Mathematics Examination

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23 November 2022

College Of Engineering Pune

(MA-19002 Univariate Calculus)

Date: 23^{th} Nov 2022
Program: S.Y.BTech
Semester: III
MIS No:

Branch: Computer
Duration: 1 hour
Max marks: 20

Instructions

- Write your MIS number on paper.
- Unless otherwise mentioned symbols and notations have their usual standard meaning.
- Use of any kind of electronic device is NOT allowed.
- Any essential result, formula or theorem assumed for answering of questions must be clearly stated.
- Exam Duration: 1hr
- Maximum Marks: 20M

Section I

Question I

1. Attempt the following questions:
a) Find the particular solution of the initial value problem: [CO2][**2**]

$$\tan x \frac{dy}{dx} = y$$
$$y(\frac{\pi}{2}) = (\frac{\pi}{2})$$

b)Check the whether the following differential equation is exact or non-exact and justify your answer. [CO2][**2**]

$$(1 + \ln xy)dx + (1 + \frac{x}{y})dy = 0$$

2. Solve the following:

a.) $3x(xy - 2)dx + (x^3 + 2y)dy = 0$ [CO2][**2**]

b.) $(2\cos y + 4x^2)dx - x\sin y = 0$ [CO2][**3**]

Question II

1. Find eigenvalues and corresponding eigenvectors of A = $\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$. Hence, find an orthogonal basis for R^2 [CO2][**2**]

2. Find the rank of matrix $\begin{bmatrix} 8 & 6 & 4 & 1 & 3 \\ 2 & 1 & -7 & 4 & 1 \\ 1 & 1 & -1 & 2 & 1 \\ 1 & -1 & 2 & 0 & 0 \end{bmatrix}$ [CO3][**3**]

3. State whether the following differential equations are linear or non-linear, justify and solve: [CO2][**4**]

   (a) $xy' + 2y = \frac{e^{3x}}{x}, x > 0$ with $y(1) = 1 + \frac{e^3}{3}$

   (b) $x^2 y \frac{dy}{dx} - xy^2 = 1$

4. Solve the Differential equation $\frac{dy}{dx} = \frac{tanx - x^2 y - 2y}{x^2 - 4x - 1 + e^x}$ [CO2][**2**]

5. Solve the following indefinite integral $\int x \cos x^2 dx$ [CO3][**3**]