FEDERAL PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT, 2012

Roll

APPLIED MATHS, PAPER-II

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

NOTE:(i) Candidate must write **Q. No.** in the **Answer Book** in accordance with **Q. No.** in the **Q. Paper.**
(ii) Attempt **FIVE** questions in all by selecting **TWO** questions from **SECTION-A** and **ONE** question from **SECTION-B** and **TWO** questions from **SECTION-C. ALL** questions carry **EQUAL** marks.
(iii) Extra attempt of any question or any part of the attempted question will not be considered.
(iv) **Use of Scientific Calculator is allowed.**

SECTION-A

Q. 1. Solve the following differential equations:

(a) $y''' - 3y'' + 2y' = \dfrac{e^x}{1+e^{-x}}$ **(10)**

(b) $y' = \dfrac{2xye^{(x/y)^2}}{y^2 + y^2e^{(x/y)^2} + 2x^2e^{(x/y)^2}}$ **(10)**

Q. 2. (a) Find the series solution of the following differential equation:
$y'' - xy = 0$ **(10)**

(b) Use the method of Fourier integrals to find the solution of initial value problem with the partial differential equation.
$\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$; $(-\infty < x < \infty)$
And with initial condition $u(x,0) = f(x)$ **(10)**

Q. 3. (a) Solve $x^2y'' - 3xy' + 5y = x^2 \sin(\ln x)$ **(10)**

(b) Find the solution of wave equation
$\dfrac{\partial^2 u}{\partial t^2} = c^2 \dfrac{\partial^2 u}{\partial x^2}$ with boundary and initial conditions
$u(0,t) = u(l,t) = 0$, $u(x,0) = f(x)$, $\dfrac{\partial u(x,t)}{\partial t} = g(x)$ **(10)**

SECTION-B

Q. 4. Discuss the following terms: **(5x4=20)**

(i) Tensors (ii) Kronecker delta
(iii) Contraction (iv) Metric Tensor
(v) Contravariant tensor of order two

Q. 5. **(10)**
(a) Prove that $\left\{ \begin{matrix} i \\ ij \end{matrix} \right\} = \dfrac{\partial}{\partial x^i}(\log \sqrt{g})$

(b) Prove that $\Delta = \begin{vmatrix} \delta_{m1} & \delta_{m2} & \delta_{m3} \\ \delta_{n1} & \delta_{n2} & \delta_{n3} \\ \delta_{p1} & \delta_{p2} & \delta_{p3} \end{vmatrix} = \in_{mnp}$ and $\in_{ijk} \in_{mnp} = \begin{vmatrix} \delta_{mi} & \delta_{mj} & \delta_{mk} \\ \delta_{ni} & \delta_{nj} & \delta_{nk} \\ \delta_{pi} & \delta_{pj} & \delta_{pk} \end{vmatrix}$

Hence prove that $\in_{ijk} \in_{mnp} = \delta_{im}\delta_{jn} - \delta_{in}\delta_{jm}$ **(10)**

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SECTION-C

Q. 6. (a) (i) What is the difference between secant and false position method? Show also graphically. **(5+5=**

(ii) Prove that $x_{n+1} = x_n - \dfrac{f(x_n)}{f^2(x_n)}$

(b) Solve the following system by Jacobi method. (Up to four decimal places).

8x + y – z = 8

2x + y + 9z = 12

x – 8y + 12z = 35

Q. 7. (a) Evaluate by $\frac{3}{8}$ Simpson's rule **(10)**

$\int_0^3 x\sqrt{1+x^2}\,dx$; with n = 6

Also calculate the absolute error.

(b) The amount *A* of a substance remaining in a reacting system after an interval of time *t* in a certain chemical experiment is given by following data:

A:	94.8	87.9	81.3	68.7
t:	2	5	8	14

Find *t* when *A*=80. **(10)**

Q. 8. (a) If $f(x) = x^3$, show that f(a,b,c) = a + b + c **(10)**

(b) Solve by trapezoidal rule

$\int_0^{2\pi} x \sin x\,dx$; with $n = 8$ **(10)**

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