SOMAIYA VIDYAVIHAR UNIVERSITY

Maximum Marks: 30	**Semester: July 2023-October 2023** **Examination: In-Semester Examination**	**Duration: 1hr. 15 min.**
Programme code: 01		**Semester:** III
Programme: B. Tech Computer Engineering	**Class:** SY	**(SVU 2020)**
Name of the Constituent College: K. J. Somaiya College of Engineering	**Name of the department:** COMP	
Course Code: 116U01C301	**Name of the Course:** Integral Transform and Vector Calculus	

Question No.		Max. Marks
Q.1	Attempt any **THREE** of the following	
(a)	Find the Laplace transform of $f(t) = t\,e^t \sin 2t \cos t$	06
(b)	Evaluate $\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\,dt$ using Laplace transforms.	06
(c)	Find the inverse Laplace transforms of $\left(\frac{1}{(s-2)(s+2)^2}\right)$	06
(d)	Find the inverse Laplace transforms of $log_e\left(1+\frac{1}{s^2}\right)$	06
Q.2	Attempt any **ONE** of the questions set (a) or (b)	
(a)	(i) Write the Fourier series of $f(x)$ in the interval $0 \le x \le 2\pi$ and formula for Fourier constants a_0, a_n and b_n.	01
	(ii) For $f(x) = \left(\frac{\pi - x}{2}\right)^2, 0 \le x \le 2\pi$ obtain Fourier constants a_0, a_n and b_n	05
	(iii) Write the Fourier series of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval $0 \le x \le 2\pi$	01
	(iv) Deduce $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots$ from Fourier series	01
	(v) Deduce $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots$ from Fourier series	01
	(vi) Deduce $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots$	01
	(vii) By using Parseval's identity prove that $\frac{\pi^4}{90} = \frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} + \cdots$	02

(b)	(i) Define Even function. Examine for $f(x) = x^2, -\pi \leq x \leq \pi$	01
	(ii) Write the Fourier series of even function $f(x)$ in the interval $-\pi \leq x \leq \pi$ and formula for Fourier constants a_0, a_n and b_n.	01
	(iii) For $f(x) = x^2, -\pi \leq x \leq \pi$ obtain Fourier constants a_0, a_n and b_n.	04
	(iv) Write the Fourier series of $f(x) = x^2$ in the interval $-\pi \leq x \leq \pi$	01
	(v) Deduce $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots$ from Fourier series	01
	(vi) Deduce $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots$ from Fourier series	01
	(vii) Deduce $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots$	01
	(viii) By using Parseval's identity prove that $\frac{\pi^4}{90} = \frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} + \cdots$	02