

Exam. Code : 103202

Subject Code : 9011

B.A./B.Sc. 2nd Semester (Old Syllabus 2014)

MATHEMATICS

Paper—I

(Integral Calculus & Differential Equations)

Time Allowed—Three Hours] [Maximum Marks—50

Note :— Attempt FIVE questions in all selecting at least TWO questions each from Sections A and B. All questions carry equal marks.

SECTION—A

I. (a) Evaluate $\int \frac{1}{a^2 \cosh^2 x + b^2 \sinh^2 x} dx$.

(b) Obtain a reduction formula for $\int \sin^n x dx$.

5,5

II. (a) Evaluate $\int \cosh^{-1} \left(\frac{1+x^2}{1-x^2} \right) dx, |x| < 1$.

(b) Evaluate $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$.

5,5

III. (a) Evaluate

$$\lim_{n \rightarrow \infty} \left[\frac{n}{n^2 + 1^2} + \frac{n}{n^2 + 2^2} + \frac{n}{n^2 + 3^2} + \dots + \frac{n}{n^2 + n^2} \right].$$

(b) Prove that $2\sqrt{2} \leq \int_1^3 \sqrt{1+x^3} dx \leq 2\sqrt{28}$. 5,5

IV. (a) Sketch the region enclosed by the curve $y^2 - 4y + 2x = 0$ and y -axis. Also find its area.

(b) Find the entire length of the curve

$$x^{2/3} + y^{2/3} = a^{2/3}. \quad 5,5$$

V. (a) Find the surface generated by revolving the parabola $y^2 = 4ax$ about the y -axis from $x = 0$ to $x = a$.

(b) Find the reduction formula for $\int \cos^m x \sin nx dx$. 5,5

SECTION—B

VI. (a) Solve $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$.

(b) Solve $x^2(y - px) = p^2y$. 5,5

VII. (a) Show that the system of confocal conics

$$\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1 \text{ is self orthogonal.}$$

(b) Find the complete primitive and singular solution of the differential equation $y = p^2$. 5,5

VIII. (a) Solve the differential equation

$$(D^2 - 3D + 2)y = \sin e^{-x}.$$

(b) Solve $(D^2 - 4D + 4)y = x^2 + \sin 2x$. 5,5

IX. (a) Solve $(D^2 + 3D + 2)y = \sin e^x$ by method of variation of parameters.

(b) Solve $D^2y - 3Dy + 2y = \cosh x$. 5,5

X. (a) Solve in series the differential equation

$$(x - x^2) \frac{d^2y}{dx^2} + (1 - x) \frac{dy}{dx} - y = 0.$$

(b) Solve $(2x^2y^2 + y)dx + (x^3y - 3x)dy = 0$. 5,5