B. PHARMACY 1st Year, 1st Semester SUPPLEMENTARY EXAMINATION, 2017

APPLIED MECHANICS

Times : Three hours | Full Marks : 100

Answer any **five** questions

1. a) For a vector with direction cosines l, m, n prove that $l^2 + m^2 + n^2 = 1$. (10)

   b) Two vectors are given as $\vec{A} = (6i + 10j + 16k)$ N and $\vec{B} = (2i - 3j)$ N. $\vec{C}$ is also a vector in the xy plane at an inclination of 30^0 to the positive x-axis and directed away from the origin. The magnitude of C is 50 N. Find the sum of the vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$. (10)

2. a) Given a force $\vec{F} = (20i + 10j + Pk)$ N. If this force is to have a component 16 N along a line having a unit vector $\vec{r} = 0.6i + 0.8k$, what should be the value of P? What is the angle between between F and r ? (10)

   b) A force $\vec{F} = (3i - 6j + 4k)$ N goes through the point (6, 3, 2)m. Replace this force by an equivalent system where the force goes through the point (2, -5, 10) m (10)

3. Write down the equations of equilibrium for a rigid body subjected to parallel and concurrent system of forces. Define statically determinate and statically indeterminate problems. A prismatic steel bar having cross-sectional area A = 3 sq. cm is subjected to axial loading as shown in Figure A. Find the net change in the length of the bar. Take E = 2.0 x 10^6 kgf/cm^2. (20)

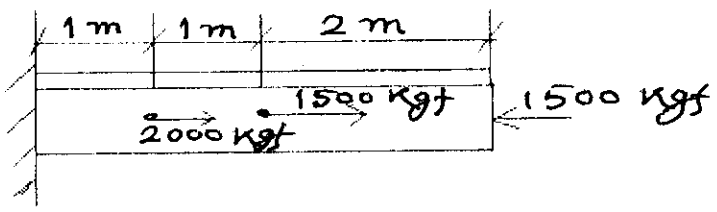

Fig. A

4. (a) Refer to Fig. B. What force F is needed to get the 300 kg block moving to the right? The coefficient of static friction for contact surfaces is 0.3. (10)

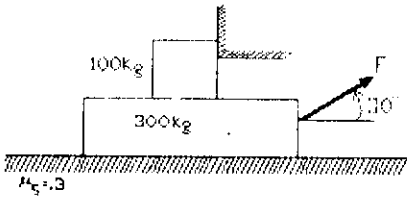

Fig. B

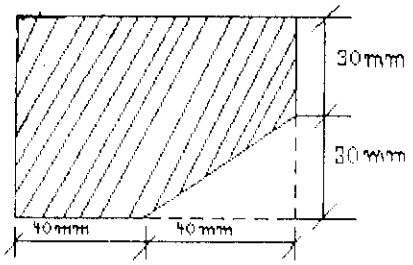

Fig. C

(b) Calculate the moment of inertia about x- axis for the shaded area (Fig. C.) (10)

5. a) An aluminium bar 2.0 m long has a square cross-section of area 3.0 cm^2 over 1.0 m of its length and 3.0 cm diameter circular cross-section over the other 1.0 m length. Determine the elongation of the bar under a tensile load of 4000 kgf. Take the value of Young's Modulus of Elasticity, $E = 0.8 \times 10^6$ kgf/cm^2. (10)

b) Derive the equation defining the deflection curve of a uniformly loaded cantilever beam. Also find the deflection at the free end. (10)

6. a) For torsion of a circular shaft with usual notations show that

$$T/J = (G\theta)/L \qquad (05)$$

b) Determine the proper diameter of a solid steel shaft to transmit 200 hp at 120 rpm, if the working stress in shear is 350 kgf/cm^2. (05)

c) A 2 m long beam with rectangular section of 10 cm width and 20 cm height is simply supported at the ends. If the beam is loaded with a uniformly distributed load of 200 kgf/m throughout the span, determine the maximum bending stress in the beam. Also draw the shear force and bending moment diagrams of the beam. (10)