Reg. No.:

Name :

VIT BHOPAL
www.vitbhopal.ac.in

TERM END EXAMINATIONS (TEE) – December - January 2021

Programme	**B.Tech – Bioengineering**	**Semester**	**Fall 2021-22**
Course Name	**Calculus for Bioengineers**	**Course Code**	**MAT1002**
Faculty Name	**Dr. Neha Choubey**	**Slot / Class No**	**A11+A12+A13/0494**
Time	**1½ hours**	**Max. Marks**	**50**

Answer ALL the Questions

Q. No.			Marks
		PART - A – (3 x 10 = 30 Marks)	
1	(a)	There are two families A and B. There are 4 men, 6 women and 2 children in family A and 2 men, 2 women and 4 children in family B. The recommended daily allowance for calories is: Man : 2400, woman : 1900, child : 1800 and for proteins is : Man : 55 gm, woman : 45 gm and child : 33 gm. Represent the above information by matrices. Using matrix multiplication , calculate the total requirement of calories and proteins for each of the two families.	10
		OR	
	(b)	Find the Taylor's series expansion of $f(x,y) = tan^{-1}(xy)$ in powers of $(x+0.5)$ and $(y-2)$ up to second degree terms. Hence compute $f(-0.4,2.2)$ approximately.	10
2	(a)	If $u = 2axy, v = a(x^2 - y^2)$ where $x = rcos\theta,\ y = rsin\theta$ then find the Jacobian of $\frac{\partial(u,v)}{\partial(r,\theta)}$.	10
		OR	
	(b)	Evaluate the integrals given below (i) $\int_1^2 (xe^x + sin\frac{\pi x}{4})\,dx$ (ii) $\int cos4x.cos2x\ dx$ (iii) $\int \frac{e^x - e^{-x}}{e^x + e^{-x}}\,dx$	10
3	(a)	Find the directional derivative of the surface $\emptyset = xyz$ in the direction normal to the surface $x^2y + y^2x + yz^2 = 3$ at the point (1,1,1).	10
		OR	

(b) Evaluate $\int cos^3 x dx$ 10

i. By reduction formula

ii. By trigonometric formula

Hence find $\int_0^{\frac{\pi}{2}} cos^3 x dx$ and verify using Wallis' formula.

Part - B – (2 x 10 = 20 Marks)

4 If $u = tan^{-1}\frac{\sqrt{(x^3+y^3)}}{(\sqrt{x}-\sqrt{y})}$, then find 10

a) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$

b) $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$

5 Verify Stoke's Theorem, where $\vec{F} = (x^2 + y^2)\hat{\imath} - 2xy\hat{\jmath}$ and C is the boundary of the rectangle $x = \pm 1, y = 0$ and $y = 2$. 10

⇔⇔⇔