ESSAY (100 marks)

INSTRUCTION:

This section consists of **SIX (6)** essay questions. Answer **FOUR (4)** questions only.

QUESTION 1

a) Give **TWO (2)** examples for each of the following terms: [CLO 3 : C1]

i. Uniform motion (2 marks)

ii. Non-uniform motion (2 marks)

b) Define and state the SI units of the following terms: [CLO 3 : C1]

i. displacement (2 marks)

ii. velocity (2 marks)

iii. acceleration (2 marks)

c) Calculate the acceleration of a car that moves from rest and achieves a velocity of 100 km/h in 15 s. [CLO 3 : C2]

(4 marks)

d) A car starts from rest and accelerates at a constant acceleration of 5 m/s^2 for 10 s. The car then travels at a constant velocity for 15 s. The brakes are then applied and the car stops in 5 s.

i. Sketch a velocity-time graph for the whole journey. [CLO 3 : C3]

(5 marks)

ii. Calculate the maximum velocity attained by the car. [CLO 3 : C3]

(2 marks)

iii. Calculate the total distance travelled. [CLO 3 : C3]

(4 marks)

POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION

(MINISTRY OF HIGHER EDUCATION)

MATHEMATICS, SCIENCE & COMPUTER DEPARTMENT

FINAL EXAMINATION
JUN 2012 SESSION

BB101: ENGINEERING SCIENCE

DATE: 19 NOVEMBER 2012 (MONDAY)

DURATION: 2 HOURS (8.30AM – 10.30AM)

This paper consists of **(9)** pages including the front page

This paper consists of **SIX (6)** questions. Answer FOUR **(4)** questions only

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(The CLO stated is for references only.)

d) Determine resultant force, Fr for the system of forces shown in Figure 2(d).

[CLO 3: C3]

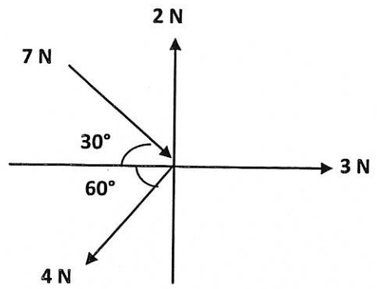


Figure 2(d)

(9 marks)

QUESTION 2

a) A box of mass 70kg is placed on a horizontal floor with a smooth surface. The velocity of the box changes from stationary to 50 m/s in 10 seconds when it is acted on by a force. Find the magnitude of the force. [CLO 3: C2]

(4 marks)

b) Figure 2b) shows an object with a mass of 10kg moves down a smooth plane inclined at an angle of 30°. (Use $g = 9.81\ m/s^2$)

Calculate the acceleration of the object. [CLO 3: C2]

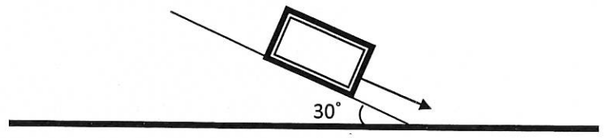
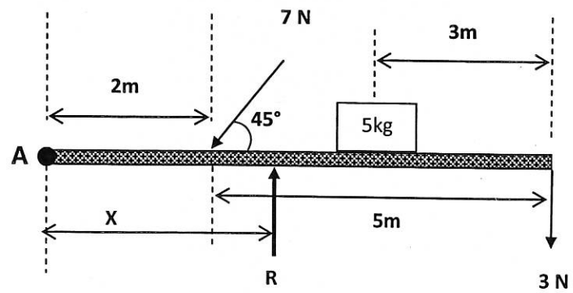


Figure 2(b)

(4 marks)

c) Figure 2c) shows a loaded beam. Find the reaction of R and its distance x from point A to keep the beam in equilibrium. ($g = 9.81\ m/s^2$). [CLO 3: C3]



(8 marks)

Figure 2(c)

QUESTION 4

a) Give the definition and SI unit for the following terms:

i. pressure [CLO 3: C1] (2 marks

ii. density [CLO 3: C1] (2 marks)

iii. relative density [CLO 3: C1] (2 marks)

b) State THREE (3) differences among solid, liquid and gas [CLO 3: C2]

(9 marks)

c) What is the total pressure experienced by Kevin if he dives 25 meters below the surface of the ocean? (Neglect the pressure due to the atmosphere)
(Density of seawater = 1.025×10^3 kg/m^3, and g = 9.81m/s^2) [CLO 3: C3]

(2 marks)

d)

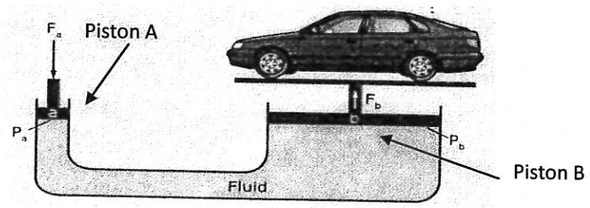


Figure 4(d)

According to Pascal's Principle, a force exerted on piston A can lift a car at piston B as shown in Figure 4(d). The diameter of piston A and piston B is 0.05 m and 0.20 m respectively, calculate the force must be exerted on the piston A to lift a 15000 N car. [CLO 3: C1]

(8 marks)

QUESTION 3

a) Define the following terms and state its SI unit.

i. Work [CLO 3 : C1] (2 marks)

ii. Energy [CLO 3 : C1] (2 marks)

iii. Power [CLO 3 : C1] (2 marks)

b) State the Principle of Conservation of Energy. [CLO 3 : C2]

(3 marks)

c) A 50g flying bullet has the same kinetic energy as a 20,000 kg locomotive which traveling at 7.2 km/h. Calculate the velocity of the bullet. [CLO 3 : C3]

(6 marks)

d) A student lifts a bucket with 98 N force in 0.5 minutes out of a well. The bucket is lifted at 30 m.

i. How much work is done on the bucket by the student? [CLO 3 : C3]

(2 marks)

ii. How much power is exerted by the student? [CLO 3 : C3]

(3 marks)

e) If a 100 W electric motor has an efficiency of 82%, find the time it takes to lift a 50kg object to a height of 8m?
(Assume g = 10 m/s^2) [CLO 3: C3]

(5 marks)

QUESTION 5

a) i. Explain three methods of heat transfer. (6 marks)

ii. Give one example for each method. (3 marks)

b) An aluminum plate with mass of 600 g is heated from 28°C to 45°C. Calculate the quantity of heat of the aluminum plate if the specific heat capacity of aluminum is 950 J kg^{-1} $°C^{-1}$. [CLO 3: C3]

(3 marks)

c) The temperature of an object with the mass of 2.5 kg increases from 30°C to 75°C when it absorbs 54000 J of heat. Calculate the specific heat capacity for the object. [CLO 3: C1]

(4 marks)

d) 600 g of copper at temperature of 115°C is put in 300 g of water with initial temperature 20°C. If there is no heat exchange with the outside, find the final temperature.

(Specific heat capacity of copper: 390 J kg^{-1} $°C^{-1}$)

(Specific heat capacity of water: 4200 J kg^{-1} $°C^{-1}$) [CLO 3: C3]

(9 marks)

QUESTION 6

a) i. What is electric charge? [CLO 3: C1] (2 marks)

ii List 3 properties of charge. [CLO 3: C1] (3 marks)

b) State the factors which influence the resistance in a conductor. [CLO 3: C1]

(4 marks)

c) The current in an incandescent lamp is 0.5A when connected to a 120V circuit and 0.2A when connected to a 10V source.

i. Does the resistance of the lamp change in these cases? [CLO 3: C1]

(1 mark)

ii. Justify your answer in (i) with calculation. [CLO 3: C3]

(5 marks)

BB101 (ENGINEERING SCIENCE) – FORMULA

1. $g = 9.81\ m/s^2$
2. $W = mg$
3. $v = u + at$
4. $s = ut + \frac{1}{2}at^2$
5. $s = \frac{1}{2}(u + v)t$
6. $v^2 = u^2 + 2as$
7. $F_y = F\sin\theta$
8. $F_x = F\cos\theta$
9. $F_R = \sqrt{(F_x)^2 + (F_y)^2}$
10. $\theta = \tan^{-1}\left(\frac{F_y}{F_x}\right)$
11. $M = Fd$
12. $E_p = mgh$
13. $E_k = \frac{1}{2}mv^2$
14. $W = Fs$
15. $P = \frac{W}{t}$
16. $P = Fv$
17. $\rho = \frac{m}{v}$
18. $\rho_{relative} = \frac{\rho_{substance}}{\rho_{water}}$
19. $P = \frac{F}{A}$
20. $P = \rho gh$
21. Pascal's Principle, $\frac{F_1}{A_1} = \frac{F_2}{A_2}$
22. $F_B = \rho Vg$
23. $Q = mc\theta$
24. $c_{water} = 4{,}200\ J/kg^oC$
25. $\rho_{water} = 1{,}000\ kg/m^3$
26. $C = \frac{Q}{v}$
27. $R = \frac{\rho I}{A}$
28. $V = IR$
29. $Q = It$
30. $E_p = \frac{1}{2}CV^2$
31. R series, $R_T = R_1+R_2+R_3+\ldots.$
32. R parallel, $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$
33. C parallel, $C_T = C_1+C_2+C_3+\ldots.$
34. C series, $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots$

c) Three resistor of 6Ω each are connected as shown in Figure 6c).

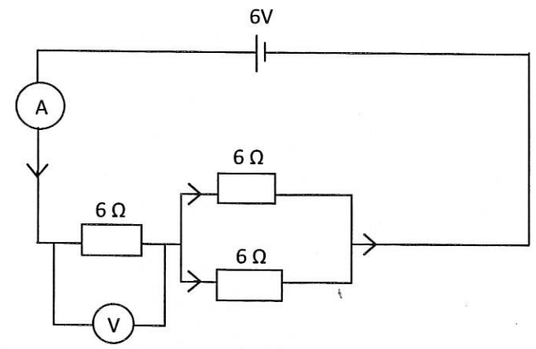


Figure 6(d)

i. Calculate the total resistance [CLO 3: C3] (4 marks)

ii. What is the readings on ammeters A [CLO 3: C3] (3 marks)

iii. What is the voltmeter reading? [CLO 3: C3] (3marks)