FEDERAL PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT, 2011

Roll Number

APPLIED MATHEMATICS, PAPER-II

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

NOTE: **(i)** Attempt **FIVE** questions in all by selecting **THREE** questions from **SECTION – A** and **TWO** questions from **SECTION – B.** All questions carry equal marks.

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

(iii) **Extra attempt of any question or any part of the attempted question will not be considered.**

SECTION - A

Q.1. (a) Solve by method of variation of parameter **(10)**

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x 1nx$$

(b) Solve first order non-linear differential equation **(10)**

$$x\frac{dy}{dx} + y = y^2 1nx$$

Q.2. (a) Solve **(10)**

$$c^2 u_{xx} = u_{tt}\,.$$

$$u(0,t) = 0$$

$$u(l,t) = 0$$

$$u(x,0) = \lambda\, Sin\left(\frac{\pi}{l}x\right)$$

$$u_t(x,0) = 0$$

(b) Solve $x^2\dfrac{\partial z}{\partial x} + y^2\dfrac{\partial z}{\partial y} = (x+y)z$ **(10)**

Q.3. (a) Work out the two dimensional metric tensor for the coordinates p and q given by **(10)**

$$p = (xy)^{\frac{1}{3}},\ q = \left(x^2 / y\right)^{\frac{1}{3}}$$

(b) Prove that $\Gamma^d_{ab} = \dfrac{1}{2} g^{dc}\left(g_{ac,b} + g_{bc,a} - g_{ab,c}\right)$ **(10)**

APPLIED MATHEMATICS, PAPER-II

Q.4. (a) Work out the Christoffel symbols for the following metric tensor **(10)**

$$g_{ab} = \begin{pmatrix} 1 & 0 \\ 0 & r^2 \end{pmatrix}$$

(b) Work out the covariant derivative of the tensor with components **(10)**

$$\begin{pmatrix} r\cos\theta & ar\sin\varphi & ar \\ \sin\theta\sin\varphi & a\sin\theta\cos\varphi & a \\ \cos\varphi & a\sin\varphi & 0 \end{pmatrix}$$

Q.5. (a) Find recurrence relations and power series solution of $(x-3)y' + 2y = 0$ **(10)**

(b) Solve the Cauchy Euler's equation $x^4 y''' + 2x^3 y'' - x^2 y' + xy = 1$ **(10)**

(10)

SECTION – B

Q.6. (a) Find the positive solution of the following equation by Newton Raphson method **(10)**

$$2 \sin x = x$$

(b) Solve the following system by Jacobi method: **(10)**

$$10x_1 - 8x_2 = -6$$

$$-8x_1 + 10x_2 - x_3 = 9$$

$$-x_2 + 10x_3 = 28$$

Q.7. (a) Evaluate the following by using the trapezoidal rule. **(10)**

$$\int_0^1 (x+1)dx$$

(b) Evaluate the following integral by using Simpson's rule **(10)**

$$\int_0^4 e^x \, dx$$

Q.8. (a) Solve the following equation by regular falsi method: **(10)**

$$2x^3 + x - 2 = 0$$

(b) Calculate the Lagrange interpolating polynomial using the following table: **(10)**

x	0	1	2
f(x)	1	0	-1

also calculate f (0.5).

****