

B.Sc. Semester - 1 (CBCS) Examination
Nov/Dec - 2022 (OLD COURSE)
MATHEMATICS (CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

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

- Q-1 (A) Answer any one out of two** [7]
- (1) Expand $\cos x$ in ascending powers of x .
 - (2) In usual notation prove that $\sin(e^x - 1) = x + \frac{x^2}{2} - \frac{5x^4}{24} + \dots$
- (B) Answer any one out of two** [4]
- (1) Find coefficient of x^4 in expansion of $\log(\cos x)$.
 - (2) State and prove Alternative form of Cauchy's mean value theorem.
- (C) Answer any three out of five.** [3]
- (1) Write the formula of Lagrange's theorem.
 - (2) Find the value of c , if Roll's theorem is applicable to $f(x) = 1/x$, $x \in [-1, 5]$.
 - (3) Find the value of c , if Roll's theorem is applicable to $f(x) = x^2 - 4x + 3$, $x \in [1, 3]$.
 - (4) Check whether the function $f(x) = 6(x-2)^2$, $x > 2$ is increasing or decreasing.
 - (5) Write expansion of $\sin x$ in ascending powers of x .
- Q-2 (A) Answer any one out of two** [7]
- (1) Solve: $(x^2 + y^2) dx + 2xy dy = 0$.
 - (2) Solve: $x^2 \frac{dy}{dx} = 3x^2 - 2xy + 1$.
- (B) Answer any one out of two** [4]
- (1) $\lim_{x \rightarrow \pi/2} (\sin x)^{\tan x}$
 - (2) Evaluate $\lim_{x \rightarrow 0} \frac{\tan^2 x - x^2}{x^2 \tan^2 x}$.
- (C) Answer any three out of five.** [3]
- (1) $\lim_{x \rightarrow 0} \frac{3x}{\tan 2x} = \underline{\hspace{2cm}}$.
 - (2) Evaluate $\lim_{x \rightarrow 0} \frac{\sin 4x}{\sin 3x} = \underline{\hspace{2cm}}$.
 - (3) Type of differential equation $x(x-y)dy + y^2 dx = 0$ is $\underline{\hspace{2cm}}$.
 - (4) General solution of $\sqrt{1-x^2} dy = \sqrt{1-y^2} dx$ is $\underline{\hspace{2cm}}$.
 - (5) I.F. of $\frac{dy}{dx} + \frac{y}{x} = 5$ is $\underline{\hspace{2cm}}$.
- Q-3 (A) Answer any one out of two.** [7]
- (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 $x \frac{dy}{dx} = y - \sqrt{y}$ differential equation.
- (B) Answer any one out of two** [4]
- (1) Solve $x \frac{dy}{dx} + y = x^3 y^6$.
 - (2) Solve: $x \frac{dy}{dx} - y = y^2 \log x$.
- (C) Answer any three out of five.** [3]
- (1) Find the integrating factor of $x \frac{dy}{dx} = x + y$.
 - (2) Is $(\sin x \sin y + \sec^2 x)dx + (\tan^2 y - \cos x \cos y)dy = 0$ exact? Yes or No.
 - (3) State general form of Bernoulli's differential equation.
 - (4) Determine whether the differential eq. $y dx + (y+x)dy = 0$ is exact or not.
 - (5) Solution of $y = px + \log p$ is $\underline{\hspace{2cm}}$.

- Q-4 (A) Answer any one out of two** [7]
- (1) Solve $(D^3 - 12D^2 + 6D - 8)y = e^{2x}$.
 - (2) Solve $(D^2 - 4D + 3)y = \cos 2x \sin 3x$
- (B) Answer any one out of two** [4]
- (1) Solve $(D^2 - 7D + 12)y = e^{5x}$
 - (2) Find $\frac{1}{(D-1)^2} x^2$.
- (C) Answer any three out of five.** [3]
- (1) solution of $(D^4 + 2D^2 + 1)y = 0$ is _____.
 - (2) Solution of $(6D^2 - D - 2)y = 0$ is _____.
 - (3) $\frac{1}{D^2 - 7D + 12} e^x =$ _____
 - (4) $\frac{1}{(D-2)^3} e^{2x} =$ _____
 - (5) $\frac{1}{D} x^2 =$ _____
- Q-5 (A) Answer one out of two** [7]
- (1) Solve: $(x^3 D^3 + 2x^2 D^2 + 2)y = 10(x + \frac{1}{x})$.
 - (2) Solve: $(x^2 D^2 - 2)y = x^2 + \frac{1}{x}$.
- (B) Answer any one out of two** [4]
- (1) Find only P.I. for $(x^2 D^2 - xD + 1)y = 2 \log x$
 - (2) Find only P.I. for $(x^3 D^3 + 3x^2 D^2 - 6xD + 6)y = (x^2 - \frac{1}{x^2})^2$
- (C) Answer any three out of five.** [3]
- (1) Solution of $(x^2 D^2 - xD - 3)y = 0$ is _____.
 - (2) Solution of $(x^2 D^2 + xD - 1)y = 0$ is _____.
 - (3) Solution of $(x^2 D^2 - 2xD + 2)y = 0$ is _____.
 - (4) C.F. of $(x^2 D^2 + 3xD + 1)y = x^2 e^x$ is _____.
 - (5) C.F. of $(D^2 + 9)y = \sin x$ is _____.
