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

Engineering physics (1)

12- 01- 2019
3 hours
90 Marks
Final exam: 3 pages

Answer the following questions:

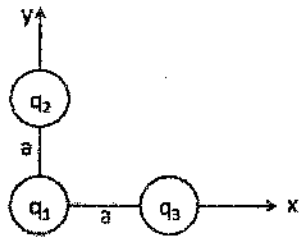
Question(1) : (ILOs: a1) ***(21 Marks)***

(a) Find the Electric Force exerted on q_1, q_1=+5μc, q_2=q_3=-2 μc, a=0.1m(K_e=8.9*10^{-9}Nm^2/c^2)

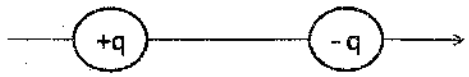
(b) A 40 cm diameter loop is rotated in a uniform electric field until the position of maximum electric flux is found. The flux in this position is 5.2*10^5N.m^2/c. What is the magnitude of the electric field?

(c) Sketch – the Electric Field Lines

- The Equipotential Surfaces in Fig. 1c.



Question (1) (a)



Question (1) (c)

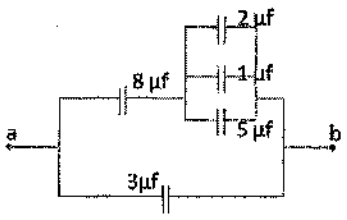
Question(2) : (ILOs: b1) ***(24 Marks)***

(a) Find the equivalent capacitance between a and b in Fig. 2a.

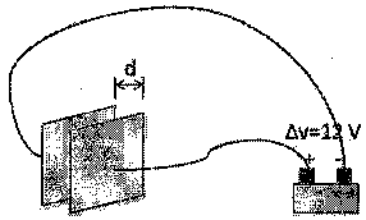
(b) A battery 12V is connected between two parallel plates. The uniform electric field between plates is 3*10^3V/m. Find the separation ' d ' between the plates.

(c) A ring of radius a carries a uniformly distributed positive total charges Q. Calculate the electric field due to the ring at a point P lying a distance x from its center along the central axis perpendicular to the plane of the ring.

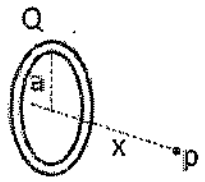
- For a=10 cm , Q= 75 μc , x= 1 cm , K_e=8.9*10^{-9}Nm^2/c^2 Find the electric field.



Question (2) (a)



Question (2) (b)



Question (2) (c)

Question(3) : (ILOs: a1) ***(15 Marks)***

(a) Choose the best answer:

1-A Newton is the force:

A. of gravity on a 1 kg body B. of gravity on a 1 g body C. that gives a 1 g body an acceleration of 1 cm/s^2 D. that gives a 1 kg body an acceleration of $1m/s^2$ E. that gives a 1 kg body an acceleration of $9.8m/s^2$

2-A certain spring elongates 9mm when it is suspended vertically and a block of mass M is hung on it. The natural angular frequency of this block-spring system is:

A. 0.088 rad/s B. 33 rad/s C. 200 rad/s D. 1140 rad/s

E. cannot be computed unless the value of M is given

3-A weight suspended from an ideal spring oscillates up and down with a period T. If the amplitude of the oscillation is doubled, the period will be:

A. T B. 2T C. T/2 D. 1.5T E. 4T

4-The standard 1kg mass is attached to a compressed spring and the spring is released. If the mass initially has an acceleration of 5.6m/s2, the force of the spring has a magnitude of:

A. 2.8N B. 5.6N C. 11.2N D. 0 E. an undetermined amount

5-Bernoulli's equation can be derived from the conservation of:

A. energy B. mass C. angular momentum D. volume E. pressure

6-An object attached to one end of a spring makes 20 vibrations in 10 s. Its angular frequency is: A. 0.79 rad/s B. 1.57 rad/s C. 2.0 rad/s D. 6.3 rad/s E. 12.6 rad/s

(b) Define the coefficient of viscosity and find its dimensions and units.

(c)A skater has the moment of inertia 150 $kg.m^2$ when his arms are outstretched and 50 $kg.m^2$ when his arms are brought to his sides. He starts to spin at the rate of 1 rev. per second when his arms are outstretched, and then pulls his arms to her sides. (1) What is his final angular velocity? (2) What are his initial and final kinetic energies? (3) Comment on your answer.

Question(4) : (ILOs: b1) ***(15 Marks)***

(a) Choose the best answer:

1-A large water tank, open at the top, has a small hole in the bottom. When the water level is 30m above the bottom of the tank, the speed of the water leaking from the hole is:

A. 2.5m/s B. 24m/s C. 44m/s D. cannot be calculated unless the area of the hole is given E. cannot be calculated unless the areas of the hole and tank are given

2-The inertia of a body tends to cause the body to:

A. speed up B. slow down C. resist any change in its motion D. fall toward Earth

E. decelerate due to friction

3-Water (density = 1×10^3 kg/m^3) flows through a horizontal tapered pipe. At the wide end its speed is 4m/s. The difference in pressure between the two ends is 4.5×10^3 Pa. The speed of the water at the narrow end is:

A. 2.6m/s B. 3.4m/s C. 4m/s D. 4.5m/s E. 5m/s

4-One end of a cylindrical pipe has a radius of 1.5 cm. Water (density = 1×10^3 kg/m^3) streams steadily out at 7m/s. The rate at which mass is leaving the pipe is:

A. 2.5kg/s B. 4.9kg/s C. 7.0kg/s D. 48 kg/s E. 7.0 × 103 kg/s

5-If a wheel is turning at 3 rad/s, the time it takes to complete one revolution is about:

A. 0.33 s B. 0.67 s C. 1.0 s D. 1.3 s E. 2.1 s

6-A fluid is undergoing steady flow. Therefore:

A. the velocity of any given molecule of fluid does not change B. the pressure does not vary from point to point C. the velocity at any given point does not vary with time

D. the density does not vary from point to point E. the flow is not uphill or downhill

(b) Drive Bernoulli's equation and one of its application.

(c) Determine the stress and total deformation of an aluminum wire, 30 m long and 5 mm in diameter, subjected to an axial load of 250 N($Y_{Aluminum} = 7\times10^{10}$ Pa).

Question(5) : (ILOs: c2) ***(15 Marks)***

(a) Choose the best answer:

1-A wheel initially has an angular velocity of 18 rad/s but it is slowing at a rate of 2rad/s^2. By the time it stops it will have turned through:

A. 81 rad B. 160 rad C. 245 rad D. 330 rad E. 410 rad

2-The hydraulic automobile jack illustrates: A. Archimedes' principle B. Pascal's principle C. Hooke's law D. Newton's third law E. Newton's second law

3-The dimensions of a wooden raft (density = 150 kg/m^3) are 3m × 3m × 1m. What maximum load can it carry in seawater (density = 1020 kg/m^3)?

A. 1350 kg B. 7800 kg C. 9200 kg D. 19, 500 kg E. 24, 300 kg

4-A disk has a rotational inertia of 6kg · m^2 and a constant angular acceleration of 2rad/s^2. If it starts from rest the work done during the first 5 s by the net torque acting on it is:

A. 0 B. 30 J C. 60 J D. 300 J E. 600 J

5-A fir wood board floats in fresh water with 60% of its volume under water. The density of the wood in g/cm^3 is:

A. 0.4 B. 0.5 C. 0.6 D. less than 0.4 E. more than 0.6

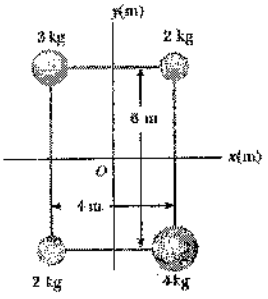
6-The ultimate strength of a sample is the stress at which the sample:

A. returns to its original shape when the stress is removed B. remains underwater

C. breaks D. bends 180° E. does none of these

(b) Show that the energy in simple harmonic motion are constant by two different methods

(c) The four particles in the figure are connected by rigid rods of negligible mass. The origin is at the center of the rectangle. If the system rotates in the xy plane about the z axis with an angular speed of 6 rad/s, calculate (1) the moment of inertia of the system about the z axis, (2) the rotational kinetic energy of the system and (3) the moment of inertia of the system about axis parallel to the z axis and 2m east to it.



Assume any missing data.

Best Wishes

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