Objective FBD-12-1-23 **Intermediate Part Second**
Paper Code
8191
MATHEMATICS (Objective) Group – I
Time: 30 Minutes   Marks: 20

Q.No.1 You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the relevant circle in front of that question number on computerized answer sheet. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero marks in that question. Attempt as many questions as given in objective type question paper and leave other circles blank.

S.#	Questions	A	B	C	D
1	$\underset{x \to 0}{Lim} \dfrac{x}{\sin 2x} = ?$	$\dfrac{1}{2}$	2	$-\dfrac{1}{2}$	-2
2	The function $f(x) = \dfrac{x}{x^2 - 4}$ is discontinuous at:	0	± 2	1	± 1
3	$\underset{h \to 0}{Lim} \dfrac{f(a+h) - f(a)}{h} = ?$	$f(a)$	$f'(a+h)$	$f'(a)$	$f'(x)$
4	$\dfrac{dy}{dx} = -\dfrac{1}{x^2}$ if :	$y = -\dfrac{1}{x}$	$y = -x$	$y = \ell nx$	$y = \dfrac{1}{x}$
5	If $f(x) = \cos x$, then $f'\left(\dfrac{\pi}{2}\right) = ?$	-1	1	0	2
6	$\dfrac{d}{dx}(e^{\frac{1}{x}}) = ?$	$e^{\frac{1}{x}}$	$-\dfrac{1}{x^2} e^{\frac{1}{x}}$	$\dfrac{1}{x} e^{\frac{1}{x}}$	$\dfrac{1}{x^2} e^{\frac{1}{x^2}}$
7	Differential of $\sqrt{y}$ is:	$\sqrt{y} \, dx$	$\sqrt{y} \, dy$	$\dfrac{1}{2\sqrt{y}} dy$	$\dfrac{1}{2\sqrt{y}} dx$
8	$\int \sec ax \tan ax \, dx = ?$ is :	$\dfrac{\tan ax}{a} + c$	$\dfrac{\sec ax}{a} + c$	$\dfrac{\sec ax \tan ax}{a} + c$	$\dfrac{\cot ax}{a} + c$
9	$\int \dfrac{1}{x^2 + 3} dx = ?$	$\tan^{-1}\left(\dfrac{x}{3}\right) + c$	$\dfrac{1}{3}\tan^{-1}\left(\dfrac{x}{3}\right) + c$	$\dfrac{1}{\sqrt{3}}\tan^{-1}\left(\dfrac{x}{\sqrt{3}}\right) + c$	$\cot^{-1}(3x) + c$
10	$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos\left(\dfrac{x}{2}\right) dx = ?$	1	$\sqrt{2}$	$2\sqrt{2}$	$4\sqrt{2}$
11	Slope of a line $ax + by + c = 0$ is:	$-\dfrac{a}{b}$	$\dfrac{a}{b}$	$-\dfrac{b}{a}$	$\dfrac{b}{a}$
12	Inclination of a line $x = 6$ is:	0	π	$\dfrac{\pi}{4}$	$\dfrac{\pi}{2}$
13	The point of intersection of lines $y = 2$ and $x = 1$ is:	$(2, -1)$	$(2, 1)$	$(2, 0)$	$(-1, 2)$
14	$x - y < 2$ is satisfied by the point:	$(3, 1)$	$(-1, 1)$	$(1, -1)$	$(0, -2)$
15	Center of a circle $(x+1)^2 + y^2 = 25$ is:	$(0, 0)$	$(1, 0)$	$(-1, 0)$	$(0, 2)$
16	Major axis of $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ is :	$x = a$	$x = \pm\dfrac{a}{c}$	$y = \pm\dfrac{a}{b}$	$y = 0$
17	Length of minor axis of $x^2 + 4y^2 = 16$ is:	4	16	20	36
18	Center of $\dfrac{(x-1)^2}{4} - \dfrac{(y+1)^2}{16} = 1$ is:	$(0, 0)$	$(1, -1)$	$(-1, -1)$	$(-1, 1)$
19	The direction cosines of y-axis are :	$0, 0, 0$	$1, 0, 0$	$0, 1, 0$	$0, 0, 1$
20	$\hat{i} \cdot \hat{k} \times \hat{j} = ?$	0	1	$\dfrac{1}{2}$	-1

MATHEMATICS (Subjective)   **Group – I**

FBD-12-1-23   Time: 02:30 Hours   Marks: 80

SECTION – I

2. Attempt any EIGHT parts: 16

(i) Define constant function with example.

(ii) Find $f^{-1}(x)$ if $f(x) = -2x + 8$

(iii) Evaluate $\displaystyle\lim_{x \to 1} \frac{x^3 - 3x^2 + 3x - 1}{x^3 - x}$

(iv) Find derivative by definition $\dfrac{1}{x^{40}}$

(v) Differentiate w.r.t. x, $\dfrac{\sqrt{1+x}}{\sqrt{1-x}}$

(vi) Find $\dfrac{dy}{dx}$, $xy + y^2 = 2$

(vii) Differentiate w.r.t. x, $\cos\sqrt{x} + \sqrt{\sin x}$

(viii) Differentiate $\cos^{-1}\left(\dfrac{x}{a}\right)$

(ix) Find $\dfrac{dy}{dx}$ if $y = x\, e^{\sin x}$

(x) Determine the interval in which $f(x) = \cos x$ is increasing or decreasing for the domain $x \in \left(-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right)$.

(xi) Define problem constraint.

(xii) Graph the solution set of $5x - 4y \le 20$

3. Attempt any EIGHT parts: 16

(i) Find the area bounded by cos, function from $x = \dfrac{-\pi}{2}$ to $x = \dfrac{\pi}{2}$.

(ii) Solve the differential equation $(e^x + e^{-x})\dfrac{dy}{dx} = e^x - e^{-x}$

(iii) Evaluate $\displaystyle\int_{-1}^{2} (x + |x|)\, dx$

(iv) Evaluate $\displaystyle\int \dfrac{e^{m\tan^{-1} x}}{1 + x^2}\, dx$

(v) Evaluate $\displaystyle\int \dfrac{1}{x\ell n x}\, dx$

(vi) Evaluate $\displaystyle\int \dfrac{(1 - \sqrt{x})^2}{\sqrt{x}}\, dx$

(vii) Use differential find $\dfrac{dy}{dx}$ if $x^2 + 2y^2 = 16$.

(viii) Find the value of $2\underline{i} \times 2\underline{j} \cdot \underline{k}$

(ix) Find a unit vector in the direction of $\underline{v} = \underline{i} + 2\underline{j} - \underline{k}$

(x) If $\overline{AB} = \overline{CD}$, then find the coordinate of the point A when points, B, C, D are $(1, 2)$, $(-2, 5)$, $(4, 11)$ respectively.

(xi) Find the volume of parallelpiped if $\underline{u} = 3\underline{i} + 2\underline{k}$, $\underline{v} = \underline{i} + 2\underline{j} + \underline{k}$, $\underline{w} = -\underline{j} + 4\underline{k}$

(xii) Find a vector of length 5, in the direction opposite that of $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$

4. Attempt any NINE parts: 18

(i) Find the midpoint of the line segment joining the points A(3, 1); B(-2, -4). Also find the distance between them.

(ii) Find slope and inclination of the line joining the points $(3, -2)$; $(2, 7)$.

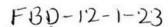(iii) Find an equation of horizontal line through $(7, -9)$.

(iv) Find an equation of the line bisecting second and fourth quadrant.

(v) Check whether the lines $3x + 4y - 7 = 0$, $2x - 5y + 8 = 0$, $x + y - 3 = 0$ are concurrent or not ?

(Continued P/2)

(vi) Find equation of lines represented by $10x^2 - 23xy - 5y^2 = 0$

(vii) Find the measure of the angle between the lines represented by $3x^2 + 7xy + 2y^2 = 0$

(viii) Find the center and radius of the circle $x^2 + y^2 + 12x - 10y = 0$

(ix) Show that the line $3x - 2y = 0$ is tangent to the circle $x^2 + y^2 + 6x - 4y = 0$

(x) Check the position of the point $(5, 6)$ with respect to the circle $2x^2 + 2y^2 + 12x - 8y + 1 = 0$

(xi) Find focus and directrix of the parabola $y^2 = 8x$

(xii) Find an equation of ellipse with given data. Vertices $(-1, 1)$, $(5, 1)$; foci $(4, 1)$ and $(0, 1)$

(xiii) Find equation of hyperbola with given data. foci $(0, \pm 6)$, $e = 2$

SECTION – II	Attempt any THREE questions. Each question carries 10 marks.

5. (a) Evaluate: $\displaystyle \lim_{x \to 0} \frac{\sec x - \cos x}{x}$ 05

 (b) If $y = \sqrt{x} - \dfrac{1}{\sqrt{x}}$, then show that $2x\dfrac{dy}{dx} + y = 2 \cdot \sqrt{x}$ 05

6. (a) Evaluate: $\int e^{2x} \cos 3x \, dx$ 05

 (b) Find equation of line through intersection of lines $x - y - 4 = 0$, $7x + y + 20 = 0$ and parallel to line $6x + y - 14 = 0$ 05

7. (a) Evaluate: $\displaystyle \int_{\frac{1}{2}}^{\frac{\sqrt{3}}{2}} \frac{\sin^{-1} x}{\sqrt{1-x^2}} \, dx$ 05

 (b) Maximize $f(x, y) = 2x + 5y$ subject to the constraints: $2y - x \le 8$; $x - y \le 4$; $x \ge 0$; $y \ge 0$ 05

8. (a) Show that $y = x^x$ has a minimum value at $x = \dfrac{1}{e}$.   05

 (b) Find an equation of the circle which passes through the points $A(5, 10)$, $B(6, 9)$ and $C(-2, 3)$ 05

9. (a) Find an equation of the ellipse with given data center $(2, 2)$, major axis parallel to y-axis and of length 8 units, minor axis parallel to x-axis and of length 6 units.   05

 (b) Prove that by vector method. $\sin(\alpha - \beta) = \sin\alpha \cdot \cos\beta - \cos\alpha \sin\beta$ 05