

2. (a) Two charges $+10\text{ C}$ and $+15\text{ C}$ are located at points $(2, -3, 4)$ and $(-3, 2, 1)$. Calculate the force on $+15\text{ C}$ charge. 3
 (b) What is electric field intensity? Find the value of an electric field due to a point charge. Why do electric lines of force not cross each other? $1+2+1=4$
3. (a) State Biot-Savart law and write its expression in vector form. 2
 (b) Using Biot-Savart law, calculate the magnetic field due to a long solenoid. 5
4. Write Four Maxwell's equations in vacuum and explain their significance. $3+4=7$
5. (a) What is impedance of an electrical circuit? Obtain the impedance of a series $L-C-R$ circuit. $1+3=4$
 (b) Explain sharpness of resonance and bandwidth of a series $L-C-R$ circuit. $1\frac{1}{2}+1\frac{1}{2}=3$
6. With the help of a ray diagram, explain the cardinal points of an optical system. Explain their importance. $6+1=7$

7. Using Fermat's principle, establish the law of reflection and refraction at a plane boundary. $3\frac{1}{2}+3\frac{1}{2}=7$

8. (a) With the help of a ray diagram, find the focal length of a combination of two thin lenses of focal lengths f_1 and f_2 separated by a distance d . .5

(b) Find the equivalent focal length of two thin lenses of focal lengths 10 cm and 12 cm in contact. 2

9. (a) Construct the system matrix for refraction of paraxial rays through a thin lens. 3

(b) Establish lens maker formula by matrix method. 4

10. (a) In a transistor, explain why the base region is made thin and emitter region is made with high doping concentration. 4

(b) Explain what are input characteristic, output characteristic and current amplification factor of a CB configuration transistor. 3

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11. (a) Convert the binary number 10111.11 to its decimal equivalent. 3
- (b) Find the sum of 1011, 1101 and 111011. 2
- (c) Subtract 1011101 from 1110011 by 2's complement method. 2
12. (a) What is a logic gate? Explain with truth table the operation of AND and OR logic gates. 1+2+2=5
- (b) What is a *p-n* junction diode? Explain the use of a *p-n* junction diode as a rectifier. 2
