Exam.		Back	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
**Examination Control Division**
2066 Jestha

Subject: - Applied Mechanics

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) A block A is constrained to move along a 20° incline in the yz plane. How far does the block have to move if the force F is to do 10 ft-ℓb work? [6]

$$\vec{F} = \{10\hat{i} + 20\hat{j} + 15\hat{k}\}\ \ell b$$

Block A

20°
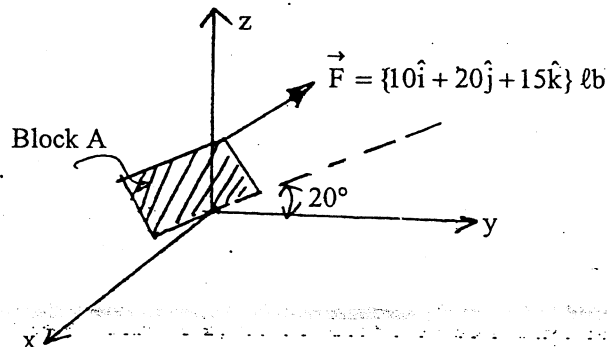
b) What is the moment of the forces shown about point A and about a point P having a position vector $\vec{r}_p = \{10\hat{i} + 7\hat{j} + 15\hat{k}\}m.$ [10]
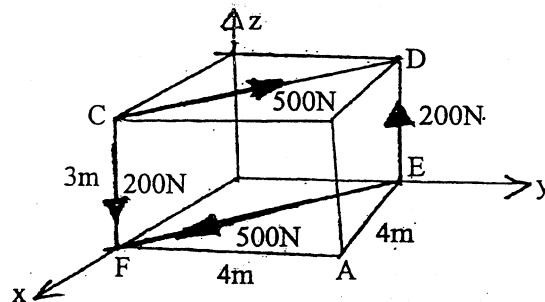
2. a) What are the co-ordinates of the centroid of the shaded area? The parabola is given as $y^2 = 2x$ with y and x in millimeters. [10]

y = 7mm

$y^2 = 2x$

x = 10mm
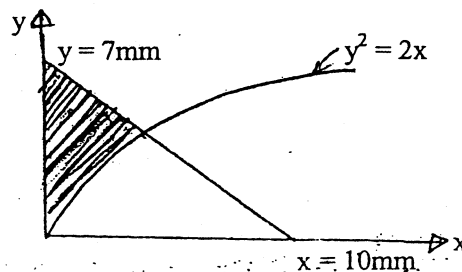
b) State and prove the parallel axis theorem. [6]

3. a) Draw the shear force and bending moment diagrams for the beam loaded as shown. Find the value of shear force where the value of bending moment is maximum sagging. [10]

90KN   54KN   22.5KN/m

A   B   C   D   E

1.8m   2.4m   3m   2.4m
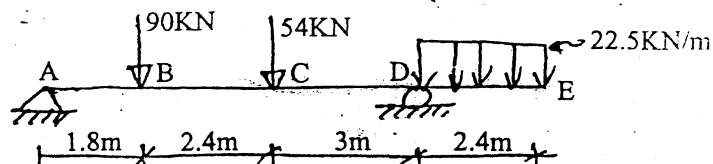
b) Determine the number forces in members BD, CD and CE for the truss as shown using method of section. [6]

B   D
                          3m
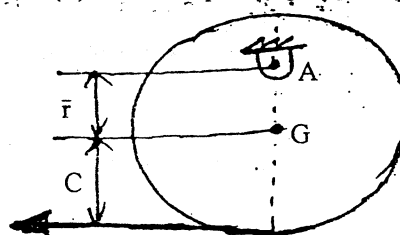A   C   E   F
   ▼20KN   ▼10KN
   3 @ 4m = 12m
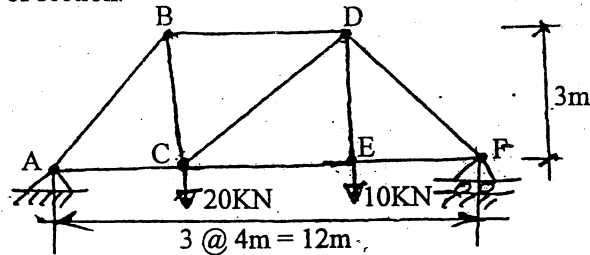
4. a) The acceleration of a particle is defined by the relation $a = -Kx^{-2}$. The particle starts with no initial velocity at x = 800mm, and it is observed that its velocity is 6 m/sec when x = 500mm. Determine (i) the value of K (ii) the velocity of the particle when x = 250mm. [8]

b) A nozzle at A discharges water with an initial velocity of 12 m/sec at an angle of 60° with the horizontal. Determine where the stream of water strikes the roof. Check that the stream will clear the edge of the roof. [8]

Stream of water

B   D   C
                    6.0m
60°
A
Man   1.2m
Ground
   4.5m   7.5m
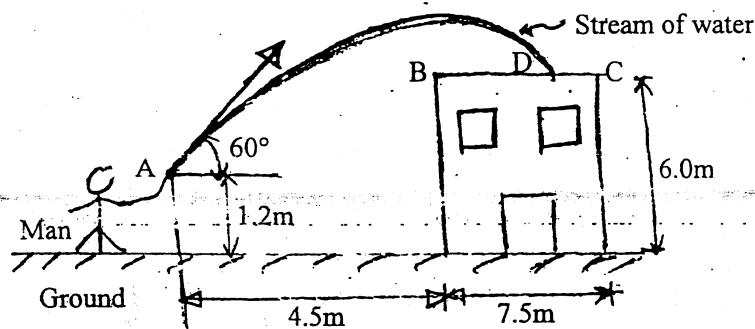
5. a) A spring is used to stop 90 kg package which is moving from a 20° incline. The spring has a constant of K = 22 KN/m and is held by cables so that it is initially compressed 150mm. Knowing that the velocity of package is 2.4 m/sec when it is 7.5m from spring and neglecting friction. Determine the maximum additional deformation of the spring in bringing the package to rest. [10]

2.4m/sec
7.5m
m = 90 kg   Cable
20°   Spring
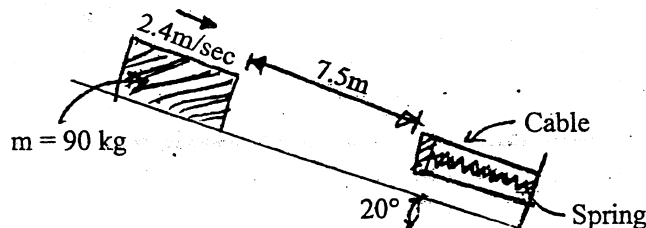
b) State and explain the principle of conservation of energy. [6]

6. a) General plane motion of a rigid body can be considered as the sum of translational and rotational motion. Justify the expression with examples. [6]

b) A uniform disk of radius C = 160mm and mass m = 6 kg hangs freely from a pin support at A. A force P of magnitude 20N is applied as shown to the chord wrapped around the disk. Determine (i) the distance $\bar{r}$ for which the horizontal component of the reaction at A is zero, (ii) the corresponding angular acceleration of the disk. [10]

A
$\bar{r}$
G   Where
C   C = radius of
                          the disk

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