of cyclotron be reversed, if magnetic field of 1.8 Wb/m^2 is used to accelerate protons.
[charge on proton = 1.6×10^{-19} C, mass of proton = 1.67×10^{-27} kg]

iii. Explain ferromagnetism on the basis of domain theory.

iv. The work function of caesium is 2.22 eV. Find the threshold frequency and photocurrent wavelength of incident light if photocurrent is brought to zero by stopping potential of 0.64 V.

Q.8. A. A battery of emf 12 V and internal resistance 1Ω is connected in parallel with another battery of emf 10 V and internal resistance 1Ω. The combination is used to send current through an external resistance of 10 Ω. Calculate the current through external resistance. **[4]**

B. State Faraday's second law of E.M.I. A conducting loop of area 7 m^2 is placed normal to uniform magnetic induction 4.8 Wb/m^2. If the magnetic induction is uniformly reduced to 2 Wb/m^2 in a time of 2 second. Calculate the induced e.m.f. produced in the loop. **[3]**

OR

Q.8. A. Define half life period. Derive expression for it **[3]**

B. i. Explain what is a polaroid. Give its two uses. **[2]**

ii. In a biprism experiment, light of wavelength 5400 Å is used to get interference pattern on screen. The fringe-width changes by 1.8 mm when the screen is moved towards biprism by 50 cm. Find the distance between two virtual images of the slit. **[2]**

MODEL QUESTION PAPER SET - III

PHYSICS

Time: 3 Hours **Total Marks: 70**

Note:
i. All questions are compulsory
ii. Neat diagrams must be drawn wherever necessary.
iii. Figure to the right indicate full marks.
iv. Use of logarithmic table is allowed.
v. All symbols have their usual meaning unless otherwise stated.

SECTION – I

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. Particle A of mass M is revolving along a circle of radius R. Particle B of mass m is revolving in another circle of radius r. If they take the same time to complete one revolution, then the ratio of their angular velocities is _____.
(A) R/r (B) r/R
(C) 1:1 (D) $\left(\frac{R}{r}\right)^2$

ii. Angular momentum of a system of particles changes when _____.
(A) force acts on a body (B) torque acts on a body
(C) direction of velocity changes (D) none of these

iii. The unit of quantity g/G where symbols have usual meaning is _____.
(A) m^3/kg (B) m/kg
(C) kg/m^2 (D) m^2/kg

iv. Which is a true statement about black body radiation?
(A) Intensity is different for all wavelengths.
(B) Intensity is more for longer wavelengths.
(C) Intensity is less for shorter wavelengths.
(D) A black body does not emits all wavelengths.

v. The value of surface tension of a liquid at critical temperature is _____.
(A) zero (B) infinite
(C) between 0 and ∞ (D) can not be determined

vi. The harmonics which are present in a pipe open at one end are _____.
(A) odd harmonics (B) even harmonics
(C) even as well as odd harmonics (D) none of these

vii. A simple pendulum performs simple harmonic motion about x = 0 with an amplitude A and time period T. The speed of the pendulum at x = A/2 will be _____.
(A) $\frac{\pi A\sqrt{3}}{T}$ (B) $\frac{\pi A}{T}$
(C) $\frac{\sqrt{3}\,\pi A}{2T}$ (D) $\frac{3\pi^2 A}{T}$

Q.2. Attempt any SIX: **[12]**

i. Obtain an expression for time period of a satellite orbiting very close to earth's surface in terms of mean density.

Show that, $T = \sqrt{\frac{3\pi}{G\rho}}$,

where ρ = mean density of earth

ii. A mass of 4 kg is tied at the end of a string 1.2 m long, revolving in a horizontal circle. If the breaking tension in the string is 200 N, find the maximum number of revolutions per minute the mass can make.

iii. A simple harmonic progressive wave of frequency 5 Hz is travelling along the positive X direction with a velocity of 40 m/s. Calculate the phase difference between two points separated by a distance of 0.8 m.

iv. Define frequency of S.H.M. Discuss its unit and dimension.

v. Distinguish between deforming force and stress.

vi. A bullet of mass 10 g and speed 500 m/s is fired into a door and gets embedded exactly at the centre of the door. The door is 1.0 m wide and weighs 9 kg. It rotates about a vertical axis practically without friction. Find the angular speed of the door just after the bullet embeds into it.

vii. State Wien's displacement law. State its significance.

viii. A uniform wire under tension is fixed at its ends. If the ratio of tensions in the wire to the square of its length is 320 dyne/cm^2 and fundamental frequency of vibration of wire is 400 Hz, find its linear density.

Q.3. Attempt any THREE: **[9]**

i. Define linear velocity. Derive the relation between linear velocity and angular velocity.

ii. A set of 24 tuning forks is arranged in the increasing order of frequencies. Each tuning fork produces 'y' beats per second with previous one. The last fork is an octave of the first. The 8th tuning fork has a frequency 120 Hz. Find y and hence find the frequency of last fork.

iii. What is surface energy? Obtain the relation between surface tension and surface energy.

iv. A steel wire of length 6 m and cross section 1 mm^2 is hung from a rigid support with a steel weight of volume 2000 cc hanging from the other end. Find the decrease in the length of wire, when steel weight is completely immersed in water.
[$Y_{steel} = 2 \times 10^{11}$ N/m^2, Density of water = 1 g/cc]

Q.4. A. Derive an expression for the kinetic energy of a body rotating with uniform angular velocity**.** **[4]**

B. A body describes S.H.M in a path 0.16 m long. Its velocity at the centre of the line is 0.12 m/s. Find the period and magnitude of velocity at a distance 1.7×10^{-2} m from the mean position. **[3]**

OR

Q.4. A. State Kirchhoff's law of radiation and give its theoretical proof. **[4]**

B. A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 50 Hz. The mass of the wire is 4.4×10^{-2} kg and its linear mass density is 4.0×10^{-2} kg m^{-1}. What is

i. the speed of a transverse wave on the string?

ii. the tension in the string? **[3]**

SECTION – II

Q. 5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. Velocity of light in air is 'c'. Its velocity in a medium of refractive index 1.5 will be _____.

(A) c (B) $\frac{c}{1.5}$

(C) $c \times 1.5$ (D) $c + 1.5$

ii. If the lengths of two wires of same material are in the ratio 2 : 1, then the ratio of their specific resistances will be _____.

(A) 1 : 2 (B) 2 : 1

(C) 4 : 1 (D) 1 : 1

iii. The phenomenon of paramagnetism is a consequence of _____.

(A) distortion effect (B) orientation effect

(C) both (A) and (B) (D) neither (A) nor (B)

iv. If 'R' and 'L' stand for the resistance and inductance respectively, then among the following the one having the dimensions of frequency is _____.

\ (A) $\frac{R}{L}$ (B) $\frac{L}{R}$

(C) $\frac{\sqrt{R}}{L}$ (D) $\frac{\sqrt{L}}{R}$

v. For what value of velocity of electrons, the stopping potential will be able to stop them?

(A) 10^3 m/s (B) very high speeds

(C) very low speeds (D) all speeds.

vi. In an amplitude modulated wave, the power content of the carrier is maximum for which value of 'm'?

(A) zero (B) 1

(C) 0.1 (D) 0.4

vii. In Boolean algebra, $\overline{A+B}$ = _____.

(A) $A \cdot B$ (B) $A + B$

(C) $\overline{A}+\overline{B}$ (D) $\overline{A} \cdot \overline{B}$

Q.6. Attempt any SIX: **[12]**

i. Distinguish between interference and diffraction.

ii. Explain working of Van de Graaff generator

iii. Resistances in a Wheatstone's bridge are 45 Ω, 90 Ω, 25 Ω and a series combination of 5 Ω and X Ω. If the bridge is balanced, calculate value of X.

iv. What is the effect of heat on a ferromagnetic substance?

v. A long solenoid of length 2 m has 1000 turns of wire closely wound on it. If the current in the winding is 2 A, calculate the magnetic field at the centre of solenoid.

vi. The electric current in a circuit is increased uniformly from 2 A to 10 A during a time interval of 2 seconds. Another coil of resistance 40 Ω and mutual inductance 1 H is placed near it. Calculate the induced current in the second coil.

vii. Calculate the de Broglie wavelength of waves associated with a beam of neutrons of energy 0.05 eV. [$h = 6.63 \times 10^{-34}$ Js, $m_n = 1.66 \times 10^{-27}$ kg]

viii. Define the following terms.

a. Demodulation b. Attenuation

Q.7. Attempt any THREE **[9]**

i. Two parallel plate air capacitors have their plate areas 100 cm^2 and 400 cm^2 respectively. If they have the same charge and potential and the distance between the plates of the first capacitor is 0.4 mm, what is the distance between the plates of the second capacitor?

ii. An alternating e.m.f is applied to a circuit containing resistance. Discuss the behaviour of current in the circuit.

iii. With the help of a neat circuit diagram, explain working of P-N junction diode as a half-wave rectifier.

iv. A resistance of 5Ω is connected in parallel to a galvanometer of resistance 495Ω. Find the fraction of the total current, passing through galvanometer.

Q.8 A. Give the theory of interference bands and hence obtain an expression for bandwidth. **[4]**

B. The photoelectric work function for a surface is 2.5 eV. Light of wavelength 6000 Å shines on the surface. Find the frequency of the incident light and also the threshold frequency. Will there be photoelectric emission or not? **[3]**

OR

Q.8. A. Explain origin of spectral line and obtain Bohr's formula. **[4]**

B. If the difference in velocities of light in glass and water is 0.24×10^8 m/s, find the velocity of light in air [Given : $\mu_g = \frac{3}{2}$, $\mu_w = 4/3$] **[3]**

MODEL QUESTION PAPER SET - IV

PHYSICS

Time: 3 Hours **Total Marks: 70**

Note:

i. All questions are compulsory
ii. Neat diagrams must be drawn wherever necessary.
iii. Figure to the right indicate full marks.
iv. Use of logarithmic table is allowed.
v. All symbols have their usual meaning unless otherwise stated.

SECTION – I

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. In uniform circular motion, the velocity vector and acceleration vector are _____.

(A) perpendicular to each other (B) in same direction
(C) opposite direction (D) not related to each other

ii. The ratio of kinetic energy of a body orbiting near the earth's surface and the kinetic energy of the same body escaping the earth's gravitational field is _____.

(A) 1:1 (B) 2:1
(C) $\sqrt{2}$:1 (D) 0.5:1

iii. Which one of the following substances possesses the highest elasticity?

(A) Rubber (B) Glass
(C) Steel (D) Copper

iv. A circular disc of mass M and radius R is rotating about its axis with uniform speed v. What is its kinetic energy?

(A) Mv^2 (B) $\left(\frac{1}{2}\right)Mv^2$
(C) $\left(\frac{1}{4}\right)Mv^2$ (D) $\left(\frac{1}{8}\right)Mv^2$

v. A body which absorbs all the radiations incident over it is called a _____.

(A) black body (B) perfectly black body
(C) good absorber (D) good emitter

vi. A liquid does not wet the sides of a solid, if the angle of contact is _____.

(A) zero (B) 120°
(C) 45° (D) 90°

vii. When two sound waves are superimposed, beats are produced when they have _____.

(A) Different amplitudes and phases (B) Different velocities
(C) Different phases (D) Different frequencies

Q. 2. Attempt any SIX: **[12]**

i. What is the angular speed of the minute hand of a clock? If the minute hand is 6 cm long. What is the linear speed of its tip?

ii. Assuming the earth to be a homogeneous sphere, determine the density of the earth from following data: $g = 9.8\ m/s^2$, $G = 6.673 \times 10^{-11}\ Nm^2/kg^2$, $R = 6400\ km$

iii. Discuss the physical significance of radius of gyration. Also discuss the factors on which radius of gyration depends.

iv. Particle performing S.H.M starts from extreme position. Plot a graph of displacement against time.

v. What is meant by an angle of contact? State the main characteristics of angle of contact.

vi. A racing car passes stand of race course, travelling at a speed of 180 km/hr. If the noise from the exhaust has a frequency of 300 Hz, determine the frequency heard by audience as the car approaches stand. (Assume speed of sound as 340 m/s)

vii. Distinguish between harmonics and overtones.

viii. Calculate the temperature at which the average K.E. of a molecule of a gas will be same as that of an electron accelerated through 4 volt. [$k_B = 1.4 \times 10^{-23}$ J/molecule K, $e = 1.6 \times 10^{-19}$ C]

Q.3. Attempt any THREE: **[9]**

i. A stone weighing 2 kg is whirled in a vertical circle at the end of a rope of length 0.5 m. Find the tension at lowest position, mid position, highest position

ii. Show that under certain conditions, a simple pendulum performs linear S.H.M.

iii. Derive an expression for strain energy using calculus method.

iv. The transverse displacement of a string (clamped at its both ends) is given by $y(x, t) = 0.06 \sin\left(\frac{2\pi}{3}x\right)\cos(120\ \pi t)$ where x and y are in m and t is s. Do all the points on the string oscillate with the same frequency and amplitude? What is the amplitude of a point 0.375 m away from one end?

Q.4 A. Obtain an expression for the binding energy of a satellite revolving in a circular orbit round the earth. Find the total energy and binding energy of an artificial satellite of mass 1500 kg orbiting at height of 1600 km above the earth's surface.
[Given $G = 6.67 \times 10^{-11}\ Nm^2/kg^2$, $R = 6400$ km, $M = 6 \times 10^{24}$kg] **[4]**

B. Define root mean square velocity of gas molecules and derive an expression for it using the expression for the pressure exerted by the gas. **[3]**

OR

Q.4. A. Derive expression for velocity of a ring and solid cylinder having same radii rolling down the smooth inclined plane without slipping. **[4]**

B. Eight droplets of water, each of radius 0.2 mm, coalesce into a single drop. Find the change in total surface energy. [Surface tension = 0.072 N/m] **[3]**

SECTION – II

Q. 5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. A wavefront is _____.
(A) a surface perpendicular to the direction of propagation of light.
(B) a surface parallel to the direction of propagation of light.
(C) a surface without any specific orientation to direction of propagation of light.
(D) a surface which has nothing to do with intensity of light.

ii. When 2 identical capacitors are connected in series then resultant capacitance is _____.
(A) C (B) $\frac{2C}{C^2}$ (C) $\frac{C}{2}$ (D) 2C

iii. In meter bridge experiment to minimise errors, the wire used must be _____.
(A) thin (B) uniform (C) homogeneous (D) all of the above

iv. μ_o is analogous to _____.
(A) ε_o (B) $\frac{1}{\varepsilon_o}$ (C) $4\pi\varepsilon_o$ (D) $\mu\varepsilon_o$

v. Dimensions of mutual inductance are _____.
(A) $[L^2M^1 T^{-2} I^{-2}]$ (B) $[L^{-2}M^1 T^{-2} I^2]$
(C) $[L^1M^2 T^{-2} I^{-2}]$ (D) $[L^2M^1 T^{-2} I^{-2}]$

vi. The kinetic energy of emitted photoelectrons _____.
(A) increases with increase in incident intensity.
(B) is independent of incident intensity.
(C) decreases with decrease in incident intensity.
(D) decreases with increase in incident intensity.

vii. The diode used in 7-segment display unit is _____.
(A) photo diode (B) junction diode
(C) zener diode (D) light emitting diode

Q. 6. Attempt any SIX: **[12]**

i. Draw a labelled block diagram of elements of communication system

ii A parallel beam of monochromatic light is incident on a glass slab at an angle of incidence of 45°. Find ratio of width of the beam in glass to that of air if R. I. of glass is 1.5

iii. In a biprism experiment, the slit is illuminated by red light of wavelength 6400 Å and the cross wire of the eyepiece is adjusted at the centre of 6th bright band. By using blue light it is found that the 8th bright band is on the cross wire. Find the wavelength of blue light.

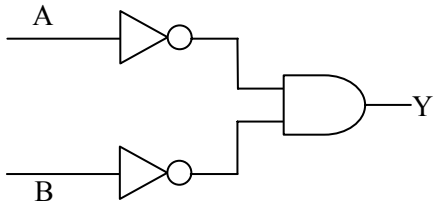
iv. Two resistances prepared from the wire of the same material having diameters in ratio 2:1 and lengths equal are connected in the left and right gap of Wheatstone's meter bridge. Determine the distance of null point from the left end of wire.

v. An infinite line charge produces a field of 1.8×10^3 N/C at a distance of 3 cm. Calculate the linear charge density.

vi. Explain what is a photoelectric cell and how it is used in exposure meter.

vii. Explain what is a Curie temperature and its importance

viii. Write the Boolean expression for the output and identify the output function.



Q. 7. Attempt any THREE: **[9]**

i. Prove Snell's law using Huygen's principle

ii. On passing light of wavelength 7500 Å through two pinholes 0.5mm apart interference pattern is observed on a screen placed at 200 cm away from pinholes. Find the distance between the fifth bright band on one side of the central bright band and the sixth dark band on the other side.

iii. Derive an expression for magnetic induction at a point near infinitely long straight conductor carrying current.

iv. A hydrogen atom undergoes a transition from a state with n = 4 to a state with n = 1. Calculate the change in the angular momentum of the electron and the wavelength of the emitted photon.
[$h = 6.63 \times 10^{-34}$ J.s, $R = 1.097 \times 10^{7}$ m^{-1}]

Q.8. A. Explain principle, construction and working of transformer. **[4]**

B. When a surface is irradiated with light of wavelength 4950 Å, a photocurrent appears which vanishes if a retarding potential greater than 0.6 V is applied across the phototube. When different source of light is used, it is found that the critical retarding potential is changed to 1.1 V. Find the work function of the emitting surface and the wavelength of the second source. **[3]**

OR

Q.8. A. Describe Davisson Germer experiment to explain wave nature. **[4]**

B. Three capacitors of capacities 2 μF, 4 μF and 6 μF are connected in series and in parallel respectively. Compare the effective capacities in the two combinations. **[3]**