

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.  
(For candidates admitted during the academic year 2011-12 & thereafter)

SUBJECT CODE : 11PH/AC/PM23

B.Sc. DEGREE EXAMINATION APRIL 2013  
BRANCH I – MATHEMATICS  
SECOND SEMESTER

REG. No. \_\_\_\_\_

COURSE : ALLIED – CORE  
PAPER : PHYSICS FOR MATHEMATICS – II  
TIME : 30 MINS. MAX. MARKS : 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF  
ANSWER ALL QUESTIONS: (30x1=30)

I. CHOOSE THE CORRECT ANSWER:

- The total electric flux over any closed surface is  
(a)  $\epsilon_0$  (b)  $q^2/\epsilon_0$  (c)  $\epsilon_0/q$  (d)  $q/\epsilon_0$
- The dielectric inside a capacitor basically increases  
(a) voltage rating (b) current rating (c) Capacitance (d) power rating
- The physical quantity represented by the unit Weber is  
(a) magnetic induction (b) magnetic flux (c) magnetic potential  
(d) gravitational potential
- EMF induced in a coil is maximum when  $\omega t$  is  
(a)  $0^\circ$  (b)  $90^\circ$  (c)  $180^\circ$  (d)  $360^\circ$
- When a conductor of length ' $\ell$ ' forming a closed circuit moves perpendicular to a uniform magnetic field B with a velocity v, the emf induced is  
(a)  $B\ell/v$  (b)  $-B\ell/v$  (c)  $-B\ell v$  (d)  $Bv/\ell$
- Which one of the following cannot be polarized?  
(a) sound waves (b) X-rays (c) Microwaves (d) radio waves
- If a white light is used, the centre of the Newton's ring is  
(a) bright (b) violet (c) red (d) dark
- The arrangement to produce parallel beam of light in a spectrometer is  
(a) telescope (b) collimeter (c) microscope (d) prism table
- The bending of light about the edges of an obstacle is called  
(a) dispersion (b) refraction (c) deviation (d) diffraction

10. The phenomenon that takes place in a nicol prism is  
(a) dispersion (b) scattering (c) deviation (d) double refraction
11. When there is no feedback between output and one of the input terminal of Op-Amp is said to be  
(a) closed loop (b) open loop (c) virtual ground (d) difference amplifier
12. The output of a AND gate is high when  
(a) both the inputs are low (b) both the inputs are high  
(c) one is high and other is low (d) None of the above
13. The value of binary addition  $1101_2 + 111_2$  is  
(a)  $110_2$  (b)  $101_2$  (c)  $11_2$  (d) none
14. The decimal equivalent of the binary number  $11011_2$   
(a) 24 (b) 25 (c) 26 (d) 27
15. The output impedance of an ideal Op-amp is  
(a)  $\infty$  (b) 0 (c) 1 (d) None of the above

**Fill in the blanks:**

16. The unit of permittivity is \_\_\_\_\_
17. When interference of waves takes place, there is redistribution of \_\_\_\_\_
18. Solar spectrum is an example of \_\_\_\_\_
19. Weber is equivalent to \_\_\_\_\_
20. The value of bandwidth for an ideal Op-amp is \_\_\_\_\_

**State whether TRUE/FALSE:**

21. Two parallel straight conductors carrying current in opposite direction will repel each other .
22. Nicol prism may be used as a polarizer and analyser.
23. The binary equivalent of the decimal number 19 is  $10011_2$  .
24. AND and OR gates are universal building blocks.
25. The output equals input and in phase of an Op-Amp is called unity gain amplifier.

**Answer briefly:**

26. State Gauss law.
27. Define Optical activity

/3/

11PH/AC/PM23

28. Give the principle of capacitor.

29. Define Aberrations.

30. Define: slew rate of an Op-amp.

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SECTION - B

ANSWER ANY FIVE QUESTIONS: (5×6=30)

1. A capacitor is made up of two plates separated by a sheet of insulating material 3 mm thick and of relative permittivity 4. The distance between the plates is increased to allow the insertion of a second sheet of thick 5 mm and relative permittivity  $\epsilon_r$ . If the capacitance of the capacitor so formed is one half of the original capacitance. Find the value of  $\epsilon_r$ .
2. An electron circulates around the nucleus in a path of radius  $0.529 \text{ \AA}$  at a frequency  $6.58 \times 10^{15} \text{ Hz}$ . Find the magnitude of the magnetic induction at the centre of the orbit. What is its dipole moment?
3. An astronomical telescope has an objective of focal length 80 cm and an eye piece of 2 cm focal length. What is its magnifying power? If the final image is at the least distance of distinct vision 25 cm, what is its magnifying power?
4. Write a short note on reflecting telescope.
5. State and prove De Morgan's theorem.
6. Perform the following :  
(i)  $1001_2 + 110_2$   
(ii)  $1101_2 - 111_2$   
(iii)  $1110_2 \div 111_2$
7. For an OP-amp, the CMRR value is 95 dB and Open loop gain is 2,00,000. Calculate the common mode gain.

SECTION – C

ANSWER ANY TWO QUESTIONS: (2 × 20 = 40)

8. Give the theory of plane transmission grating. Describe the experiment to determine the wavelengths of mercury spectrum using grating?

- 9.a. Obtain the expression for the force experienced by an electron moving in magnetic field.
- b. Write down the Maxwell's electromagnetic equation and give their significance.
- 10.a. What are the different types of defects of images? Explain.
- b. Describe the methods to minimize spherical aberration and chromatic aberration.
- 11.a. What are the ideal characteristics of Operation amplifier?
- b. Explain how an Op-amp. can be used as an inverting and non-inverting amplifier.

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