

B.Sc. Semester - 1 (CBCS) Examination
July-2025 (OLD COURSE)
MATHEMATICS (CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

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- Que-1(A) Answer any one out of two (07)**
- 1) In usual notation prove that $e^x \cdot \sin^2 x = x^2 + x^3 + \frac{x^4}{6} + \dots$
 - 2) Show that $\frac{2}{\pi} < \frac{\sin x}{x} < 1$, Where $0 < x < \frac{\pi}{2}$.
- Que-1(B) Answer any one out of two (04)**
- 1) Obtain expansion of e^x in ascending power of x .
 - 2) Find coefficient of x^4 in expansion of $\log \cos x$. Where $-\frac{\pi}{2} < x < \frac{\pi}{2}$
- Que-1(C) Answer any three out of five (03)**
- 1) Write the formula of Lagrange's theorem.
 - 2) Find the value of c , if Roll's theorem is applicable to $f(x) = x^2 - 3x + 2$, $x \in [1, 2]$.
 - 3) Check whether the function $f(x) = 6(x-2)^2$, $x > 2$ is increasing or decreasing.
 - 4) Show that $f(x) = x^3 + 6x^2 + 12x - 7$ is strictly increasing in every interval.
 - 5) State Alternative form of Cauchy's mean value theorem.
- Que-2(A) Answer any one out of two (07)**
- 1) Solve: $(x+1) \frac{dy}{dx} - y = e^{3x} (x+1)^2$.
 - 2) Solve: $x(x-y)dy + y^2 dx = 0$.
- Que-2(B) Answer any one out of two (04)**
- 1) $\lim_{x \rightarrow \pi/2} (1 - \sin x) \tan x$.
 - 2) Solve: $e^x \tan y dx + (1 - e^x) \sec^2 y dy = 0$
- Que-2(C) Answer any three out of five (03)**
- 1) Evaluate $\lim_{x \rightarrow 0} \frac{x}{\tan 2x}$.
 - 2) Evaluate $\lim_{x \rightarrow 0} \frac{\sin 4x}{\sin 3x}$.
 - 3) State general form of linear differential equation.
 - 4) Find general solution of $\sqrt{1-x^2} dy = \sqrt{1-y^2} dx$.
 - 5) Evaluate $\lim_{x \rightarrow 0} \frac{a^x - 1}{b^x - 1}$.
- Que-3(A) Answer any one out of two (07)**
- 1) Show that $(x^2 - 2xy^2 + y^4)dx - (2x^2y - 4xy^3 + \sin y)dy = 0$ is exact, hence find its solution.
 - 2) Solve: $x^2 p^2 + xyp - 6y^2 = 0$.
- Que-3(B) Answer any one out of two (04)**
- 1) Solve: $p^2 - 7p + 10 = 0$.
 - 2) Verify that $(\sin x \sin y + \sec^2 x)dx + (\tan^2 y - \cos x \cos y)dy = 0$ is exact or not.
- Que-3(C) Answer any three out of five (03)**
- 1) State general form of Bernoullie's differential equation.
 - 2) Find the integrating factor of $x \frac{dy}{dx} = x + y$.
 - 3) Find the integrating factor of $x \frac{dy}{dx} + y = x^3 y^3$.
 - 4) Solve: $y = px + \sin^{-1} p$.
 - 5) Determine whether the differential eq. $ydx + (y+x)dy = 0$ is exact or not.

- Que-4(A) Answer any one out of two (07)**
- 1) Solve $(D^2 - 2D + 5)y = \sin 3x$.
 - 2) In usual notation prove that $\frac{1}{f(D^2)} \sin ax = \frac{1}{f(-a^2)} \sin ax$; $f(-a^2) \neq 0$
- Que-4(B) Answer any one out of two (04)**
- 1) Find $\frac{1}{(D-1)^2} x^2$.
 - 2) Solve $(D^2 - 7D + 12)y = e^{5x}$.
- Que-4(C) Answer any three out of five (03)**
- 1) Solve $(D^4 + 2D^2 + 1)y = 0$.
 - 2) Solve $(6D^2 - D - 2)y = 0$.
 - 3) Find $\frac{1}{D^2 - 7D + 12} e^x$
 - 4) Find $\frac{1}{(D-2)^3} e^{2x}$
 - 5) Find only P.I. for $(D^2 - 1)y = \sin 5x$
- Que-5(A) Answer any one out of two (07)**
- 1) Solve: $(x^3 D^3 + 3x^2 D^2 - 6xD + 6)y = (x^2 - \frac{1}{x^2})^2$
 - 2) Solve: $(x^2 D^2 - 2xD + 2)y = x^3$.
- Que-5(B) Answer any one out of two (04)**
- 1) Solve: $(x^2 D^2 - 2xD - 4)y = x^4$
 - 2) Find only P.I. for $(x^2 D^2 + 7xD + 5)y = x^5$.
- Que-5(C) Answer any three out of five (03)**
- 1) Solve $(x^2 D^2 - xD - 3)y = 0$
 - 2) Solve $(x^2 D^2 + xD - 1)y = 0$
 - 3) Find C.F. of $(x^2 D^2 + 3xD + 1)y = x^2 e^x$
 - 4) Solve $(x^2 D^2 - 2xD + 2)y = 0$
 - 5) Find only P.I. for $(x^2 D^2 - xD + 1)y = 2 \log x$
