PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE-2019

SUBJECT: MATHEMATICS (PAPER-I)

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

NOTE: Attempt FIVE Questions in All. THREE Questions from Section 'A' and TWO Questions from Section 'B'. Calculator is allowed. (not programmable)

SECTION-A

Q 1:- (a) Evaluate the following limit

$$\lim_{x\to 0}\frac{\cos ecx-\cot x}{x}$$

(b) Find $\frac{dy}{dx}$ for the given $y=x^{x}e^{x}\sin(\ln x)$ **(10+10=20 Marks)**

Q 2:- (a) Evaluate $\int_{0}^{\pi}\frac{x\sin x}{1+\cos^{2}x}dx$

(b) Solve $x\frac{dy}{dx}+y=x^{2}y^{2}$ **(10+10=20 Marks)**

Q 3:- (a) Find the solution of the following initial value problem

$$y'''+12y''+36y'=0\ ;\ \ y(0)=0,\ y'(0)=1,\ y''(0)=-7$$

(b) Solve the given differential equation by the method of undetermined coefficients

$$y^{(4)}+y'''=1-x^{2}e^{-x}$$ **(10+10=20 Marks)**

Q 4:- (a) A mass weighing 24 pounds, attached to the end of a spring, stretches it 4 inches. Initially, the mass is released from rest from a point 3 inches above the equilibrium position. Find the equation of motion.

(b) Find equations of the asymptotes of the following curve

$$y(x-y)^{2}=x+y$$ **(10+10=20 Marks)**

Q 5:- (a) The velocity of a car travelling on a motorway at 15 minute intervals is as follows

Time in Hours (t)	¼	½	¾	1	5/4
Velocity in (Km)	100	90	115	120	80

Using Trapezoidal rule, find total distance travelled by the car in 60 minutes period from $t=\frac{1}{4}$ to $t=\frac{5}{4}$.

(b) Find c of the mean value theorem for $f(x)=x^{3}-3x-1$ on [-11/7, 13/7]

(10+10=20 Marks)

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SECTION-B

Q 6:- (a) Investigate the convergence of the series $\sum_{n=0}^{\infty}\frac{2^n+5}{3^n}$.

(b) Find the Taylor series generated by $f(x)=e^x$ at $x=0$.

(10+10=20 Marks)

Q 7:- (a) Show that the given function is not analytic at any point

$$f(z)=\frac{x}{x^2+y^2}+i\frac{y}{x^2+y^2}$$

(b) Evaluate $\oint_c \frac{z+1}{z^4+2iz^3}dz$ where c is the circle $|z|=1$.

(10+10=20 Marks)

Q 8:- (a) Examine whether the following equation represents two straight lines. If so, find the equations of each straight line $6x^2-17xy-3y^2+22x+10y-8=0$

(b) Prove that the radius of curvature at the point $(2a,2a)$ on the curve $x^2y=a(x^2+y^2)$ is $2a$.

(10+10=20 Marks)