

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION
EXAMINATION - NOVEMBER, 1990

Sim 30
• L.A
• H.P

035

ENGINEERING SCIENCE.

S - A - H

IME : 3.00 Hours.

This paper consists of part I and II. Part II consists of Sections A, B and C.

Attempt ALL 20 questions in part I and any FIVE in part II. You must attempt at least ONE question from Sections A, B and C.

Part I carries 40%

Part II carries 60%

ALOUCE NYESE PAWA.

H 3

$F = \frac{mv}{t}$
 $F = \frac{m(v-u)}{t}$
 $F = \frac{m \cdot v}{t}$
 $F = \frac{m \cdot v}{t}$
 $12 \times 5 = 60 \text{ kgms.}$

This paper consists of 4 printed pages.

1. ✓ Distinguish between dynamic and static friction.
2. ✓ A body moves with an angular speed of 250 rad/sec. If the radius of rotation is 34m, calculate its linear velocity.
3. ✓ Briefly explain the difference between mass and weight.
4. ✓ How does a body move in the third second if it starts from rest with a uniform acceleration of 10m/s^2 ?
5. ✓ Explain what is meant by the term INERTIA, relating it with one of the Newton's laws of motion.
6. ✓ A resultant force of 12N acts for 5 seconds on a body of mass 2kg. What is the change in momentum of the body?
7. ✓ State the law of conservation of momentum. 11
8. ✓ Define the term centre of gravity of a body.
9. ✓ What do you understand by the term Efficiency of a machine?
10. ✓ A machine with a velocity ratio of 6 requires 800 J of work to raise a load of 600N through a vertical distance of 1m. Find the efficiency of the machine. 75%
11. Define the refractive index.
12. ✓ An object placed 2cm in front of a convex lens of focal length 5cm produces a magnified image. Find the position of the image.
13. ✓ What is the difference between heat capacity and specific heat capacity?
14. ✓ Define the term linear Expansivity of a solid.
15. ✓ What is meant by the temperature of a body?
16. ✓ A fixed mass of gas at constant pressure has a volume of 10cm^3 at 27°C . Find its volume at 57°C .
17. ✓ What is the frequency of sound with a wave length of 12cm?
18. ✓ State ohm's law and define resistance.
19. ✓ What is meant by the e.m.f. of a cell?
20. ✓ Find the internal resistance of a cell of e.m.f. 2 volts if it sends a current of 0.1 ampere through a 19Ω resistance.

PART II
SECTION A

21. A uniform rod AB 2m long of mass 4kg rests on supports C and D which are placed 5cm from each end. If masses of 2kg, 4kg and 5kg are placed 20cm, 180cm and 130cm respectively from A, find the reactions of the supports.

$$F = \frac{m(W - u)}{t} + F_r$$

22. A wheel and differential axle has the following dimension: effort wheel 300mm diameter, major axle 150mm diameter and minor axle 70mm diameter. To raise a load of 450N an effort of 75N is required. Calculate the force ratio and efficiency of the machine at this load.

40/5 (M.R = $\frac{2D}{d_1 - d_2}$ or $\frac{2R}{r_1 - r_2}$)

23. A torque of 150 Nm is applied to a motor shaft at stand still so that it is made to rotate. The speed of the shaft increases from zero to 250 rev/min. in 15 sec. Find:

- (a) the angular velocity of the shaft, in rad/s at the end of the 15 sec. 26.166
- (b) the angular acceleration in rad/s² 1.74
- (c) the total angle turned through 292.505 rad
- (d) the work done by the Torque. 5877 J

SECTION B

24. (i) From Newton's second law of motion, Force is proportional to the rate of change of momentum i.e. $F \propto \frac{m(v - u)}{t}$

where v = final velocity in m/s
 u = initial velocity in m/s
 t = time taken in sec.
 m = mass of the body.

Two bodies will be at rest.

Mathematically $F = Km \frac{(v - u)}{t}$ where K is a constant.

If $F = 0$ what can be said about the motion of the body?

(ii) A constant force is applied for a period of 10 seconds to a body of mass 10kg, so that it is accelerated from rest to a speed of 15m/s against opposing frictional force equal to 20N.

35N = $F = \frac{m(v - u)}{t}$

Find:

- (a) The applied force 35N
- (b) The acceleration after the applied force is removed 3 m/s²
- (c) The total distance travelled before the body again comes to rest. 75m
- (d) The total time for which the body is in motion.

25. (a) Explain as to why burns from steam are usually more severe than those from boiling water.

(b) A plastic tray weighing 48 gm and containing 200gm of water at 20°C is put in a refrigerator which abstracts heat at a uniform rate of 2100 J/min.

Calculate: $48 + 200 = 248$

- (i) The time taken for the tray and water to reach 0°C. 4.80 2360 sec
- (ii) The total time taken to freeze all the water to ice at 0°C. 2294.3

Given that specific heat capacity of plastic = 105×10^3 J/kgK

Latent heat of fusion of ice = 335×10^3 J/kg

Latent heat of steam = 2260×10^3 J/kg

SECTION C

26. (a) A man sits in a chair facing a plane mirror which is 2m away from him and views the image of a chart which faces the mirror, the chart being 60cm behind his head. How far away from his eyes does the chart appear to be?

4.6m.

- (b) Yellow light has a wavelength of $\lambda = 6 \times 10^{-5}$ cm. Light has a speed of $c = 3 \times 10^8$ m/s. Find the frequency of yellow light.

27. (a) What is an electrolyte?

- (b) A current of 8 A is maintained for 10 minutes through an electrolytic cell containing Cu^{2+} ions. How much copper is deposited? The charge of an electron is 1.6×10^{-19} C, Avogadro's number is 6.02×10^{23} molecules per mole, molecular weight of copper is 63.6 gm per mole.

28. (a) A man stands 750m from a mountain and beats a drum once. How much time will pass before he hears an echo?

3.30 2.21

- (b) A length of wire has a frequency of 256 Hz when stretched by a force of 48 N. By what force must it be stretched to give a frequency of 320 Hz?

= 79 N.

H.

$$f = \frac{c}{\lambda}$$

$$\lambda = \frac{c}{f}$$

$$\lambda f = \frac{c}{\lambda}$$

$$T \propto F$$

$$\frac{T_1}{T_2} = \sqrt{\frac{F_1}{F_2}}$$

$$\frac{48}{256} = \sqrt{\frac{48}{320}}$$

$$\frac{320 \times 48}{256}$$