PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Odd Semester   Session 2023-24   Pre-University

B. Tech. –I Semester
Fundamentals of Mechanical Engineering (BME-101)

CO Number	Course Outcome
CO1	Define (L1: Remember) various laws, theorems and parameters used in mechanical engineering and mechatronics.
CO2	Describe (L2: Understand) the utility of concepts of mechanical engineering and mechatronics in real life applications.
CO3	Derive (L3: Apply) the general equations of Mechanical Engineering and compare performance of different devices.
CO4	Illustrate (L4: Analyze) various concepts and working of devices used in mechanical engineering and mechatronics with suitable diagrams.
CO5	Calculate (L5: Evaluate) the general parameters related to various problems of mechanical engineering.

Time: 3 Hrs.   **M. M. 70**

Section A

**Q1. Attempt all questions:**   **(2X7 = 14 Marks)**

a)	Define Poission's ratio.	CO1
b)	Define the term relative humidity and specific humidity.	CO1
c)	Define the term swept volume and compression ratio.	CO1
d)	Define Sensor and Actuator.	CO1
e)	Define the term Accuracy and precision in measurement.	CO1
f)	At a point A in a fluid flow system, the pressure reading was observed to be $-25 kN/m^2$. Calculate this pressure in meter of water and meters of oil (sp. gravity 0.85).	CO5
g)	Calculate the kinematic viscosity of a fluid in stokes whose specific gravity is 0.85 and dynamic viscosity is 0.011 Poise.	CO5

Section B

Q2. Attempt all questions: **(7X3 = 21 Marks)**

a)   Two spheres, each of weight 50N and radius of 10cm, rest in an inclined plane, 30^0 with   CO5
the horizontal as shown in fig .Calculate the reaction on the point of contact A,B and C.
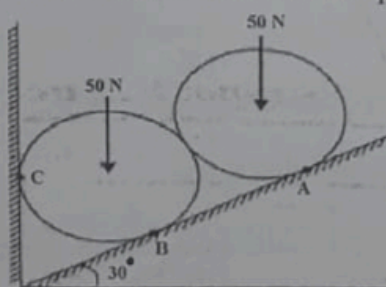
b i)   Describe the terms Autotronics, Bionics and Avionics with their applications in the field   CO2
of mechatronics.

OR

ii)   Describe the working of Cam and Ratched Paul Mechanism with their applications and   CO2
advantages.

c i)   Derive Pascal's law with their statement.

OR   CO3

ii)   Derive an expression for volumetric strain for a rectangular bar which is subjected to three   CO3
mutually perpendicular tensile stresses.

<div align="center">

Section C   (7X1 = 7 Marks)

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Attempt any one part of the following questions:

Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter of   CO5
25mm and length 1.6m, if the longitudinal strain in a bar during a tensile test is four times
of the lateral strain. Also calculate change in volume, when the bar is subjected to a
hydrostatics pressure of $100N/mm^2$. Take $E=1X10^5 N/mm^2$.

<div align="center">OR</div>

A metallic bar 300mmX100mmX40mm (dimension along x, y and z axis respectively) is   CO5
subjected to a force of 5kN (tensile),6kN (tensile) and4kN (tensile) along x, y and z
direction respectively. Calculate the change in dimension and change in volume of block.
Take $E=2X10^5 N/mm^2$ and poisson's ratio=0.25.

<div align="right">(7X1 = 7 Marks)</div>

. Attempt any one part of the following questions:

a)   A steel shaft 25mm diameter and 30cm long falls of its own weight inside a vertical open   CO5
tube 25.2mm diameter . The clearance,assumed uniform, is filled with glycerin of
viscosity 1.5 Pa s. Calculate the velocity of cylinder fall at this condition. Take density of
steel 7850 Kg/m^3.

<div align="center">OR</div>

b)   A refrigerating plant is required to produce 2.5 tons of ice per day at -4^0C from water at   CO5
20^0C. If the temperature range in the compressor is between 25^0C and -6^0C, Calculate
power required to drive the compressor. Latent heat of ice=335kJ/kg and specific heat of
ice=2.1 kJ/kg.K.

<div align="right">(7X1 = 7 Marks)</div>

Q5. Attempt any one part of the following questions:

a)   Describe different ways of producing refrigeration and application of refrigeration system.   CO2
<div align="center">OR</div>
b)   Describe construction and working of window air conditioner system with comfort   CO2
condition.

<div align="right">(7X1 = 7 Marks)</div>

Q6. Attempt any one part of the following questions:

a)   Illustrate the working of two stroke diesel engine with neat sketch.   CO4
<div align="center">OR</div>
b)   Illustrate the working principle of Centrifugal pump with schematic diagram.   CO4

<div align="right">(7X1 = 7 Marks)</div>

Q7. Attempt any one part of the following questions:

a)   Describe the working principle and construction details of optical pyrometer.   CO2
<div align="center">OR</div>
b)   Describe the origin and evolution of mechatronics. Also Explain different types of   CO2
Mechanical Actuation System based on power inputs.