

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086**  
**(For candidates admitted during the academic year 2023 - 2024)**

**B.Sc. DEGREE EXAMINATION APRIL 2024**  
**BRANCH I - MATHEMATICS**  
**SECOND SEMESTER**

**COURSE : ALLIED – CORE**

**PAPER : PHYSICS FOR MATHEMATICS -II**

**SUBJECT CODE : 23PH/AC/PM23**

**TIME : 3 HOURS**

**MAX. MARKS : 100**

Q. No.	SECTION A Answer ALL the questions (20x1=20)	CO	KL
1.	What does Coulomb's law describe? a) The force between two masses b) The force between two charges c) The force between two magnets d) The force between two objects at rest	CO1	K1
2.	Which of the following materials typically exhibits the highest capacitance per unit volume? a) Air b) Glass c) Vacuum d) Dielectric material	CO1	K1
3.	What is the SI unit of electric flux? a) Joule per coulomb b) Newton per meter squared c) Volt per meter d) Newton meter squared per coulomb	CO1	K1
4.	Which factor affects electric potential difference the most between two points in an electric field? a) Distance between the points b) Amount of charge at each point c) Permittivity of the medium d) Angle between the electric field lines and the surface	CO1	K1
5.	When the number of loops in a coil is increased the magnetic induction will a) Decreases b) Increases c) Remains the same d) Fluctuates	CO1	K1
6.	Lorentz force describes a) The force experienced by a charged particle moving in a magnetic field b) The force experienced by a charged particle due to an electric field c) The force experienced by a mass moving in a gravitational field d) The force experienced by a particle undergoing nuclear decay	CO1	K1

7.	The strength of an electromagnet depends on a) Voltage b) Length of the wire c) Temperature d) All of the above	CO1	K1
8.	What is the main principle behind the operation of a ballistic galvanometer? a) Electrostatic repulsion b) Magnetic induction c) Thermal expansion d) Piezoelectric effect	CO1	K1
9.	Spherical aberration in lenses is due to: a) Imperfections in lens material b) Incorrect lens positioning c) Variation in focal length d) Inconsistency in focusing parallel light rays	CO1	K1
10.	What causes chromatic aberration in lenses primarily? a) Uneven curvature of lens surfaces b) Variation in refractive index with wavelength c) Excessive lens thickness d) Inadequate lens coating	CO1	K1
11.	What type of optical instrument is best suited for observing distant celestial objects such as stars, planets, and galaxies? a) Telescope b) Binoculars c) Magnifying glass d) Periscope	CO1	K1
12.	What is the primary function of the Hubble Space Telescope? a) To search for extra-terrestrial life b) To study the formation and evolution of galaxies c) To monitor weather patterns on Earth d) To measure atmospheric conditions on Mars	CO1	K1
13.	What causes the formation of Newton rings? a) Interference between reflected and transmitted light waves b) Magnetic field interactions c) Gravitational lensing d) Quantum tunnelling	CO1	K1
14.	Which of the following statements about thin films is true? a) Thin films are typically hundreds of micrometers thick. b) Thin films are used primarily in bulk manufacturing processes. c) Thin films can exhibit unique optical, electrical, and mechanical properties. d) Thin films are not applicable in the field of nanotechnology	CO1	K1
15.	In a plane transmission grating, which factor primarily influences the angular dispersion of the diffracted light? a) Wavelength of incident light b) Thickness of the grating c) Width of the grating slits d) Number of grating lines per unit length	CO1	K1

16.	What happens to light when it undergoes polarization? a) It changes color b) It changes intensity c) It changes direction d) It changes wavelength	CO1	K1
17.	In an inverting operational amplifier configuration, if a positive voltage is applied to the input terminal, what is the expected polarity of the output voltage? a) Positive b) Negative c) Zero d) It depends on the specific op-amp used	CO1	K1
18.	In an inverting operational amplifier configuration, what is the relationship between the input voltage and the output voltage? a) The output voltage is equal to the input voltage b) The output voltage is inversely proportional to the input voltage c) The output voltage is directly proportional to the input voltage d) The output voltage is independent of the input voltage	CO1	K1
19.	What does De Morgan's Theorem state? a) It states that the sum of two variables is equal to the product of their complements. b) It states that the product of two variables is equal to the sum of their complements. c) It states that the complement of the sum of two variables is equal to the product of their complements. d) It states that the complement of the product of two variables is equal to the sum of their complements.	CO1	K1
20.	What is the use of the Karnaugh map in digital logic design? a) To design combinational logic circuits b) To design sequential logic circuits c) To simulate circuit behavior d) To analyze circuit efficiency	CO1	K1
<b>Q. No.</b>	<b>SECTION B</b> <b>Answer ALL the questions</b> (10x2=20)	<b>CO</b>	<b>KL</b>
21.	Define coulomb's law	CO2	K2
22.	What is electric potential?	CO2	K2
23.	Write down the Biot savart law	CO2	K2
24.	Define Lorentz force	CO2	K2
25.	Define monochromatic aberration	CO2	K2
26.	What is a coma?	CO2	K2
27.	Define interference.	CO2	K2
28.	Define diffraction.	CO2	K2
29.	Differentiate inverting and non-inverting amplifier	CO2	K2
30.	What is karnaugh map?	CO2	K2
<b>Q. No.</b>	<b>SECTION C</b> <b>Answer any TWO questions</b> (2x20=40)	<b>CO</b>	<b>KL</b>
31.	(a) Derive the equation for electric field due to uniformly charged hollow cylinder (10 marks)	CO3	K3

	(b) Obtain an expression for electric potential due to a point charge <b>(10 marks)</b>	CO4	K4
32.	(a) Derive the expression for force on a charge in a magnetic field. <b>(10 marks)</b>	CO3	K3
	(b) Explain the theory of moving coil ballistic galvanometer <b>(10 marks)</b>	CO4	K4
33.	(a) Explain spherical aberration in lenses <b>(10 marks)</b>	CO3	K3
	(b) Explain the phenomenon of interference due to reflected light. <b>(10 marks)</b>	CO4	K4
34.	(a) Explain the theory of plane transmission grating for normal incidence. <b>(10 marks)</b>	CO3	K3
	(b) State and verify De-Morgan's Theorem <b>(10 marks)</b>	CO4	K4
	<b>SECTION D</b> <b>Answer any FOUR questions</b> <b>(4 x 5= 20)</b>		
35.	The radii of the inner and outer sphere of a spherical capacitor are $2 \times 10^{-2}$ m and $6 \times 10^{-2}$ m. If the dielectric medium between the plates is air, calculate the capacitance of the spherical capacitor if the outer is earthed and the inner sphere is positively charged.	CO5	K5
36.	Two point charges, $q_1 = 4 \times 10^{-6}$ C and $q_2 = -6 \times 10^{-6}$ C are placed 2 meters apart in a vacuum. Calculate the magnitude and direction of the electric force exerted on each charge.	CO5	K5
37.	Two lenses of focal lengths 8 cm and 4 cm are placed at a certain distance apart. Calculate the distance between the lenses if they form an achromatic combination.	CO5	K5
38.	In a Newton's ring experiment, the diameter of the 20th dark ring was found to be 5.82 mm and the 10th ring is 3.36mm. If the radius of the plano convex lens is 1m, calculate the wavelength of light used.	CO5	K5
39.	A parallel beam of monochromatic light is allowed to be incident normally on a plane grating having 1250 lines per cm and a second order spectral line is observed to be deviated through $30^\circ$ . Calculate the wavelength of the spectral line.	CO5	K5
40.	Consider two point charges, $Q_1 = +3\mu C$ and $Q_2 = -2\mu C$ , located at points A and B respectively. The distance between them is 2 m. Calculate the electric potential at a point P located 4 m from $Q_1$ and 3 m from $Q_2$ .	CO5	K5

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