**FEDERAL PUBLIC SERVICE COMMISSION**
**COMPETITIVE EXAMINATION FOR**
**RECRUITMENT TO POSTS IN BPS-17 UNDER**
**THE FEDERAL GOVERNMENT, 2010**

**Roll Number**

## APPLIED MATH, PAPER-I

| **TIME ALLOWED: 3 HOURS** | **MAXIMUM MARKS:100** |
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| **NOTE:** | **(i)** Attempt **FIVE** question in all by selecting at least **TWO** questions from **SECTION – A** and **THREE** question from **SECTION – B**. All questions carry **EQUAL** marks.<br>**(ii) Use of Scientific Calculator is allowed.** |
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## SECTION – A

**Q.1.** Explain the following giving examples and supported by figures: **(5+5+5+5)**
(a) Gradient
(b) Divergence
(c) Curl
(d) Curvilinear Coordinates

**Q.2.** Given that A,B,C are vectors having components along axis. Prove that: **(10+10)**
(a)

$$B \times C = \begin{vmatrix} i & j & k \\ B_x & B_y & B_z \\ C_x & C_y & C_z \end{vmatrix}$$

(b) $A \times B \times C = A_x B_x C_x (i \times k) + A_y B_x C_y (j \times k)$

**Q.3.** (a) State and prove Stokes Theorem **(10)**
(b) Given that V=4y i+x j + 2z k, find
$\int (\nabla \times V) \cdot n d\sigma$ over the hemi sphere $x^2+y^2+z^2=a^2$, z>=0. **(10)**

## SECTION – B

**Q.4.** Discuss the following systems supported by figures/diagrams:
(a)
- Equilibrium of a System coplanar forces **(5)**
- Centre of mass of right circular solid cone of height h. **(5)**

(b) Centre of gravity of a rigid body of any shape. **(10)**

**Q.5.** (a) What is Simple Harmonic Motion? Discuss it in detail using Derivatives with respect time. **(10)**

(b) Describe the Simple Harmonic Motion of a pendulum and Calculate the time period of the motion. **(10)**

**Q.6.** (a) Derive expression for the following:
- Moment of inertia **(5)**
- Product of inertia **(5)**

(b) Calculate the moment of inertia of solid sphere of mass m=37 and radius a=15.
Derive the general expression. **(10)**

**Q.7.** (a) Explain Kepler's Laws. **(10)**
(b) What is Impulsive Motion? Derive its equation. **(10)**

**Q.8.** (a) Define Work, Torque, Power and energy. **(10)**
(b) A cricket ball is thrown vertically upwards, it attained the maximum height h after t Seconds. Calculate its. **(10)**
- Velocity of projection in direction vertically upward.
- Acceleration when it returns to the point of projection.

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