TB142340C **Reg. No:……**

Name:.....

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2017
(Supplementary – 2014 Admission
SECOND SEMESTER-COMPLEMENTARY COURSE (MATHEMATICS)
MAT2ICM - INTEGRAL CALCULUS AND MATRICES
(Common for Physics and Chemistry)

Time: Three Hours **Maximum Marks: 80**

PART A

I. Answer all questions. Each question carries 1 mark

1. Find $\int_0^{\pi} \sin x \, dx$.
2. Let $\int_{-3}^{0} g(t)\, dt = 2$ Find $\int_{-3}^{0} -g(x)\, dx$.
3. Find $\frac{d}{dx}\int_0^x \frac{1}{1+t^2}\, dt$.
4. Find $\int_{-1}^{0} \sqrt{y+1}\, dy$.
5. Let f be an odd function , then what is the value of $\int_{-a}^{a} f(x)\, dx$?
6. Find $\int_0^{\pi} 3\cos^2 x \sin x \, dx$.
7. Find $\int_0^3 \int_0^2 (4 - y^2)\, dy\, dx$.
8. Find rank of the matrix $A=\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$.
9. Define a homogeneous system of linear equations.
10. What are the eigen values of a diagonal matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$.

(10×1=10)

PART B

II. Answer any eight questions. Each question carries 2 marks.

11. What values of a and b maximize the value of $\int_a^b (x - x^2)\, dx$?
12. Give an example of a non-integrable function on $[0,1]$.
13. State Max-Min inequality.
14. Find the length of the circle of radius r defined parametrically by $x = r\cos t, y = r\sin t, 0 \le t \le 2\pi$.
15. Find the area of the region bounded by $y = \sqrt{x}, 0 \le x \le 4$ and $X-$ axis.
16. State Cavalieri's principle.
17. Find $\int_1^e \int_1^e \int_1^e \frac{1}{xyz}\, dx\, dy\, dz$.
18. Find the average value of $f(x, y) = x\cos xy$ over the rectangle $R: 0 \le x \le \pi, 0 \le y \le 1$.
19. Find $\int_1^{\ln 8} \int_0^{\ln y} e^{x+y}\, dx\, dy$.
20. Find the rank of $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \end{bmatrix}$
21. Define an Elementary Matrix and show that $|R_{ij}| = -1 = |C_{ij}|$ for a 3×3 matrix

22. Define the characteristic polynomial and find the characteristic polynomial of

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$$

(8×2=16)

PART C

III. Answer any six questions. Each question carries 4 marks

23. Find the average value of $f(x) = \sqrt{4-x^2}$ on $[-2, 2]$.
24. State Pappus Theorems for surface areas and volumes..
25. The line segment $x = 1 - y,\ 0 \le y \le 1$ is revolved about Y axis to generate a cone. Find its lateral surface area.
26. Find the area of the surface generated by revolving the curve $y = x^3,\ 0 \le x \le \frac{1}{2}$ about X - axis.
27. State Fubini's theorem (first form) and verify it where $f(x,y) = 1 - 6x^2y, R: 0 \le x \le 2, -1 \le y \le 1$.
28. Find the area enclosed by the cardioid $r = a(1 + \cos\theta)$.
29. Obtain row equivalent canonical matrix C to the matrix $A = \begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 5 \\ -1 & -2 & 6 & -7 \end{bmatrix}$ and hence find the rank.
30. Examine whether the following equation are consistent.

$$x - 4y + 7z = 14$$
$$3x + 8y - 2z = 13$$
$$7x - 8y + 26z = 5$$

31. Determine the characteristic roots of $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.

(6×4=24)

PART D

IV. Answer any two questions. Each question carries 15 marks

32. a) Sketch the region bounded by the coordinate axes and the line $x + y = 2$. Also find the area of the region.
b) Find the area of the region between the $X-$ axis and the graph of $f(x) = x^3 - x^2 - 2x$, $-1 \le x \le 2$.
33. Find the volume of the region bounded by $y = \sqrt{x},\ y = 2\ and\ \ x = 0$ about
a) $X-$axis b) $Y-$ axis c) $y = 2$ d) $x = 4$
34. Find the volume of the region D enclosed by the surfaces $z = x^2 + 3y^2$ and $z = 8 - x^2 - y^2$.
35. Solve using Cramer's rule

$$2x + y + 5z + w = 5$$
$$x + y - 3z - 4w = -1$$
$$3x + 6y - 2z + w = 8$$
$$2x + 2y + 2z - 3w = 2$$

(2×15=30)