Kafr Elshiekh University
Faculty of Engineering
Department of
Physical and Mathematical Engineering
Preparatory Year

Engineering physics (1)

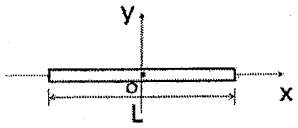
2- 01- 2018
3 hours
90 Marks
Final exam: 3 pages

Answer the following questions:

Question(1) : (ILOs: a1) ***(15 Marks)***

(a) Suppose that the acceleration (a) of a particle moving with uniform speed (v) in a circle of radius (r), is proportional to (r^n) and (v^m). Determine the values of n and m and write the simplest form of an equation for the acceleration.

(b) Calculate the moment of inertia of a uniform rigid rod of length (L) and mass (M) about an axis perpendicular to the rod and passing through its center of mass.



(c) The position versus time for an object in simple harmonic motion is given by [$x(t) = 0.05 \cos(5t+0.127\pi)$ m]. What is the velocity and acceleration of this object?

Question(2) : (ILOs: b1) ***(15 Marks)***

(a)A solid steel sphere is initially surrounded by air ($P_o=10^5$ N/m^2). The sphere is lowered into the ocean to a depth where the pressure is ($2*10^7$N/m^2). The volume of the sphere in air is (0.5 m^3). By how much does this volume change once the sphere is submerged?($\beta=20*10^{10}$N/m^2)

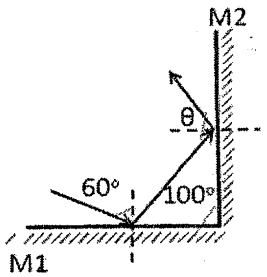
(b) The pressure experienced at a point on the bottom of a swimming pool (9 m) in depth is (189.5 k Pa). What is the density of water? ($P_o=10^5$ Pa), (g= 9.8 m/s^2).

(c) What is the main assumptions of the *Ideal fluid flow* ?

Question(3) : (ILOs: c1) ***(15 Marks)***

(a) Two mirrors make an angle of (100°) with each other, A ray is incident on mirror M_1 at an angle of (60°). Find the direction of the ray after it is reflected from mirror M_2.

(b) Draw a sketch showing the path of light rays from a point on the bottom of a swimming pool to the eye of an observer.



(c) An object is placed (15 cm) away from a lens. A virtual image is formed (5 cm) from the lens. Determine the focal length of lens, and the type of lens.

Question(4) : (ILOs: a1) ***(15 Marks)***

(a) Choose the best answer:

1-A total charge of 6.3×10^{-8} C is distributed uniformly throughout a 2.7-cm radius sphere. The volume charge density is:

a. $3.7 \times 10{-}7$ C/m^3. b. $6.9 \times 10{-}6$ C/m^3. c. $6.9 \times 10{-}6$ C/m^2.

d. $2.5 \times 10{-}4$ C/m^3. e. $7.6 \times 10{-}4$ C/m^3.

2- Each plate of a capacitor stores a charge of magnitude 1mC when a 100-V potential difference is applied. The capacitance is:

a. 5 μF. b. 10 μF. c. 50 μF. d. 100 μF. e. none of these.

3- The capacitance of a parallel-plate capacitor is: a. proportional to the plate area.

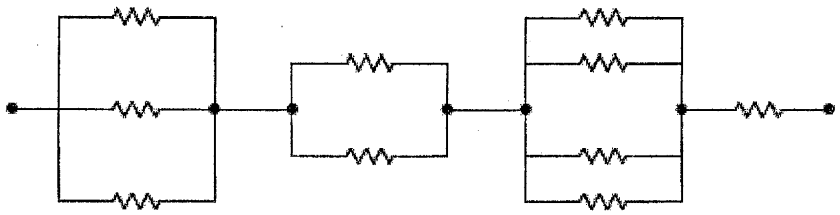
b. proportional to the charge stored. c. independent of any material inserted between the plates.

d. proportional to the potential difference of the plates. e. proportional to the plate separation.

4- The units of resistivity are: a. ohm. b. ohm·meter. c. ohm/meter

d. ohm/meter^2 e. none of these.

5- Each of the resistors in the diagram has a resistance of 12 Ω. The resistance of the entire circuit is:



a. 5.76 Ω. b. 25 Ω. c. 48 Ω. d. 120 Ω. e. none of these.

6-A farad is the same as a:

(a) J/V. (b) V/J. (c) C/V. (d) V/C. (e) N/C.

7- If the plate area of an isolated charged parallel-plate capacitor is doubled:

(a) the electric field is doubled. (b) the potential difference is halved.

(c) the charge on each plate is halved. (d) the surface charge density on each plate is doubled. (e) none of the above.

(b) Define the Electric Dipole and discuss the effect of electric Field on it.

Question(5) : (ILOs: b1) ***(15 Marks)***

(a) A sphere made of insulating material of radius R has a charge density $\rho = ar$ where a is a constant. Let r be the distance from the center of the sphere.

1) Find the electric field everywhere, both inside and outside the sphere.

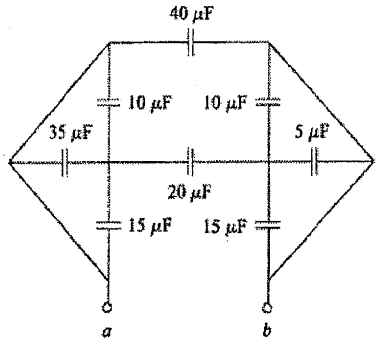
2) Find the electric potential everywhere, both inside and outside the sphere. Be sure to

indicate where you have chosen your zero potential.

3) How much energy does it take to assemble this configuration of charge?

(b) Start from Gauss's law find the capacitance per unit length for infinite cylindrical capacitor.

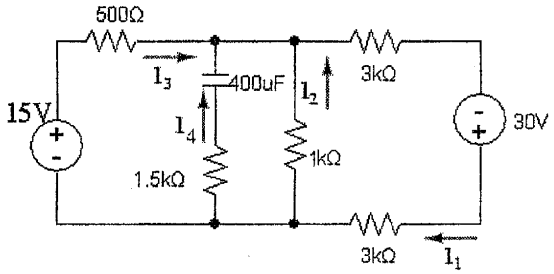
(c) For the following figure find the equivalent capacitance and if the potential between a and b is 30V find the potential difference for each one.



Question(6) : (ILOs: c2) ***(15 Marks)***

(a) The resistivity of Sodium sulfate (Na_2SO_4) solution is about 20 Ω·cm. The charge carriers are chiefly Na^+ and SO_4^{-2} ions, and of each there are about 3×10^{20}/ cm. If we fill a plastic tube 2 meters long with Sodium sulfate solution and connect a 12-volt battery to the electrodes at each end, what is the resulting average drift velocity of the each ion, in cm/s?

(b) Find the current in each branch of the following circuit and the charge on the capacitor and the energy stored in it.



(c) State the properties of conductors.

Useful data: $q_e = 1.6022 \times 10^{-19}$ C, $m_e = 9.1 \times 10^{-31}$ kg, $K_e = 9 \times 10^9$ N.m^2/C^2

Best Wishes

Dr. Ahmed Saeed **Dr. Demyana Adel Abdel Masieh**