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**

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. **(ii) Use of Scientific Calculator is allowed.**

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
$\int (\nabla \times V) . n d\sigma$ 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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Roll Number

APPLIED MATH, PAPER-II

TIME ALLOWED: 3 HOURS **MAXIMUM MARKS:100**

NOTE:	(i) Attempt **FIVE** question in all by selecting at least **TWO** questions from **SECTION–A, ONE** question from **SECTION–B** and **TWO** questions from **SECTION–C**. All questions carry **EQUAL** marks. **(ii) Use of Scientific Calculator is allowed.**

SECTION – A

Q.1. Solve the following equations:
(a) $d^2y/dx^2 + 5\ dy/dx + 6y = x$ **(10)**
(b) $d^2y/dx^2 + 5\ y\ x = e^x$ **(10)**

Q.2. (a) Derive Cauchy Rieman partial differential equations. **(10)**
(b) Derive Lapace Equation. **(10)**

Q.3. Solve:
(a) $(\partial^2/\partial x^2 + \partial^2/\partial x\partial y + \partial^2/\partial y^2)\ u = 4\ e^{3y}$ **(10)**
(b) u" + 6u' + 9=0; Given that u(0)=2 and u'(0)=0. **(10)**

SECTION – B

Q.4. (a) Discuss the following supported by examples:
- Tensor, **(5)**
- $\in_{ijk} \in_{lmk}$ **(5)**
- Scaler Fields for a continuously differentiable function f=f(x,y,z) **(5)**

(b) Can we call a vector as Tensor, discuss.
What is difference between a vector and a tensor?
What happens if we permute the subscripts of a tensor? **(5)**

Q.5. (a) Discuss the simplest and efficient method of finding the inverse of a square matrix a_{ij} of order 3x3. **(10)**
(b) Apply any efficient method to compute the inverse of the following matrix A: **(10)**

$$\mathbf{A} = \begin{bmatrix} 25 & 2 & 1 \\ 2 & 10 & 1 \\ 1 & 1 & 4 \end{bmatrix}$$

SECTION – C

Q.6. (a) Develop Gauss Siedal iterative Method for solving a linear system of equations A x = b, where A is the coefficient matrix. **(10)**
(b) Apply Gauss Siedal iterative Method to solve the following equations: **(10)**

$$25X_1 + 2X_2 + X_3 = 69$$
$$2X_1 + 10X_2 + X_3 = 63$$
$$X_1 + 2X_2 + X_3 = 43$$

Q.7. (a) Derive Simpson's Rule for finding out the integral of a function f(x) from limits x=a to x=b for n=6 subintervals (i.e. steps). **(10)**
(b) Apply Simpson's Rule for n=6 to evaluate: **(10)**

$$\int_0^1 f(x)dx \quad \text{where} \quad f(x) = 1/(1+x2).$$

Q.8. (a) Derive Lagrange Interpolation Formula for 4 points: **(10)**

(b) A curve passes through the following points:
(0,1),(1,2),(2,5),(3,10). Apply this Lagrange Formula to interpolate the polynomial. **(10)**

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