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

APPLIED MATH, PAPER-II

TIME ALLOWED: 3 HOURS
MAXIMUM MARKS: 100

NOTE:
(i) Attempt FIVE questions 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) \( \frac{d^2y}{dx^2} + 5 \frac{dy}{dx} + 6y = x \) \hspace{1cm} (10)
(b) \( \frac{d^2y}{dx^2} + 5 y = e^x \) \hspace{1cm} (10)

Q.2. (a) Derive Cauchy Riemann partial differential equations. \hspace{1cm} (10)
(b) Derive Laplace Equation. \hspace{1cm} (10)

Q.3. Solve:
(a) \( \left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial x \partial y} + \frac{\partial^2}{\partial y^2} \right) u = 4 e^{xy} \) \hspace{1cm} (10)
(b) \( u'' + 6u' + 9=0; \) Given that \( u(0)=2 \) and \( u'(0)=0. \) \hspace{1cm} (10)

SECTION – B

Q.4. (a) Discuss the following supported by examples:
    - Tensor, \hspace{1cm} (5)
    - \( \varepsilon_{ijk} \in \varepsilon_{lmk} \) \hspace{1cm} (5)
    - Scaler Fields for a continuously differentiable function \( f=f(x,y,z) \) \hspace{1cm} (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? \hspace{1cm} (5)

Q.5. (a) Discuss the simplest and efficient method of finding the inverse of a square matrix \( a_{ij} \) of order 3x3. \hspace{1cm} (10)
(b) Apply any efficient method to compute the inverse of the following matrix \( A: \) \hspace{1cm} (10)
\[
A = \begin{bmatrix}
25 & 2 & 1 \\
2 & 10 & 1 \\
1 & 1 & 4 \\
\end{bmatrix}
\]

SECTION – C

Q.6. (a) Develop Gauss Siedal iterative Method for solving a linear system of equations \( A \cdot x = b, \) where \( A \) is the coefficient matrix. \hspace{1cm} (10)
(b) Apply Gauss Siedal iterative Method to solve the following equations: \hspace{1cm} (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). \hspace{1cm} (10)
(b) Apply Simpson’s Rule for \( n=6 \) to evaluate: \hspace{1cm} (10)
\[
\int_0^1 f(x)dx \quad \text{where} \quad f(x) = 1/(1 + x^2).
\]

Q.8. (a) Derive Lagrange Interpolation Formula for 4 points: \hspace{1cm} (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. \hspace{1cm} (10)