RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

M.A./M.Sc. THIRD SEMESTER EXAMINATION, DECEMBER 2017

SECOND YEAR [BATCH 2016-18]

APPLIED CHEMISTRY

Date : 16/12/2017

Time : 11 am – 1 pm

Paper : XIII

Full Marks : 50

[Use a separate Answer Book for each group]

Group - A

1. Answer **any three** : [3×5]

   a) Give the axiomatic definition of probability. Show that the conditional probabilities satisfy all the three axioms of probability.

   b) There are three identical urns each containing 25 white and 50 black balls. One ball is transferred blindly from the first to the second urn and then one ball is transferred from the second to the third urn. Finally, a ball is drawn from the third urn. What is the probability that this ball is white?

   c) The probability that a man hitting a target is $1/3$. How many times must he fire so that the probability of hitting the target at least once is more that $0 \cdot 9$?

   d) Find the value of the constant K so that the function f_x given by $f_x(x) = \begin{cases} Kx(2-x) & , \quad 0 < x < 2 \\ 0 & , \quad \text{elsewhere} \end{cases}$ is a probability density function. Construct the distribution function and compute $P(x > 1)$.

   e) Given $\Sigma x = 56, \Sigma y = 40$, $\Sigma x^2 = 524$, $\Sigma y^2 = 256$, $\Sigma xy = 364$, n = 8 find (i) the correlation coefficient of x and y and (ii) the regression equation of x on y.

2. Answer **any two** : [2×5]

   a) Given the following table :

x	0	5	10	15	20
f(x)	1·0	1·6	3·8	8·2	15·4

   Construct the difference table and compute f(21) by Newton's backward interpolation formula.

   b) Evaluate $\int_0^1 \cos x dx$ correct to three significant figures taking five equal sub-intervals.

   c) $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$. Determine $y(0 \cdot 03)$ with step length h = 0·01 by Euler's method.

Group - B

3. Answer **any two** : [2×5]

   a) Show that the vector $\vec{F} = (2x - yz)\hat{i} + (2y - zx)\hat{j} + (2z - xy)\hat{k}$ is irrotational. For this $\vec{F}$, find a scalar function ϕ such that $\vec{F} = \vec{\nabla}\phi$. [2+3]

   b) Verify Green's theorem in the plane for $\oint_C [(3x^2 - 8y^2)dx + (4y - 6xy)dy]$, where C is the boundary of the region R bounded by $y = \sqrt{x}$, $y = x^2$.

c) Verify Stokes' theorem for $\vec{F}=(2x+y)\hat{i}+yz^2\hat{j}+y^2z\hat{k}$, where S is the hemisphere $x^2+y^2+z^2=1$ above xy plane and C is its boundary.

4. Answer **any three** : [3×5]

a) Solve : $xy-\frac{dy}{dx}=y^3e^{-x^2}$.

b) Obtain the general solution and singular solution of $y=px+\sqrt{a^2p^2+b^2}$ where $p=\frac{dy}{dx}$. [2+3]

c) Solve by the method of variation of parameters : $\frac{d^2y}{dx^2}+y=\operatorname{cosec}x$.

d) Solve : $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+2y=\sin(\log x)$.

e) Write down standard form of Bessel's differential equation. If $J_n(x)$ is the Bessel function of first kind of order n then prove that $xJ_n'(x)=nJ_n(x)-xJ_{n+1}(x)$. [1+4]

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