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SB—101—2022

FACULTY OF ARTS/SCIENCE

B.A./B.Sc. (First Year) (Second Semester) EXAMINATION

MAY/JUNE, 2022

(New Pattern)

MATHEMATICS

Paper III

(Calculus)

(Theory)

(Friday, 17-06-2022) **Time : 10.00 a.m. to 12.30 p.m.**

Time— 2½ Hours *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Figures to the right indicate full marks.

1. Find reduction formula for $\int x \sin^n x \, dx$ and integrate $\sqrt{3x^2 + 6x + 5}$. 15

Or

(*a*) Show that : 8

$$\int x^m (a + bx^n)^p \, dx = \frac{x^{m-n+1} (a + bx^n)^{p+1}}{b(np + m + 1)} - \frac{a(m - n + 1)}{b(np + m + 1)} \int x^{m-n} (a + bx^n)^p . dx.$$

(*b*) Evaluate : 7

$$\int \frac{x^2 + 5x + 41}{(x + 3)(x - 1)(2x - 1)} dx$$

2. Find the reduction formulae for $\int \sec^n x \, dx$ and evaluate : 15

$$\int_0^{\pi/2} \sin^6 \theta \, d\theta .$$

P.T.O.

Or

(*a*) Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. 8

(*b*) Find the reduction formulae for $\int e^{ax} \sin^n bx \, dx$. 7

3. Attempt any *two* of the following : 5 each

(*a*) Evaluate :

$$\int_0^a \int_0^b (x^2 + y^2) \, dx dy$$

(*b*) Show that :

$$\int_0^{\pi/4} \log(1 + \tan\theta) \, d\theta = \frac{\pi}{8} \log 2$$

(*c*) Integrate :

$$x^{1/2} (1 + x^{3/4})^3$$

(*d*) Evaluate :

$$\int \frac{1 + x^2}{1 + x^4} dx .$$