ملاحظات هامة: ١- يجب المحافظة علي ترتيب الأسئلة عند الإجابة عليها ولا تستخدم ورقة الرسم البياني في الرسم أو الحل

٢- يجب البدء في الإجابة علي كل سؤال في بداية صفحة جديدة وممنوع استخدام حل آخر لأي جزء في الإمتحان

Question 1 [12 marks]

(a) Monochromatic light of wavelength 589 nm is incident from a medium of refractive index n_1=1.5 with an incident angle θ on a thin film of thickness t=1 μm and refractive index n_2=1.45 as shown in the following figure.   (5marks)
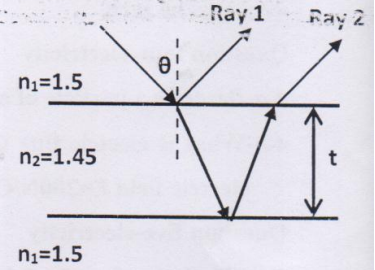
(i) Find the angle θ to have completely polarized reflected beam?

(ii) Find the minimum angle θ to have total internal reflection?

(iii) What is the phase difference between Ray 1 and Ray 2?

(iv) Write the conditions of constructive and destructive interference?

(b) Sketch only   (وضح بالرسم فقط مع كتابة كامل البيانات)   (4 marks)

  (i) Polarization by selective absorption using polarizer and analyzer

  (ii) Michelson Interferometer

(c) In a double slit experiment, a thin plate cover one slit and thereby introduces a 90° phase lag.

  (i) What is the path difference between the waves at the center?

  (ii) What are the conditions for constructive and destructive interferences?   (3 marks)

Question 2 [13 marks]

(a) What are the reasons for attenuation through the optical fibers?   (4 marks)

(b) What is meant by (i) numerical aperture=0.3   (ii) modal dispersion   (4 marks)

(c) (i) Find the rest energy of a proton (m=1.673 × 10^{-27} kg) in units of electron volts (1 ev=1.602 ×10^{-19} J).

  (ii) If the total energy of a proton is three times its rest energy, what is the speed of the proton?

  (iii) Determine the relativistic kinetic energy of the proton in units of electron volts.   (3 marks)

(d) A train moving with speed 0.6C relative to the ground has a measured length of 320 m in the ground frame.

  (i) Find the relativistic length of the train?

  (ii) How long time does the train take to pass a tree in the ground frame.   (2 marks)

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$K = 9 \times 10^9 \ Nm^2/C^2$ $(\varepsilon_0 = 8.8 \times 10^{-12} \ F/m)$ $(m_p = 1.6 \times 10^{-27} \ kg$ $e = 1.6 \times 10^{-19} \ C)$

Question three-electricity

3-a-Plot E versus r, and V versus r for a solid conducting charged sphere of radius a.(3 marks)

3-b-A point charge $q_1 = 5 \ \mu C$, is at $x = 0.0$, while $q_2 = 10 \mu C$ is at $x = 1.0 \ m$. At what point, besides infinity, would (i) the net electric field on x-axis be zero, (ii) the net electric potential on x-axis be zero. (3 marks)

Question four-electricity

4-a-*Describe* a particle of a charge q that is placed in an uniform electric field E.   (3 marks)

4-b-What is electric flux Φ for a sheet of radius *5cm* immersed perpendicular to a uniform electric field E=200N/C?
(3 marks)

Question five-electricity

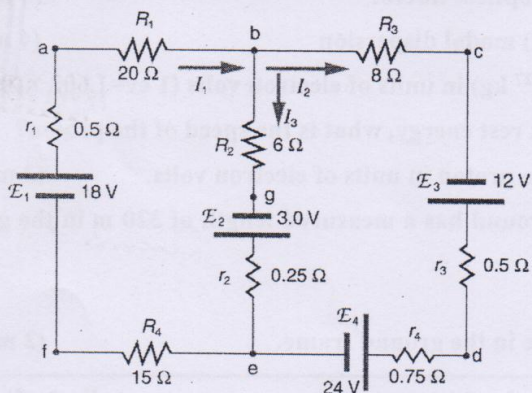5-a- Find the electric field due to infinite line charge (λ charge density per unit length) at distance r from the line. (3 marks)

5-b- A solid conducting sphere of radius 10cm, has an electric charge density 18 $\mu C/m^2$. Find the electric field and electric potential at its center, its surface and at $r = 15$ cm. (3 marks)

Question six-electricity

6-a-The plates of a parallel-plate capacitor in vacuum are *6.0 mm* apart and *0.5 m^2* in area. A potential difference of *8.0 kV* is applied across the capacitor. Compute: i) the capacitance; ii) the charge on each plate; and iii) the magnitude of the electric field in the space between them.

The battery is then disconnected, and a piece of Bakelite (k = 4.8) is inserted between the plates. What is the capacitance, the charge on the plates, and the potential difference between the plates, after the dielectric is inserted? (4 marks)

6-b-Solve for the currents in each branch of the circuit in the figure. (3 marks)