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B.M.S COLLEGE FOR WOMEN, AUTONOMOUS

BENGALURU – 560004

SEMESTER END EXAMINATION – SEPTEMBER-2023

B.Sc.in Mathematics – 2nd Semester

ALGEBRA-II AND CALCULUS-II

(NEP Scheme 2021-22 Onwards F+R)

Course Code: MAT2DSC02 **QP Code: 2015**

Duration: 2 ½ Hours **Max. Marks: 60**

Instructions: Answer all the sections.

SECTION-A

I. Answer any SIX of the following. Each question carries TWO marks. (6X2=12)

1. Define a subgroup of a group
2. Calculate the order of the elements in the multiplicative group of $G = \{1, -1, i, -i\}$.
3. Find the angle between radius vector and the tangent to the curve $r = a(1 + sin\theta)$
4. Find polar sub-tangent to the curve $r = a(1 + cos\theta)$ at $\theta = \frac{\pi}{3}$
5. Evaluate $\int_0^{\frac{\pi}{2}} \cos^4 x dx$
6. Evaluate $\int_0^{\frac{\pi}{2}} \sin^2 x cos^4 x \, dx$
7. Evaluate $\int_0^2 \int_0^1 x^3 dxdy$
8. Evaluate $\int_0^1 \int_0^2 \int_0^3 (x^2 yz) dxdydz$

SECTION-B

II. Answer any TWO of the following. Each question carries SIX marks. (2X6=12)

1. Prove that a non-empty subset H of a group is a subgroup of G if and only if

$$a * b^{-1} \in H, \forall a, b \in H$$

2. If a is a generator of a group G, then show that $O(a) = O(G)$.
3. State and prove Lagrange's theorem.

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SECTION-C

III. Answer any SIX of the following. Each question carries SIX marks. (6X6=36)

1. With usual notations, show that $\tan\varphi = r\frac{d\theta}{dr}$
2. For the cardioid $r = a(1 - \cos\theta)$ show that $2ap^2 = r^3$
3. a) Compute $\frac{dS}{dx}$ for the curve $x^2 = 4ay$
   b) Calculate the radius of curvature for $xy = c^2$ at (x, y)
4. Derive reduction formula for $\int \sin^n x\, dx$ and hence evaluate $\int_0^{\frac{\pi}{2}} \sin^n x\, dx$
5. Evaluate i) $\int_0^1 \frac{x^3}{\sqrt{1-x^2}} dx$ ii) $\int_0^1 x\cos^6 x dx$
6. Find the area included between the Cardiods $r=a\,(1+\cos\theta)$ and $r=a\,(1-\cos\theta)$.
7. Evaluate $\int xydx + yzdy + zxdz$ under the curve $x = t, y = t^2, z = t^3$ varying from -1 to +1
8. Evaluate $\int_0^1 \int_{y^2}^1 \int_0^{1-x} xdzdxdy$.

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