



DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY
University Examinations 2021/ 2022

**FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELORS OF
SCIENCE IN ELECTRICAL ENGINEERING, , CIVIL ENGINEERING, BED CIVIL,BED EEE,
BSC GEGIS & GIS, BSC GEOLOGY, MECHATRONICS, CHEMICAL ENGINEERING
SPH 1120/SPH 1120 PHYSIC I & PHYSICS FOR ENGINEERS I**

INSTRUCTIONS

Answers question **one** and any other **two** questions.

Constants

Answers question **one** and any other **two** questions.

Some Useful Contents:

1. $C = 3 \times 10^8 \text{ m/s}$
2. $g = 10 \text{ m/s}^2$
3. Density of water = 1 g/cm^3
4. Specific heat capacity of water = 4200 J/kgk
5. Atmospheric pressure = 101.3 kpa
6. Universal gas constant = 8.314 J/mol.k .
7. Specific heat capacity of copper = 390 J/kgk
8. Specific heat capacity of ice = 2100 J/kgk .
9. Latent heat of fusion ice = $3.6 \times 10^5 \text{ J/kg}$
10. Latent heat of vaporization of water = $2.26 \times 10^6 \text{ J/kg}$.
11. $\sigma = 5.6699 \times 10^{-8} \text{ w/m}^2 \text{ k}^4$
12. $G = 6.67 \times 10^{-11} \frac{\text{N.m}^2}{\text{kg}^2}$

Question One (30 marks)

(a) Define the following terms

(i) vector quantity.

(1 mark)

- (ii) Temperature. (1 mark)
- (iii) Power. (1mark)
- (b) .State two sources of sound. (2 marks)
- (c) Using dimensional analysis ,find the dimensions of work. (2 marks)
- (d) The displacement of a particle is given as $\mathbf{r} = (t^3 + 2t)\mathbf{i} + (8t + 2t^3)\mathbf{j}$.Determinetheparticle`s speed at 5seconds. (4 marks)
- (e) State and explain three factors that determine rate of heat conduction. . (3marks)
- (f) State two types of waves. (2marks)
- (g) A cylinder contains 60 litres of air at 40degree Celsiusand 35kpa. The temperature is raised to $75^{\circ}C$, and the volume is reduced to 20litres. Calculate the final pressure of the gas in atmospheres. (4 marks)
- (h) An electromagnetic wave is transmitted at 112.6MHz .Calculate the wavelength of the wave.(3 marks)
- (i) Two bodies are placed 180cm apart. If the two bodies have masses of 120kg and 160 kg,What is the net gravitational force between them. (3 marks)
- (j) Derive the Bernoulli`s principal. (4 marks)

Question Two(20 marks)

- (a) Define the following terms.
- (i) Refraction. (1 mark)
- (ii) Interference. (1 mark)
- (iii) Diffraction. (1 mark)
- (b) State three applications of total internal reflection. (3 marks)
- (c) Draw a ray diagram to show how a convex lens is used as a simple microscope and write the characteristics of the image formed. (4 marks)
- (d) Determine the critical angle of a material whose $n = 1.42$. (3 marks)
- (e) State three characteristics of image formed by convex mirror if the object is between the focal point and the center of curvature. (3 marks)
- (f) An object of height 20cm is placed 18cm from a concave mirror whose radius of curvature is 12cm. Find the position and size of the image. (4 marks)

Question Three (20 marks)

- (a) Define the following terms
- (i) Heat. (1 mark)
- (ii) Specific heat capacity. (1 mark)
- (iii) Latent heat of vaporization. (1 mark)
- (b) Calculate the heat required by 15kg of ice at $-5^{\circ}C$ to water at $100^{\circ}C$. (4 marks)
- (c) A rectangular steel cube 60cm by 50cm by 100cm is heated in a fire to a temperature of 257 degrees Celsius .Taking that its emissivity is unity, determine the total rate of heat radiation . (4 marks)

- (d) A Specimen of diameter 6 mm is subjected to a tensile load of 16kN which causes a 250mm wire to increase to 251mm , calculate
- (i) the longitudinal strain in the material (2marks)
 - (ii) stress induced in the material (4marks)
 - (iii) its Young's modulus of elasticity. (3marks)

Question Four (20 marks)

- (a) State
- (i) Archimedes principle (1 marks)
 - (ii) Law of floatation. (1 mark)
 - (iii) Pascal principle. (1 mark)
- (b) State and explain three factors that affect coefficient of viscosity of a fluid. (6 marks)
- (c) A water pipe having a radius of 8
- (d) 5.0 cm carries water into a basement of a house at a speed of $12m/s$ and a pressure of 300Mpa.If the pipe tapers is of 2.4cm radius and rises to a second floor 9m above the input point, calculate
- (i) the speed of water in the second floor. (3 marks)
 - (ii) the abs. pressure of the water at second floor. (4 marks)
- (e) Calculate the gauge pressure that a machine must produce in order to suck some viscous liquid whose density is $2500kg/m^3$ from a trench up a tube by a height of 13m. (4 mark)

Question Five (20 marks)

- (a) Define the following terms
- (i) a radian. (1 mark)
 - (ii) Wavelength. (1 mark)
- (b) A body of 2kg is subjected to a time dependent force in the direction of x given by $F = (3t^2 - 4t)N$. Determine its velocity and displacement at any time t given that $V = 50m/s$ at $t = 0$ and displacement $x = 18m$ at $t = 0$. (6 marks)
- (c) A transverse wave motion is given by $y = 4\pi\sin(140\pi t + \frac{1}{5}x)$. Determine the wave
- (i) amplitude. (1 mark)
 - (ii) frequency and period. (4 marks)
 - (iii) velocity. (3 marks)
- (d) Two forces ($700N, 110^\circ$) and ($800N, 60^\circ$) at a point. Determine a single force that will have the same effect as the two forces, give the answer in polar form. (4marks)