



AB-3158
B.Sc. (Sem. V) Examination
March/April – 2015
Mathematics (E.G.)
(Mechanics - 1)

Time : 2 Hours]

[Total Marks : 50

Instruction :

(1)

<p>नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवडी पर अवश्य बपवी. Fillup strictly the details of signs on your answer book.</p> <p>Name of the Examination : B.SC. (SEM. V)</p> <p>Name of the Subject : MATHEMATICS (E.G.)</p> <p>Subject Code No. : 3 1 5 8 Section No. (1, 2,...): Nil</p>	<p>Seat No. : □ □ □ □ □ □</p> <p style="text-align: center;">Student's Signature</p>
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- (2) First question is **compulsory**.
(3) Figures to the right indicate marks of question.
(4) Follow usual notations.

- 1 Answer any **four** of the following questions: 8
- (1) Explain the forces which do no work.
 - (2) Define internal and external force.
 - (3) Find the distance of the mass centre of the flat semicircular plate.
 - (4) Define a couple and find its moment.
 - (5) Explain in short what you mean by friction.
 - (6) State the theorem of Varignon.
 - (7) State any two useful forms of the equation of a motion of a particle.

- 2 (a) In usual notations prove that 4
- $$\delta x = \delta a - (y-b)\delta\theta, \delta y = \delta b + (x-a)\delta\theta$$

OR

- (a) State and prove the principle of Virtual work. 4

(b) Attempt **any two** of the following questions: 10

- (1) State and prove Lamy's theorem.
- (2) A particle is in equilibrium under three forces. Two of the forces act at right angles to one another, one being double the other. The third force has a magnitude 18 kg wt. Find the magnitude of the other two.
- (3) Find a system of two forces equipollent to a system of three forces represented by the sides of an equilateral triangle taken in order.

3 (a) Define Mass centre. Prove or disprove: There may be some systems which contains either no Mass centres or two Mass centres. 4

OR

(a) Show that the field of force (X, Y) is conservative if and only if 4

$$\frac{\partial X}{\partial y} = \frac{\partial Y}{\partial x}$$

(b) Attempt any two of the following questions: 10

- (1) A framework ABCD consists of four equal rods smoothly joined together to form a square. It is suspended at a peg at A and a weight W is attached at C. The framework being kept in shape by a light rod connecting B and D. Determine the thrust in this rod.
- (2) Explain Potential Energy. In a conservative system, prove that the increment in potential energy equals the work done with sign changed.
- (3) All sides of a cubical box without lid are made of some uniform thin material. Then find its mass centre.

- 4 (a) In usual notations, obtain the equation of common catenary in the form 4

$$y = \frac{H}{W} \left(\cosh \frac{wx}{H} - 1 \right).$$

OR

- (a) Show that the suspension bridge represents equation of parabola. Also find its tension. 4
- (b) Attempt any two of the following questions: 10
- (1) Prove that the force of attraction between two particles is the gradient of the potential energy with sign reversed.
 - (2) A rod of length $2a$ rests on a rough floor against a smooth edge of a table of length 3 ft. If the rod is on the point of slipping when inclined at an angle of 60° to the horizontal, find the coefficient of friction.
 - (3) A uniform cable hangs across two pegs at the same height, the ends hanging down vertically. If the free ends are each 12 ft long and the tangent to the catenary of each peg makes angle 60° with the horizontal, then find the total length of the cable.