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Reg. No. 

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**Fifth Semester B.A./B.Sc.2 Degree Examination, October/November 2013**  
**MATHEMATICS (Optional) (Paper – III)**  
**Dynamics and Calculus of Variations (Regular)**

Time : 3 Hours

Max. Marks : 80

**Instruction :** Answer *all* questions.

I. Answer **any ten** of the following : **(10×2=20)**

- 1) Write the expressions for tangential and normal accelerations of a particle moving in a plane curve.
- 2) If the radial velocity is proportional to transverse velocity, find the path.
- 3) A point describes a cycloid  $S = 4a \sin \psi$  with uniform velocity, find its acceleration.
- 4) Define apse and apsidal distance.
- 5) If the path of the central orbit is  $r^2 = 2ap$ , find the law of force.
- 6) Define coefficient of restitution. What is the coefficient of restitution for perfectly elastic bodies ?
- 7) Define i) Range ii) Maximum height of a projectile.
- 8) Define horizontal range. Show that maximum horizontal range is  $\frac{u^2}{g}$ .
- 9) State fundamental problem of calculus of variations.
- 10) Define a functional and give an example.
- 11) What is the Euler's equation when the functional is independent of  $x$  ?
- 12) Solve variational problem  $\int_0^1 [y^2 + x^2 y'] dx$ ,  $y(0) = 0$ ,  $y(1) = 1$ .

II. Answer **any six** of the following : **(6×5=30)**

- 13) Derive the expressions for the radial and transverse velocities of a particle in a plane curve.
- 14) A point moves in a plane curve so that its tangential and normal accelerations are equal and the tangent rotates with constant angular velocity. Show that the path is  $S = Ae^\psi + B$ .
- 15) Define central force. With usual notations prove that  $p^2 = h^2 u^2 \left[ u + \frac{d^2 u}{d\theta^2} \right]$ .
- 16) Derive the equation of the path of the projectile and show that it is a parabola.

P.T.O

