RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [BATCH 2016-19]

B.A./B.Sc. FOURTH SEMESTER (January – June) 2018

Mid-Semester Examination, March 2018

Date : 16/03/2018 — **MATH FOR IND. CHEMISTRY (General)**

Time : 1 pm – 2 pm — Paper : IV — Full Marks : 25

[Use a separate Answer Book for each group]

Group – A

(*Answer any two questions*) [2×5]

1. Using the operator theory, prove that (i) $E \equiv 1+\Delta$ and (ii) $(1+\Delta)(1-\nabla) \equiv 1$, where E is the shift operator, Δ and ∇ are the forward and backward difference operators, respectively.

2. Using the following table, calculate the difference table and interpolate at $x = 0{\cdot}35$, correct upto 2 decimal places.

x	0·1	0·2	0·3	0·4	0·5
y	1·40	1·56	1·76	2·00	2·28

3. Find the whole area of the cycloid $x = a(\theta + \sin\theta),\ y = a(1-\cos\theta)$ bounded by its base.

Group – B

Answer any two questions from Question Nos. 4 to 6 : [2×5]

4. Solve the differential equations :

   a) $\dfrac{d^2y}{dx^2} - 5\dfrac{dy}{dx} + 6y = 0$. [2]

   b) $\dfrac{d^2y}{dx^2} - 4\dfrac{dy}{dx} + 4y = 0$. [3]

5. Solve the differential equation : $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + y = x^2e^{3x}$. [5]

6. Suppose $A = x^2z^2\hat{i} - 2y^2z^2\hat{j} + xy^2z\hat{k}$. Find $\nabla \times A$(or curl A) at the point $P(1,-1,1)$. [5]

Answer any one question from Question Nos. 7 & 8 : [1×5]

7. Test for convergence : [2·5+2·5]

   a) $\displaystyle\int_0^1 \frac{dx}{(1-x)^{2/3}}$. b) $\displaystyle\int_2^\infty \frac{dx}{\sqrt{x^2-1}}$.

8. Test for convergence : [2·5+2·5]

   a) $\displaystyle\int_0^1 \frac{dx}{\sqrt{1-x^2}}$. b) $\displaystyle\int_a^\infty \frac{dx}{x\sqrt{1+x^2}}\ (a>0)$.

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